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ABSTRACT

Socio-Economic Status and Inequalities in Children's IQ and Economic Preferences*

This paper explores inequalities in IQ and economic preferences between children from high and low socio-economic status (SES) families. We document that children from high SES families are more intelligent, patient and altruistic, as well as less risk-seeking. To understand the underlying causes and mechanisms, we propose a framework of how parental investments as well as maternal IQ and economic preferences influence a child's IQ and preferences. Within this framework, we allow SES to influence both the level of parental time and parenting style investments, as well as the productivity of the investment process. Our results indicate that disparities in the level of parental investments hold substantial importance for SES gaps in economic preferences and, to a lesser extent, IQ. In light of the importance of IQ and preferences for behaviors and outcomes, our findings offer an explanation for social immobility.

JEL Classification: C90, D64, D90, D81, J13, J24, J62

Keywords: socio-economic status, time preferences, risk preferences, altruism, experiments with children, origins of preferences, human capital

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1 Introduction

Both economic theory and empirical evidence have established a robust link between IQ and economic preferences and many important outcomes in life. More intelligent individuals achieve higher levels of education, income, occupational status, job performance and better health outcomes (Heckman and Vytlacil, 2001; Schmidt and Hunter, 2004; Strenze, 2007; Hanushek and Woessmann, 2008; Almlund et al., 2011). Similarly, more patient individuals are less likely to be involved in crime (Åkerlund et al., 2016), have higher educational attainment, occupational success, income and wealth (Ventura, 2003; Eckel, Johnson, and Montmarquette, 2005; DellaVigna and Paserman, 2005; Golsteyn, Grönqvist, and Lindahl, 2014; Cadena and Keys, 2015; Dohmen et al., 2016) and better health outcomes (Fuchs, 1982; Kirby, Petry, and Bickel, 1999; Bickel, Odum, and Madden, 1999; Kirby and Petry, 2004; Chabris et al., 2008; Golsteyn, Grönqvist, and Lindahl, 2014; Cadena and Keys, 2015). Risk preferences predict labor market and health outcomes, investing and addictive behaviors, as well as migration decisions (Barsky et al., 1997; Hong, Kubik, and Stein, 2004; Bonin et al., 2007; Anderson and Mellor, 2008; Kimball, Sahm, and Shapiro, 2008; Jaeger et al., 2010; Dohmen et al., 2011; Dohmen and Falk, 2011; von Gaudecker, van Soest, and Wengström, 2011; Becker et al., 2012; Dawson and Henley, 2015; Hsieh, Parker, and van Praag, 2017). Finally, social preferences are associated with cooperative behavior in various domains of life, including the work place, donating, repayment of loans or management of common pool resources (Karlan, 2005; Dohmen et al., 2009; Rustagi, Engel, and Kosfeld, 2010; Carpenter and Seki, 2011; Becker et al., 2012; Burks et al., 2016; Deming, 2017). Table A1 in the appendix provides a comprehensive summary of the empirical evidence.[1]

IQ and preferences are not only associated with key outcomes in adulthood, but also in childhood and adolescence. In particular, higher IQ is positively associated with success in school (Reynolds, Temple, and Ou, 2010; Almlund et al., 2011) and impatience is linked to drinking and smoking, a higher body mass index, a lower propensity to save and worse education outcomes (Castillo et al., 2011; Sutter et al., 2013; Castillo, Jordan, and Petrie, 2015). Like adults, more risk-taking children and adolescents are more likely to be overweight or obese (Sutter et al., 2013). Importantly, these associations tend to persist, as measures of IQ and economic preferences in childhood or adolescence have also been shown to predict adult outcomes (Strenze, 2007; Borghans, ter Weel, and Weinberg, 2008; Golsteyn, Grönqvist, and Lindahl, 2014).[2]

[1]For more extensive evidence on IQ and outcomes, we refer the reader to several meta-analyses and overview articles (Schmidt and Hunter, 2004; Strenze, 2007; Almlund et al., 2011).

[2]Related literature in psychology on childhood temperament documents (i) that childhood temperament predicts functioning in childhood, (ii) the existence of some continuity in IQ and temperament development

Differences in preferences also determine outcomes at the societal level. For instance, aggregate patience relates to the level of economic development of countries and regions, risk preferences predict labor protection policies and social preferences are associated with the frequency of armed conflicts (Falk et al., 2015; Hübner and Vannoorenberghe, 2015; Dohmen et al., 2016). The relevance of IQ and preferences at the individual and aggregate level calls for a better understanding of their origins. In particular, if systematic differences in IQ and preferences emerge during childhood and are linked to the family environment, this may provide further evidence for inequality being founded early in life, with important implications for persistence of inequality and social immobility.

This paper contributes to the understanding of the origins of inequality by documenting a systematic and strong relation between a family's socio-economic status (SES) and a child's economic preferences and IQ. Establishing such a relationship is challenging, as it requires comprehensive information concerning a household's socio-economic environment, as well as precise measures of the offspring's preferences and IQ. We have collected such data for 435 parents and their children. They contain parent surveys on the household environment, including detailed measures of SES, maternal preferences and IQ, parenting styles and time investments. They also comprise results from high-quality IQ tests and incentivized, experimentally-elicited measures of patience, risk-taking and altruism for the children. All measurements were elicited twice under identical conditions, but with several months in between. Moreover, SES was part of the sampling scheme, such that families can be naturally classified into high and low SES families, depending on the level of parental education and household income. In presenting our results, we first use this classification to document early gaps in the children's IQ and preferences. Subsequently, in line with some of the recent literature (Cunha and Heckman, 2007; Cobb-Clark, Salamanca, and Zhu, 2016; Doepke and Zilibotti, 2017), we propose and estimate a framework in which SES can influence both the level of investments and their overall productivity.

Our main finding is that gaps in time, risk and social preferences as well as IQ open up early in life and are strongly related to a child's socio-economic environment. Children from families with higher SES are significantly more patient and altruistic, less likely to be risk-seeking and they score higher on IQ tests. The SES gaps are sizable. They amount to around 0.65 of a standard deviation in IQ and range between 0.21 and 0.35 of a standard deviation in preferences by mid-elementary school age. These gaps compare to about half of the black-white achievement gaps in the US and are larger than the estimated effects of most

from early childhood to early adulthood and (iii) that early childhood differences in temperament are systematically related to a broad range of adult outcomes (Caspi, 2000; Caspi et al., 2003; Moffitt et al., 2011).

intervention programs. The overall pattern of results suggests that childhood circumstances cumulate as low parental education and low parental income tend to reinforce each other if both are present in a single family. Our findings indicate that the SES gaps are mostly driven by differences in maternal characteristics and by SES-related disparities in the level of parental investments, while SES-related differences in the productivity of the investment process are largely irrelevant.

We move beyond existing work in at least three respects. First, this is the only paper to date that consistently relates precise measures of socio-economic disparities in the household environment to key economic preferences in children.[3] The reason is a prior lack of data combining incentivized measures of children's economic preferences with detailed information on their family environment.[4] Given the considerable importance of preferences in economic theory and empirical work, the literature on the relationship between a child's economic preferences and its household environment is surprisingly scarce. For time preferences, the study by Delaney and Doyle (2012) comes closest to analyzing this relationship. They use parental answers to questions concerning psychological concepts such as hyperactivity, impulsivity and persistence of three year-old children and show that children from families with higher SES are less impulsive. Concerning risk preferences, Alan et al. (2017) study the intergenerational transmission of risk attitudes, using maternal and paternal years of education as control variables. Regarding social preferences, Bauer, Chytilová, and Pertold-Gebicka (2014) is the only closely-related study.[5] Similar to us, they find a positive relationship between parental education and altruism in primary school children.[6]

Second, what sets our paper apart from existing studies is that we study time preferences, risk preferences, social preferences and IQ in the same sample of children and in one coherent framework. This is important, as no economic decision involves only one preference or cognitive aspect. For example, addictive behaviors such as smoking, drinking or gambling involve risk considerations, but also a trade-off between immediate and delayed

[3]While research on the relation between SES and children's economic preferences remains in its infancy, the effect of SES on children's overall IQ is well established (see Bradley and Corwyn, 2002, for a summary of the literature).

[4]For a discussion see also Falk and Kosse (2016), who use breastfeeding duration as a proxy to explore the relation between early-life circumstance and preferences.

[5]Benenson, Pascoe, and Radmore (2007) also present evidence that higher SES is associated with higher levels of altruism. However, in their study, SES is only measured at the school level, using the fraction of children who receive a free lunch. Angerer et al. (2015a) use children's statements about their parents' profession to deduce measures of parental income and education. They find a marginally significant, positive effect of higher paternal education on children's donations to a charity.

[6]In addition, psychological literature exists focusing on the relation of more broadly-defined concepts, such as socio-emotional behavior, cognitive development and family adversity (see, e.g., Obradović et al., 2010; Burchinal et al., 2000, and the references therein). This work follows a different tradition and the measures are usually not incentivized.

utility (Ida and Goto, 2009; Sutter et al., 2013). In this respect, our approach offers a more holistic view of SES-related disparities in child characteristics that matter for economic decision-making.

Third, above and beyond studying SES as a "black box", we provide a simple, static framework to study how the family environment differs by SES and why these differences translate into differences in children's time preferences, risk preferences, altruism and IQ. Within this framework, we capture several aspects of developmental inputs, such as parenting style investments, parental time investments and the IQ and preferences of the child's mother. We allow SES to affect both the *level* of parental investments and the *productivity* of the investment process. In addition to a direct intergenerational transmission of IQ and economic preferences from mothers to children, we find that socio-economic differences in child IQ and preferences are mostly due to differences in parental inputs, i.e., the parenting style and time investments, and not due to differences in productivity. Our model estimates can be used to study the extent to which the SES gap in IQ and economic preferences would be reduced in the presence of policies that target economic resources or parental investments, respectively.

The remainder of the paper is organized as follows. First, we describe the composition of our sample, the data collection process, our definition of SES and our measures of economic preferences and IQ. Section 3 provides descriptive evidence on gaps in IQ and preferences between children from high and low SES households. Section 4 presents and estimates a framework of how maternal IQ and preferences, household income, parental education and investments interact to form a child's preferences and IQ. In the final section, we discuss the implications of our findings and conclude.

2 Data

This section introduces the data and describes our measures of IQ and preferences. We first report how the families were recruited and interviewed, as well as how we classified them in terms of SES. We then provide a detailed description of the incentivized experiments and IQ tests.

2.1 Sampling and data collection

Our sample comprises 435 children and their mothers.[7] The families were recruited using official registry data comprising more than 95% of the addresses of families living in Bonn and Cologne (Germany) who had children aged 7-9. Offers to take part in the study were sent by mail to all families with children born between September 2003 and August 2004 and one-third of families with children born between September 2002 and August 2003. 12.5% (N=1874) of the contacted families agreed to participate.[8] Since our main focus is on SES-related disparities in child IQ and preferences, we distinguished between two groups of families. First, we invited all low-income, low parental education or single parent families to obtain a large sample of socio-economically disadvantaged children. A family was categorized as "low income" if its household equivalence income was lower than the 30th percentile of the German income distribution, and as "low education" if neither parent has obtained a university entrance certificate. Second, we invited a randomly-chosen subgroup of 150 high SES families, i.e., who did not meet any of the above criteria.

All 435 children and their mothers took part in two consecutive interviews, with a time interval of 16 months.[9] These interviews took place in their respective hometown in centrally-located apartments that where rented and equipped for the purpose of this study. The data collections were conducted by trained university students (mostly graduates) of psychology or education science and lasted about one hour.[10] During the interviews and experiments, the interviewer, the mother and the child were in the same room. However, a standardized seating plan ensured that the mother and child did not have eye contact and could not communicate otherwise.

During the interviews, the children participated in a sequence of seven experiments, two intelligence tests (one on fluid and one on crystallized IQ) and answered a brief questionnaire. While the children participated in the experiments, their mothers filled out a

[7] During the interviews, 96% of the children were accompanied by their biological mother, 2% by their biological father, 3 children by a step or foster parent and one child by the new partner of a biological parent. We do not have unambiguous information on the accompanying person for about 1% of the children. Throughout the paper, we will use the term "mother" for the adult accompanying the child.

[8] The parents answered a short screening questionnaire about the socio-economic characteristics of the household, consented to let their children participate in the study and (if selected) to let them take part in a one-year mentoring program. In our analysis, we exclude the subgroup of selected children. An additional requirement was that the families speak (at least some) German at home, to ensure that both the children and their mothers understood the questionnaire items and experimental instructions, which were phrased in German.

[9] At the time of the first data collection, the children were on average 7.8 years old. At the time of the second data collection, the children were on average 9.1 years old.

[10] All mothers received a flat payment of 35 Euros in the first data collection and 45 Euros in the second data collection to cover travel expenses and incentivize participation.

comprehensive questionnaire. First, they provided general information about the child, such as name, age, gender and the number of older and younger siblings. Second, they answered a battery of questions related to the socio-economic background of the family. Third, they were asked to provide information on the childhood environment, including measures of parenting style, parent-child activities and an assessment of how satisfied the parents were with their child's development. Finally, the mother answered a battery of questions regarding her own economic preferences and completed an IQ test. Maternal economic preferences were elicited using the questionnaire measures validated by Falk et al. (2016) and maternal IQ was measured by a short version of the Standard Progressive Matrices Plus test (SPM Plus).[11]

Families in this study are not necessarily representative of the German population. All families live in the same part of the country, study participation was voluntary and SES was part of the sampling scheme. In particular, they may differ systematically in terms of maternal intelligence and maternal economic preferences. To investigate non-random selection, we compare our sample along several dimensions to the German Socio-Economic Panel (SOEP), a representative sample of households in Germany. Note that a substantial part of the questionnaire answered by the mothers matched the SOEP questionnaire. When compared to the SOEP, our sample indeed comprises a moderately higher share of high SES households, as well as more intelligent, altruistic and risk-taking mothers (see table A7 of Section A.4).

We are interested in assessing effect sizes that are interpretable in terms of population standard deviations. Thus, we proceed as follows. First, we construct inverse probability weights (IPWs) that account for systematic differences in SES, maternal IQ, and maternal preferences between our sample and the representative SOEP data (for details, see Section A.4). We then use these weights, to estimate the moments of the population distribution. Last, we standardize our measures of child IQ and economic preferences using these moments. In addition, we draw on the aforementioned weights to evaluate the robustness of our results with respect to self-selection. Moreover, we construct a second set of weights, which allows us to assess and correct for potential non-random attrition (attrition is 16.2%, see Section A.4.2 for a description of the weighting scheme).

2.2 Socio-economic status

Common classifications of SES rely on income or education (see, e.g., Ganzeboom, De Graaf, and Treiman (1992)). In line with this literature and our initial sampling scheme, we clas-

[11] For a detailed description of the maternal preference and IQ measures, see Section A.10.2.

sify a family as "low SES" if either one or both of the following conditions are met: (i) the parents are low-educated, i.e., neither parent has obtained a university entrance certificate; or (ii) net equivalence household income lies below the 30th percentile of the German income distribution.[12] All other families are classified as "high SES".

Later, we also use parental education and household income as continuous measures of a child's socio-economic background. For education, we construct a measure comprising the overall number of years of education averaged over mothers and fathers, i.e., including occupational training and university education. For income, we use net monthly household equivalence income, computed in line with standard OECD and EUROSTAT procedures (see Hagenaars, De Vos, and Zaidi, 1994).[13] Our income measure thus accounts for both the number of individuals living in a household and economies of scale that arise as the household size increases.

Education is a measure of human capital and thus a primary means to generate income. As a result, our data display a strong correlation ($\rho = 0.57$) between parental education and family income. 45% of the children with low-educated parents experience both low parental education and low family income as two forms of socio-economic disadvantage.

2.3 Description of experiments and IQ tests

In the following, we explain the experiments to measure patience, risk-taking and altruism in children, before we present the IQ tests. To assess preferences, we relied on a combination of established and newly-developed measurement tools, which were carefully pre-tested and adapted to the children's age range. All experiments were incentivized using toys and a small amount of money. For this purpose, we introduced an experimental currency called "stars". After the interview, children could exchange the number of paper stars that they had collected in the experiments for toys (see the picture in figure A1). A reward with the monetary equivalent of 4 Euro was guaranteed. Each star collected in the experiments increased the value of the reward by 0.15 Euro. For comparison, note that the mean amount of pocket money in our sample was about 1.5 Euro per week. In order to minimize "in-experiment wealth effects", all earned stars were put in separate paper bags after each experiment, such that the children could not see their accumulated "wealth". We used

[12]The monthly net household equivalence income threshold of 1,065 Euro is calculated based on representative household data (SOEP, 2011). It closely aligns with the official poverty line (e.g., 1,033 Euro in 2015).

[13]Net monthly household equivalence income is computed by dividing total monthly nominal household income (after taxes, but including all transfers) by a factor that takes the household's size and composition into account. The factor takes on the value 1 for a single-person household. For each additional person aged 14 years or older 0.5 is added, while for each person younger than 14 years 0.3 is added.

standardized control questions to verify that all participating children had understood the instructions.[14]

At both data collections, the interviews, experimental procedures and tests were identical and administered in the same fixed order. For each child and variable we thus obtain two measures, which we aggregate using equal weights. Hence, our measures are an assessment of the child's economic preferences in mid-childhood, which is considered as a single development stage in much of developmental psychology (e.g., Inhelder and Piaget, 1958; Berger, 2011).[15] This procedure reduces random measurement error, which tends to be larger in measures of economic preferences, based on a single experiment, than is the case, e.g., for multi-item survey measures of personality traits.[16] Experimentally-elicited preference measures bear several important advantages: they are constructed from revealed preferences in well-defined and controlled contexts. This gives them a readily-interpretable metric, likely reduces non-random measurement error and allows for a straightforward comparison across individuals.

2.3.1 Time preferences: piggy bank experiment

Our measure of patience is the number of saved coins in a piggy bank. We developed the piggy bank experiment as an age-adapted version of the common time preference elicitation paradigm for adults, which involves trade-offs between smaller but sooner available amounts of money and larger but delayed amounts of money. Children were endowed with seven 20 cent coins. They could choose how many coins to put in a piggy bank and how many to take immediately. The amount put in the piggy bank was doubled and sent to the children via postal mail one week after the interview. We ensured that the children were certain to receive the money. To minimize potential trust issues, we explicitly addressed the letter to the children themselves, wrote the address on the envelope and put the saved amount of money in the envelope while the children were watching.

[14] Less than 1% of the observations had to be excluded because the children did not fully understand the experimental protocol.

[15] All results remain qualitatively the same when we conduct our analyses separately for each of the two data collections.

[16] For economic preferences, test-retest correlations are in the range of 0.1-0.5 (see Chuang and Schechter, 2015), while for personality traits they are as high as 0.6-0.8 (see Roberts and DelVecchio, 2000). We analyze and discuss the test-retest properties of our measures in Section A.5. We then show that test-retest properties of the experimental measures in our sample of preschool children are in line with the test-retest properties of the same (age-adapted) measures in a sample of young adults. Moreover, the correlations do not vary systematically by socio-economic status. Hence, in empirical models of SES, with preferences as dependent variables, measurement error is likely captured by the error term.

The number of coins put into the piggy bank is our measure of the child's patience, where a higher number implies a higher degree of patience.[17] The average number of coins put into the piggy banks was 5.12, with a standard deviation of 1.62.

2.3.2 Risk preferences: coin-flipping experiment

To elicit an overall measure of risk-taking as well as measures of risk neutrality, risk aversion and risk seeking, the children made two choices. Situation A assessed risk aversion. Here, the children could choose between a safe option with a lower expected return and a risky option with a higher expected return. Situation B identified risk seeking. In this situation, the children could choose between a safe option with a higher expected return and a risky option with a lower expected return.

During the experiments, the interviewer presented two coins in each of the two situations. In situation A, one of the coins had three stars printed on each side. The other coin had seven stars on one side and zero on the other. Children chose which coin should be tossed. The interviewer explained that choosing the coin with three stars on each side implied winning three stars for certain. However, choosing the other coin implied that the outcome (seven or zero stars) was determined by chance, with both outcomes being equally likely. The safe amount (three stars) was also "determined" by a coin toss to reduce the likelihood that children did not choose the risky option only for entertainment or game value. After children had made their decision, but before actually tossing the chosen coin, the interviewer presented two more coins in another color (situation B). Now, one coin had four stars on each side, while the other coin again had zero stars on one side and seven on the other. Children made their second decision and the interviewer tossed the two chosen coins. The order in which the two variations of the game (situation A versus situation B) were played was randomized. The coin-flipping experiments is thus a simple, vivid way to assess risk preferences. It is easier to understand than, e.g., a choice list representation commonly used for adults (see, e.g., Holt and Laury, 2002; Dohmen et al., 2010; Charness, Gneezy, and Imas, 2013).

Our main measure of risk-taking is the number of risky choices (zero to four) over the two data collection points in both situations. On average, the number of risky choices is 1.68, with a standard deviation of 1.18.

[17] In a recent methodological contribution on how to measure children's time preferences, Angerer et al. (2015b) compare a choice list measure and a "single choice time-investment-exercise" that is very similar to our piggy bank experiment. The authors show that both measures yield similar aggregate results and substantially correlate within subjects.

In later analyses, we also investigate child behavior in the risk-averse, risk-neutral and risk-seeking domains. Children are categorized as risk-averse if they chose the safe option in situation A and situation B (in at least one of the data collection points). Children are categorized as risk-seeking if they chose the risky option in both situations (in at least one of the data collection points). The remaining children, including those who alternated between risk-averse and risk-seeking choices, are categorized as risk-neutral.[18] The corresponding shares are displayed in figure A2.

2.3.3 Altruism: three dictator game experiments

Our measure of altruism reflects behavior in three dictator game experiments: one binary choice game and two continuous dictator games with different receivers. In the binary choice game, each child had to decide between two possible allocations of two stars between him-/herself and another unknown child of similar age from the same city (following the experimental protocols by Fehr, Bernhard, and Rockenbach (2008) and Fehr, Rützler, and Sutter (2013)). In one allocation, (2,0), the decision-maker received two stars, while the other child received zero stars. In the alternative allocation, (1,1), both the decision-maker and the recipient received one star each. Both possible allocations were demonstrated to the children and the interviewers checked whether the children had fully understood the implications of each allocation. We also ran two continuous dictator games. In both versions of the game, the interviewers showed the children two paper bags, one belonging to the interviewed child and the other belonging to another child, the receiver. Between games, we varied the receiver. In one game, the receiver is a child living in a nearby city. In the other game, the child lives in an African country. Children knew that the African child does not live together with his parents since they are either "ill or dead". In both versions, children were endowed with 6 stars. After the children had distributed the stars between the two bags, the interviewer checked that they had understood how many stars they and the other child would receive. If the children did not understand the resulting allocation, the rules were explained again and the children could alter their decision. We cooperated with three charity organizations (one in Cologne, Bonn and Togo (SOS Children's Village), respectively) to ensure that the allocation decisions were implemented as described.[19]

[18] Note that our data do not allow a closer view on different degrees of risk aversion in the risk-averse domain.

[19] Our agreement with the charity organizations ensured that the receiving children benefited from the monetary equivalents of the distributed stars in form of toys. This was also communicated to the decision-makers.

The joint measure of altruism is the average share of stars that a child gave away in all six dictator game experiments (three experiments in each of the two data collections). The average share of stars given away is 0.351, with a standard deviation of 0.125.

2.3.4 Intelligence (IQ)

Our measure of IQ combines information on crystallized and fluid intelligence. Fluid IQ measures the part of overall IQ that refers to general logical reasoning in new situations, intellectual capacity or processing speed. Crystallized IQ is the part of overall IQ that broadly refers to knowledge that has been acquired in life, such as vocabulary. Following the work of Cattell (1971), these two basic components form general intelligence or simply (overall) IQ.

We rely on IQ tests that are commonly used for children. First, we measured fluid IQ using the matrices test of the HAWIK IV, which is the German version of the well-established Wechsler IQ test for children (Petermann and Petermann, 2010). Children were presented up to 35 blocks or rows of pictures featuring different colors and forms. In every block or row, one cell was missing. Children had to choose which of five pictures best fit into the missing cell. Second, we measured crystallized IQ using the German translation of the commonly-used Peabody Picture Vocabulary Test Revised (PPVT-R) (Dunn and Dunn, 2007).[20] For each item, the interviewer read out one word and showed the child four pictures. Children had to decide which picture best fit the word. For both fluid and crystallized IQ, we separately standardize the average score over both data collections. Our joint measure of IQ is the standardized sum of both subtests.

3 SES gaps in child IQ and economic preferences

In this section, we document differences in IQ and economic preferences between elementary school children who grow up in high and low SES families. Our aim is to uncover the importance of SES as an indicator of early disparities in a child's environment, before we turn to the underlying causes and mechanisms.

The gaps in IQ and economic preferences among children from high and low SES households are displayed in figure 1. The horizontal bars represent coefficients of regressions of

[20]Due to time constraints, we had to restrict the test to fourteen items. We chose those fourteen items that had the largest discriminatory power in the SOEP pretest data of the mother and child questionnaires "MukiIIIb" and "MukiIIIc", which were based on a 61-item version of the PPVT-R test (see, e.g., Bartling et al., 2010).

IQ and economic preferences on a dummy variable that equals one for high and zero for low SES households. The figure shows that all our measures of child IQ and economic preferences vary systematically by SES. In particular, children in high SES families have a higher IQ ($p < 0.01$), are more patient ($p < 0.05$), less risk-taking ($p < 0.1$) and more altruistic ($p < 0.05$) than children from families with low SES (see table A2 for the corresponding regression results).[21] The differences by SES are sizable. High SES children have a 65% of a standard deviation higher IQ, are 35% of a standard deviation more patient, 23% of a standard deviation less risk-taking and 21% of a standard deviation more altruistic than their low SES counterparts.

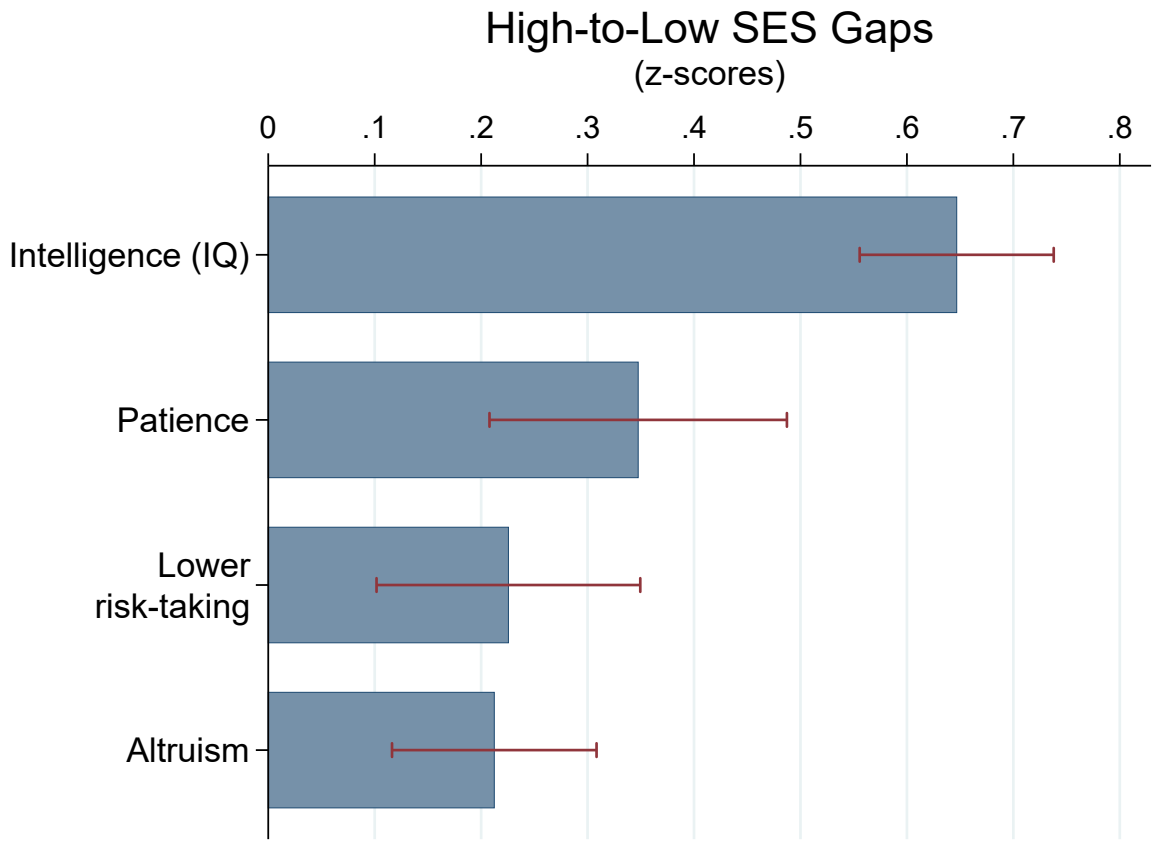

Figure 1: The figure displays gaps in IQ and economic preferences between elementary school children from high and low SES families. The horizontal bars represent coefficients of a dummy variable that equals 1 for high and 0 for low SES households in regressions of IQ or preferences on this SES dummy (OLS for IQ and altruism, Tobit for patience and risk-taking). Error bars show bootstrapped SE (1,000 bootstrap replications).

[21] For comparison, in table A2 we report three different estimates of standard errors (SE). The different estimates are very similar, but bootstrapped SEs are slightly more conservative than OLS or White SEs. Therefore, we report p-values based on bootstrapped SE for all regressions in this study.

The above effect sizes are substantial when compared to racial gaps, or the impact of most childhood interventions. Regarding patience and IQ, the SES gaps exceed half the seize of the black-white achievement test gap in the US (Jencks and Phillips, 1998; Carneiro, Heckman, and Masterov, 2005; Hanushek, 2010). Moreover, the gaps are larger than most of the standardized effect sizes reported for early child care or school-based interventions. In a meta-analysis, Duncan and Magnuson (2013) find a weighted average impact of early child care programs on cognitive and achievement outcomes of 21%, and McEwan (2015) reports average effect sizes of less than 15% of a standard deviation in school achievement for a large number of primary school interventions.[22]

The above-reported gaps in child IQ and preferences are important in light of the literature showing that differences in these characteristics translate into child behaviors and outcomes. Previous studies have documented that children's IQ, patience, risk-taking and prosocial behavior predict success at school (Reynolds, Temple, and Ou, 2010; Almlund et al., 2011; Castillo et al., 2011; Castillo, Jordan, and Petrie, 2015; Almås et al., 2016), while impatience and a high willingness to take risks predict negative health outcomes and risky behaviors, such as smoking or drinking alcohol (Sutter et al., 2013). Importantly, measures of IQ and economic preferences as measured in childhood have also been shown to predict adult outcomes (Strenze, 2007; Borghans, ter Weel, and Weinberg, 2008; Golsteyn, Grönqvist, and Lindahl, 2014). Thus, our key result that gaps in IQ and economic preferences by SES emerge early has wide-ranging implications for important outcomes in childhood, adolescence and adulthood alike.

The results displayed in figure 1 unveil that SES is associated with certain preference and IQ *profiles* in children. For example, children from low SES backgrounds are, on average, less patient *and* more risk-taking; they are less altruistic *and* less intelligent, et cetera. SES thus evokes the simultaneous determination of "risk factors" which favor social immobility and marginalisation. For example, individuals who are both less intelligent and less patient are likely to obtain lower levels of education.[23] Table A3 shows how preferences relate to important *teenage* life-outcomes in our data.[24] It displays Pearson correlation coefficients between our child preference and IQ measures and teenage life-outcomes from follow-up surveys, collected four to five years after the first data collection. The results indicate that those profiles that prevail in high SES families (high IQ, high

[22]Some high-quality early childhood education programs such as the Perry Preschool or Abecedarian programs show much larger effects, at least in the short run (see Duncan and Magnuson (2013) and Heckman, Pinto, and Savelyev (2013)).

[23]These findings also suggest that SES drives part of the observed preference correlations displayed in table A11.

[24]For details on the teenage data see Section A.6.

patience, low risk-taking, high altruism) translate into more educational success, more social participation, and less juvenile offending during adolescence.[25]

In the appendix, we show that the high-to-low SES gaps displayed in figure 1 are robust to various alternative specifications. First, we use two different sets of weights in the underlying regressions of figure 1, to make our sample comparable to the German population of families and correct for selective sample attrition. Our results remain very similar when we apply the corresponding weighting schemes (see Section A.4). Second, we add control variables that account for potential SES-related differences in the experimental procedures (see Section A.7). Here, we show that our results are unaffected by potential in-experimental wealth effects or differential perceptions of the incentives used. Third, we vary the definition of parental education. Our results remain the same whether we rely on measures of maternal education, paternal education or both, suggesting a large degree of assortative mating among spouses with similar educational degrees (see Section A.8). Finally, we show that the differences in IQ and economic preferences by SES do not significantly differ for boys and girls (see table A4).

Alternatively to using the sum of risky choices as a measure of risk preferences, our data allow classifying behavior in a more fine-grained way. Figure A2 displays the shares of risk-averse, risk-neutral and risk-seeking children by SES. Overall, 44% of the elementary school children in our sample are classified as risk-averse, 32% as risk-neutral and 24% as risk-seeking (compare Slovic (1966) and Falk and Kosse (2016) for similar results). Regarding differences in children's risk preferences by SES, high and low SES children are about equally likely to be risk-averse (43.3% vs. 44.4%, $p = 0.814$, see table A5). However, a higher share of high SES children are risk-neutral (36.1% vs. 28.2%, $p < 0.1$), whereas a higher share of low SES children are risk-seeking (20.6% vs. 27.4%, $p < 0.1$). Hence, our finding that low SES children are significantly more risk-taking than children from high SES families does not originate from high SES children being more risk-averse, but rather from low SES children being more risk-seeking as opposed to risk-neutral.[26]

The results on SES gaps presented thus far rely on a definition of SES that classifies households as low SES if they meet at least one of two criteria (low household income and low parental education). This reflects our sampling scheme. Nonetheless, to better understand which components of low SES matter, we also decompose the overall gap into the parts that are explained by low education or low income, respectively. We repeat the

[25]For recent evidence on the relation of skills/personality and political or social participation see Hufe and Peichl (2016) and Holbein (2017).

[26]Similarly, using breastfeeding duration as a measure of favorable conditions within a child's family, Falk and Kosse (2016) find that children who are breastfed for a shorter period of time are more prone to take risks during preschool age.

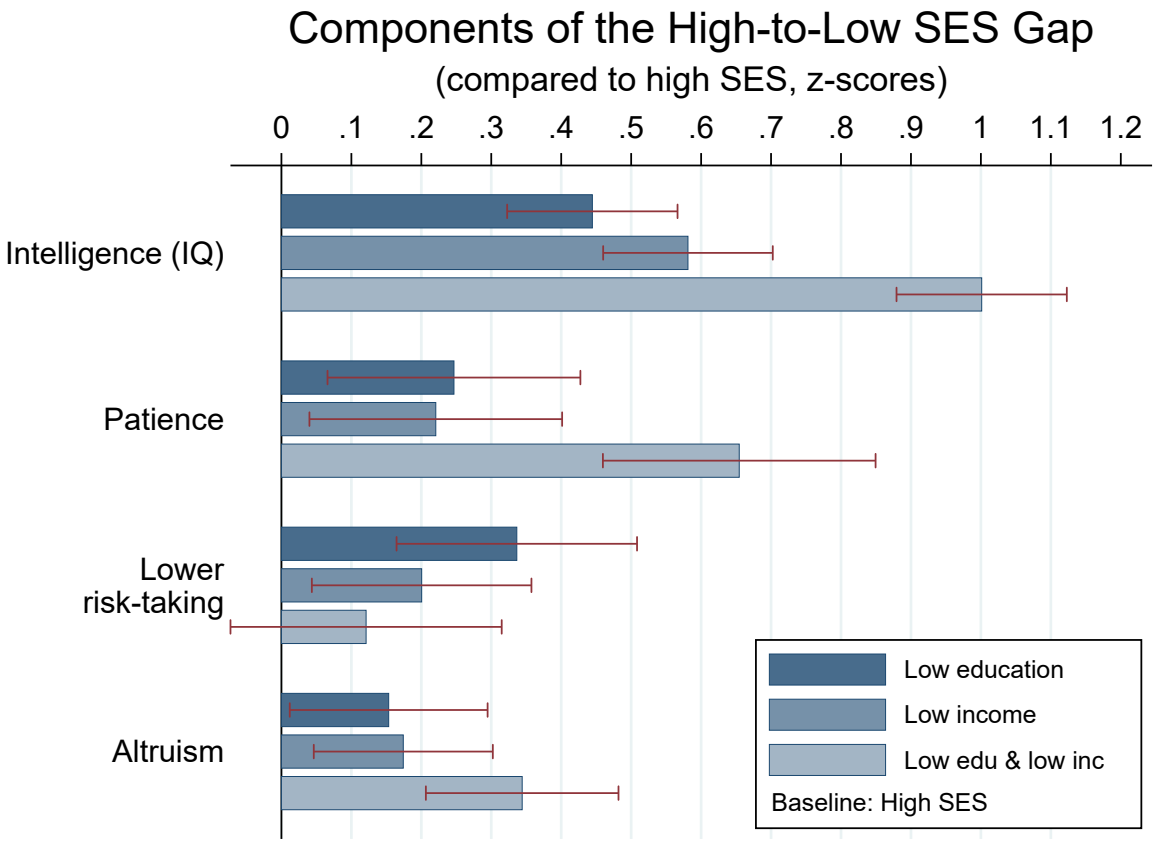

Figure 2: The figure displays gaps in IQ and economic preferences between elementary school children from different socio-economic backgrounds. The horizontal bars represent coefficients of three dummy variables in regressions of IQ or preferences on the three dummies (OLS for IQ and altruism, Tobit for patience and risk-taking). The first dummy variable equals 1 for a parental background that is characterized by low education but an income above the low SES threshold and 0 otherwise. The second dummy variable equals 1 for a parental background that is characterized by low income but a level of parental education exceeding the low SES threshold and 0 otherwise. The third dummy variable equals 1 if both low SES criteria are met (low income and low parental education) and 0 otherwise. The displayed coefficients indicate differences between each respective low SES subgroup and the baseline category of high SES (neither low parental education nor low income). Error bars show bootstrapped SE (1,000 bootstrap replications).

analysis shown in figure 1, but now sub-divide the low SES category into (i) low parental education only, (ii) low parental income only and (iii) both low parental education and low parental income. The gaps between children from these three groups and those from high SES families are presented in figure 2. It shows that children from high SES families score higher on IQ tests, are more patient, less risk-taking and more altruistic than children from low SES families regardless of whether we use low income only, low education only or a combination of both. Moreover, if both low income and low parental education are present in a single family, the SES gaps in IQ, patience and altruism are largest, suggesting that low income and low parental education are "risk factors" that reinforce each other.

4 SES and the development of preferences and IQ: a conceptual framework

In the previous section, we have shown that parental SES is a powerful predictor of a child's IQ and economic preferences. In this section, we present and estimate a framework, inspired by the model of Becker and Tomes (1986) as well as the technology of skill formation (Cunha and Heckman, 2007; Cunha, Heckman, and Schennach, 2010), concerning how maternal IQ and preferences, household income, education and parental investments affect a child's IQ and preferences. Given the cross-sectional nature of our data, we cannot estimate a fully dynamic model in which children's IQ and preferences are a function of last period's levels, and in which parents adapt their investments over time. Instead, we present a static framework and approach potential endogeneity by collecting measures on the parental assessment of their children's development. Relying on this approach, we approximate the process of a child's IQ and preference development until mid-childhood. In this respect, our framework can be thought of as an application of Becker and Tomes (1986) for one particular period of childhood, where initial endowments are captured by maternal IQ and preferences.

4.1 The formation of child IQ and preferences

We model the formation of a child's IQ and preferences as a function of maternal IQ and preferences and parental investments. Moreover, we allow the productivity of this process to vary across high and low SES families.

Child development is represented by a four-dimensional vector of IQ, patience, lower degrees of risk-taking and altruism denoted by $P_i = (P_i^{IQ}, P_i^P, P_i^R, P_i^A)$. In line with the

literature on the technology of skill formation (Cunha, Heckman, and Schennach, 2010), we assume that IQ and preferences are formed according to a production function with Constant Elasticity of Substitution (CES), which we write as:

$$P_i^\ell = \Pi_{\text{SES}}^\ell [{\gamma_M}^\ell M_i^{\ell\phi^\ell} + {\gamma_s}^\ell I_i^{S\phi^\ell} + {\gamma_t}^\ell I_i^{T\phi^\ell}]^{\frac{1}{\phi^\ell}} e^{\eta_i^\ell} \qquad \ell \in \{IQ, P, R, A\}, \tag{1}$$

where $\gamma_j^\ell \in [0,1]$ are production shares, such that $\sum_j^J \gamma_j^\ell = 1$. $\phi^\ell \in [-\infty, 1]$ is an elasticity parameter and $\varepsilon = 1/(1-\phi^\ell)$ represents the elasticity of substitution in the inputs that generate IQ and preferences. Moreover, e^{η^ℓ} reflects unobserved random shocks. Factor inputs are as follows: M^ℓ denotes the maternal characteristic that corresponds to P^ℓ, I^S is a positive parenting style and I^T denotes time investments. M^ℓ enters the production function to capture the direct transmission of IQ and preferences, which can take place socially or genetically. As an example, one may imagine that if a mother acts very altruistically, the child likely imitates that behavior.[27] Apart from that, M^ℓ may capture the (genetic) heritability in IQ and possibly preferences.

Π_{SES} in equation (1) denotes a factor-neutral SES-specific productivity parameter. It captures productivity differences that arise if, for example, the same amount of inputs yields a larger amount of output in high rather than low SES families (in which case, $\Pi_{\text{SES}} > 1$). Such productivity differences may arise, for example, if a certain level of investment by a highly-educated or affluent mother is more productive than the same investment by a less educated or poor mother.

Note that all parameters of the above function may differ across preferences and IQ. Thus, for each characteristic P^ℓ the substitutability of inputs may vary freely from perfect complements ($\phi^\ell \to -\infty$) to perfect substitutes ($\phi^\ell \to 1$). Along the same lines, the production shares (γ) and the factor-neutral productivity parameter may vary freely across characteristics.

4.2 Parental investment and the determinants of SES

Recent empirical studies (Cunha and Heckman, 2007; Heckman, 2008; Heckman and Mosso, 2014; Doyle et al., 2017) stress the importance of parental investments in children. Such investments can take various forms, as any parent-child interaction represents some kind of "investment" into the child's human capital. We think of parental investments along two

[27] For descriptive evidence on an intergenerational transmission of preferences, see Kosse and Pfeiffer (2012, 2013) for evidence on patience, Dohmen et al. (2012) and Alan et al. (2017) for risk-taking and Kosse et al. (2016) for social preferences.

dimensions: parenting styles and parental time investments. First, the type of parental interactions such as the tone and attitude by which parents approach their children is termed "parenting style" (denoted by S), reflecting the quality of parent-child interactions. Doepke and Zilibotti (2017) present a theoretical model in which they argue that parenting style depends on the socio-economic environment in which a family lives and that parenting style may affect children's preferences. Moreover, Burton, Phipps, and Curtis (2002) show that both socio-economic factors and parenting style are important determinants of child behavior. Second, we focus on time-intensive high-quality parent-child interactions (denoted by T), termed "time investments". Time investments capture the so-called "quality time" that children spend with their parents (Price, 2008; Guryan, Hurst, and Kearney, 2008).

Investments are a natural candidate of how SES translates into differences in IQ and preferences. In order to capture this mechanism, we specify a simple investment system to approximate the underlying structural model of parental investment decisions. According to this model, parental investments are determined by household characteristics, maternal characteristics as well as SES:

$$I_i^m = \delta_0^m + \delta_M^m M_i^P + \delta_{\text{SES}}^m \text{SES}_i + \delta_{X_i}^m X_i + \epsilon_i^m \qquad m \in \{S, T\}, \tag{2}$$

where M^P denotes a vector of maternal IQ and preferences, SES comprises education and income as measures of socio-economic status and X_i is a vector of household characteristics. ϵ_I^m with $m \in \{S, T\}$ are error terms, which may correlate across investment equations. In addition, as discussed in the next section, ϵ_I^m may correlate with $\eta_i{}^\ell$, i.e., as parents react to shocks in the development of their children.

By specifying equations (1) and (2) of the above framework, we allow SES to affect a child's IQ and preferences through two main channels. First, parental education and household income can have a direct effect on the level of parental investments (*level effect*). For example, more educated parents tend to spend more quality time with their children (see, e.g., Guryan, Hurst, and Kearney, 2008). Similarly, high-income families may find it easier to comfort and reward their children (in particular if rewards are costly) rather than punishing them (Weinberg, 2001). Second, the effect of parental investments may differ by SES if education or material resources interact with the amount and quality of parental investments. This *productivity effect* is captured by Π_{SES} in equation (1).[28]

[28]Mothers in turn can use their IQ and preferences to produce education and household income. This relationship is described in Section A.11.

4.3 Estimation strategy

4.3.1 Parenting style and time investments

This section explains how we measure parenting style and time investments (for further details, see Section A.10.1). First, we elicit parenting practices ($\mathcal{M}^S$) through several questionnaire items that can be grouped in a measure of parental warmth (comprising praise and emotional warmth), a measure of parental interest and monitoring, and a measure of parental psychological and behavioral control (punishment). Parenting style does not follow a natural metric and is assumed to be latent, but known to the mothers. We thus employ a measurement model with a flexible distributional factor structure to extract latent parenting style, where a higher value reflects permissive, warm and child-oriented parenting, while a lower value is associated with a higher degree of punishment.

We assume that the observed measurements ($\mathcal{M}^S$) of parenting practices are additively separable in the natural logarithm of the latent parenting factor ($\ln(I^S)$), a function of maternal IQ and preferences (M^P) and household characteristics (X). Then, for family i and measurement k, we can write:

$$\mathcal{M}^S_{k,i} = \mu_k + M^P_{k,i}\gamma_k + X_{k,i}\beta_k + \lambda_k \ln(I^S) + \epsilon_{k,i} \qquad \text{for } k = 1, ..., K, \tag{3}$$

where the terms μ_k are intercepts, λ_k are factor loadings and $\epsilon_{k,i}$ are measurement errors. Measurements are standardized to have a mean of zero and standard deviation of one (using representative weights, see Section A.4). Since the scale of each factor is arbitrary, we set the factor loading in the first measurement equation to unity ($\lambda_1 = 1$). Furthermore, we assume $E[\epsilon_{k,i}] = 0$ for all $k = 1, ..., K$ and that the measurement errors are independent across equations and the latent factor. Finally, we require $K > 2$ to ensure identification.[29]

The distribution of I^S is flexibly approximated by a mixture of two normal distributions, such that the probability density function can be written as:

$$f_I(\ln(I)) \sim \omega p_1(\ln(I^S_1)) + (1 - \omega)p_2(\ln(I^S_2)),$$

where ω is the mixture weight and $I^S_1 \sim N(\mu_1, V_1)$ and $I^S_2 \sim N(\mu_2, V_2)$. We estimate the above model (3) using maximum likelihood following the procedure laid out in Sarzosa and Urzúa (2016).

Second, in addition to parenting style, we account for parental time investments. Parental time investment can be thought of as the quantity of parental interactions and it

[29] Heckman, Pinto, and Savelyev (2013) show that under these assumptions the above system is identified.

is measured in terms of the share of total time that parents and children spend together on highly interactive activities (talking/discussing, having a meal together, playing outside, board games, reading to the child, playing an instrument together). Using the share of time devoted to highly interactive activities allows us to hold the maternal time budget for non-work related activities fix, which might itself be a function of other familial contexts, such as the number of children or the number of available caregivers.[30] For details, see Section A.10.1.

4.3.2 Production function

Aside from precise measures of parenting styles and time investments, our data are characterized by two exceptional features, which we exploit in our empirical specification of the model. First, they contain very precise measures of preferences and IQ for both mothers and children. All preference measures of children are interpretable in terms of decision-making behavior in incentivized experiments (section A.10.1 provides details on our measures of maternal IQ and preferences). Second, stratified sampling of our data by education and income allows for a clear distinction between high and low SES families. In line with the sampling scheme, we define a low SES group ($SES = 0$) and a high SES group ($SES = 1$), as in the first part of this paper (for details, see Section 2.2). We use this definition in our model to investigate whether there are productivity differences in the formation of preferences and IQ across high and low SES families. We then use our estimates to investigate how the SES gap documented in figure 1 would change in response to policies aiming to raise household income, parental education or parental investments.

In order to empirically estimate equation (1), we take the natural logarithm to obtain:

$$\ln\left(P_i^{\ell}\right) = \ln(\Pi_{\text{SES}}^{\ell}) + \frac{1}{\phi^{\ell}} \ln\left[\gamma_M^{\ell} M_i^{\ell\phi^{\ell}} + {\gamma_s}^{\ell} I_i^{S\phi^{\ell}} + {\gamma_t}^{\ell} I_i^{T\phi^{\ell}}\right] + \eta_i^{\ell}, \tag{4}$$

for all $\ell \in \{IQ, P, R, A\}$. To ensure that our measures of maternal IQ, preferences and time investments are non-negative, we follow Cunha, Heckman, and Schennach (2010) and assume that each measure in our data represents the natural logarithm of the original (standard normalized) characteristic entering equation (1). Along the same lines, we assume that our measures of parenting styles are proxies of the natural logarithm of the underlying

[30] This approach is in line with the findings reported in Hsin and Felfe (2014), i.e., that high SES mothers tend to substitute highly interactive activities for detrimental activities. If we use the absolute number of highly interactive activities as an alternative measure of parental time investments, our results remain similar. There is, however, more variability in the absolute number of interactive activities among low SES than among high SES families and the estimated relationship of this measure with child outcomes is weaker.

parenting factor. Π^{ℓ}_{SES} denotes a factor-neutral productivity parameter, which we assume to equal unity for low SES families and which may vary freely for high SES families. Π^{ℓ}_{SES} thus captures any productivity differences across socio-economic status that are not due to level differences in investments or maternal IQ and economic preferences.

4.3.3 Investment endogeneity

Estimates of the above production function are biased if the parental investments, parenting style and quality time respond to unobserved developmental shocks. This endogeneity may arise if parents compensate or reinforce recent shocks to their child's development that are unobserved to the researcher but observable to the parents.[31] Cunha, Heckman, and Schennach (2010) model the unobserved heterogeneity as latent variables, while Attanasio et al. (2015) employ a control function approach. Due to the small size of our sample and because we focus on two different types of parental investments, we follow a different strategy.[32] Specifically, we assume that the error terms in equations (1) and (2) are additively separable in a part that captures the parental reaction to shocks and an idiosyncratic random shock:

$$\begin{aligned} \eta^{\ell}_{i} &= \gamma^{\ell}_{\alpha}\alpha_i + \varepsilon^{\ell}_{i} \\ \epsilon^{m}_{i} &= \delta^{m}_{\alpha}\alpha_i + \nu^{m}_{i}, \end{aligned} \tag{5}$$

where $\eta^{\ell}_{i} \sim N(0, \sigma^{2^{\ell}})$ and $\epsilon^{m}_{i} \sim N(0, s^{2^{m}})$. Moreover, all idiosyncratic random shocks are assumed independent across equations and orthogonal to α_i. Under these assumptions, the error terms across investment and technology equations are only related due to differences in parental perceptions about their children's development. In our parent survey we collected measures of α_i, which we use according to equations (5) to deal with potential endogeneity issues (see Section A.10.3 for details).

4.4 Results: model estimates

Figure 3 displays kernel density plots of the logarithm of the estimated parenting style as well as time investments to illustrate differences between high and low SES families. For both dimensions of parental investments, we find large and significant differences by parental SES, with a larger difference for time investments than for parenting style.

[31] For a discussion, see Cunha, Heckman, and Schennach (2010) and Attanasio et al. (2015).

[32] By sampling design, our sample is very homogenous in age and place of residence, such that contextual variation cannot be used as exclusion restriction.

Figure 3: Parental Investments by Socio-economic Status

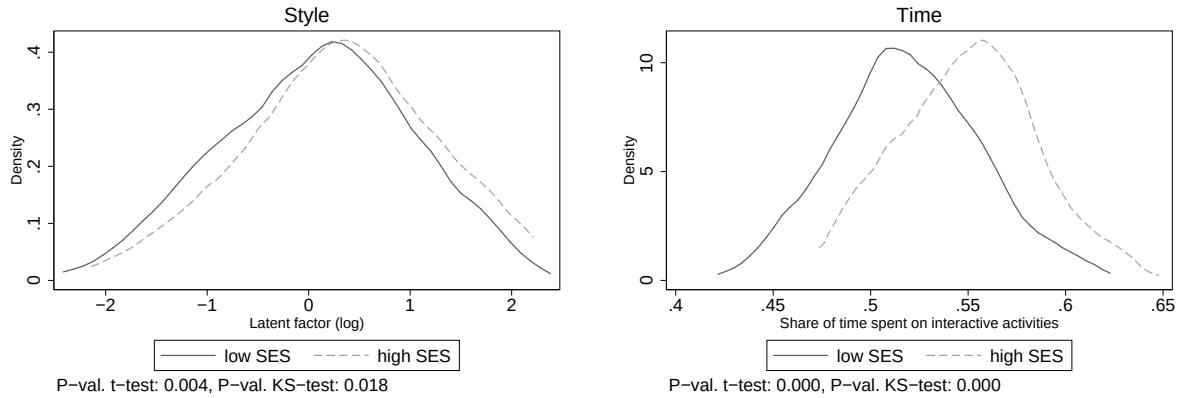

Table 1 displays the results of the parental investment system. Accounting for potential endogeneity of investments in terms of satisfaction with child development, both a positive parenting style and parental time investments are significantly related with SES. However, the respective channels through which SES affects either investment differ markedly: while parenting style is almost exclusively related to household income, parental time investments are more strongly predicted by parental education. We can only speculate about the mechanisms behind these findings. For example, one could plausibly argue that a higher level of household resources facilitates a positive parenting style if resources enable parents to reward rather than punish their children (see Weinberg, 2001, for a model along these lines). In addition, a higher household income likely reduces parental stress, which may increase parental warmth and reduce (unfair) punishments. On the other hand, a higher level of education may be associated with increased knowledge about the benefits of close interactions with the child in terms of their positive effects on child human capital development.

Table 2 reports the estimates of the CES production function. The table presents the estimated coefficients for inputs, the productivity parameter Π_{SES}, the elasticity parameter ϕ from equation (1) and the elasticity of substitution in the inputs that generate child IQ and preferences. Several important features of child development stand out. First, we find that maternal characteristics are important for the development of child characteristics. This indicates that mothers transmit their own preferences and IQ to their children either genetically or through serving as a role model (Dohmen et al., 2012; Alan et al., 2017). Second, both a positive parenting style and time inputs matter for child development. Third, the productive efficiency of the developmental process does not substantially vary by the socio-economic status of the parents, as Π_{SES} is close to one in all models. This finding is key, as it suggests that the socio-economic differences in child IQ and preferences

Table 1: The relationship between SES and parental investments

	Parental Investments			
	Style	Time	Style	Time
SES				
High SES	0.224** (0.091)	0.646*** (0.095)		
Parental education			0.018 (0.019)	0.117*** (0.018)
Log HH income			0.311*** (0.118)	0.178 (0.111)
Satisfaction child devt.				
δ_α	0.130*** (0.034)	0.014 (0.031)	0.127*** (0.033)	0.013 (0.030)
Observations	435	435	435	435

Notes: Standard errors (in parentheses) are bootstrapped using 1,000 bootstrap replications. Further control variables comprise maternal preferences and IQ, child age, the overall number of children in the household and an indicator of single parenthood. Significance at * p < 0.1, ** p < 0.05, *** p < 0.01.

documented in the first part of the paper are mostly due to differences in inputs. In other words, if low SES families were to provide the same inputs in terms of maternal IQ and preferences, parenting styles and time investments, they would "produce" children with similar preferences and IQ as high SES families. In fact, after accounting for investments and maternal preferences, low SES families are slightly more efficient when it comes to the production of lower risk-taking, patience and altruism.[33] Fourth, the elasticity of substitution in inputs is larger than one for the development of IQ, and slightly larger than (but close to) one for economic preferences. This result has important implications for policy, as it suggests that a policy that raises only one type of input (e.g., maternal time inputs) would be effective even if all other inputs were kept unaltered. Although our model is arguably much simpler, our findings regarding the elasticity of substitution in inputs for IQ are in line with those reported in Cunha, Heckman, and Schennach (2010) given that our developmental stage lies between the ones that they investigate.

It is difficult to interpret the size of the estimated coefficients given the non-linear setup of the model, which ensures that the degree to which different parental investments map into child outcomes depends on the estimated elasticity. Therefore, we present average marginal effects in table 3 to illustrate the average effect of a one standard deviation increase in inputs on child IQ and preferences. We find that the biological or social heritability of maternal characteristics is largest for IQ and smallest for risk preferences. This result is in line with findings from a large body of literature on the heritability of IQ, which documents that IQ is strongly transmitted from parents to children (Black, Devereux, and Salvanes, 2009). Time and style investments are of similar importance for IQ and altruism. However,

[33]This finding also suggests that our model does not leave out other important inputs.

Table 2: Production function estimates

	IQ	**Patience**	**Lower risk-taking**	**Altruism**
SES productivity				
Π_{SES}	1.082	0.860	0.733 †	0.893
	(0.108)	(0.101)	(0.097)	(0.096)
Inputs				
M^{ℓ}	0.429 ‡	0.349 ‡	0.255 ‡	0.344 ‡
	(0.052)	(0.056)	(0.054)	(0.052)
Style	0.271 ‡	0.285 ‡	0.306 ‡	0.329 ‡
	(0.047)	(0.054)	(0.057)	(0.053)
Time	0.301 ‡	0.367 ‡	0.439 ‡	0.327 ‡
	(0.047)	(0.053)	(0.049)	(0.048)
Satisfaction with child development				
γ_{α}	0.984	0.985	0.987	0.990
	(0.008)	(0.012)	(0.078)	(0.009)
Elasticity				
ϕ	0.338 §	0.253	0.046	0.155
	(0.178)	(0.286)	(0.195)	(0.193)
ε	1.511	1.340	1.049	1.183
	(0.414)	(0.491)	(0.219)	(0.197)
Observations	435	435	435	435

Notes: $\varepsilon = 1/(1-\phi^{\ell})$ represents the elasticity of substitution in the inputs that generate IQ and preferences. The reported SE (in parentheses) were bootstrapped using 1,000 bootstrap replications. † This coefficient is statistically different from one at the one percent level. ‡ These coefficients are statistically different from zero at the one percent level. § This coefficient is statistically different from zero at the ten percent level.

Table 3: Production function (average marginal effects)

Marginal effects	**IQ**	**Patience**	**Lower risk-taking**	**Altruism**
$\text{AME}_{M^{\ell}}$	0.585***	0.442***	0.374***	0.554***
	(0.084)	(0.099)	(0.069)	(0.114)
$\text{AME}_{\text{Style}}$	0.313***	0.343***	0.445***	0.424***
	(0.074)	(0.090)	(0.093)	(0.069)
AME_{Time}	0.367***	0.464***	0.449***	0.436***
	(0.072)	(0.120)	(0.107)	(0.085)
Observations	435	435	435	435

Notes: The reported SEs (in parentheses) were bootstrapped using 1,000 bootstrap replications. Significance stars at * p < 0.1, ** p < 0.05, *** p < 0.01.

regarding time and risk preferences, time investments are relatively more important than style investments.[34]

4.5 Policy implications

The above model of the relationship between maternal IQ and preferences, investments, SES and child IQ or preferences is complex in the sense that the CES production function is highly non-linear. Moreover, the levels of investment also relate to SES. Consequently, the above-reported coefficients are relatively uninformative when it comes to policy implications. Hence, whilst keeping in mind the above set of assumptions and the limitations of our one-period model, we use our model estimates to predict outcomes and make statements about potential policy effects. Two types of family policies are conceivable to reduce socioeconomic disparities in child development: (i) policies that change the amount of resources available to low SES families, through either an increase in parental education or income subsidies, whereby examples are compulsory education laws or anti-poverty policies such as the earned income tax credit in the US (see, e.g., Oreopoulos, Page, and Stevens, 2006; Dahl and Lochner, 2012); (ii) policies that enhance parental investments among low SES families, for example, through home visiting programs that target parental investments. Recent evidence shows that home visiting programs are indeed effective in raising parental investments (Gertler et al., 2014; Attanasio et al., 2015; Baranov et al., 2016; Doyle et al., 2017; Heckman et al., 2017).[35] For example, Baranov et al. (2016) find an effect of 20% of a standard deviation on time-intensive investment, while Heckman et al. (2017) report effect sizes of 0.27-0.37% of a standard deviation on non-abusive parenting attitudes and of up to 0.18% of a standard deviation on maternal emotional and verbal responsivity. We thus conclude that an increase in parental investments of around 20% of a standard deviation might be realistic in terms of the effect size that a large-scale parental investment policy can achieve.

We investigate how five different policies would change the IQ and preference development of children from low SES families. For this purpose, we take our model estimates as given and predict counterfactual outcomes for the respective group of individuals who would be affected by a certain policy. The five different policies are:

1. A compulsory schooling policy that requires both parents to obtain 13 years of education (A-level equivalent).

[34] In figure A4 of Section A.12, we use the estimates reported in table 2 to show graphically how a change in parental investments (by ventile) affects children's IQ and preferences.

[35] To the extent that maternal investments can be substituted for by professional care-givers, high-quality early child care programs might also apply here (Heckman, 2011; Heckman, Pinto, and Savelyev, 2013).

2. A policy that provides (tax-neutral) income support to poor families. All family net equivalence incomes are raised to the threshold level of 1,065 EUR.

3. A policy that raises parenting style investments by 20% of a standard deviation.

4. A policy that raises parental time investments by 20% of a standard deviation.

5. A policy that raises both parenting style investments and parental time investments by 20% of a standard deviation.

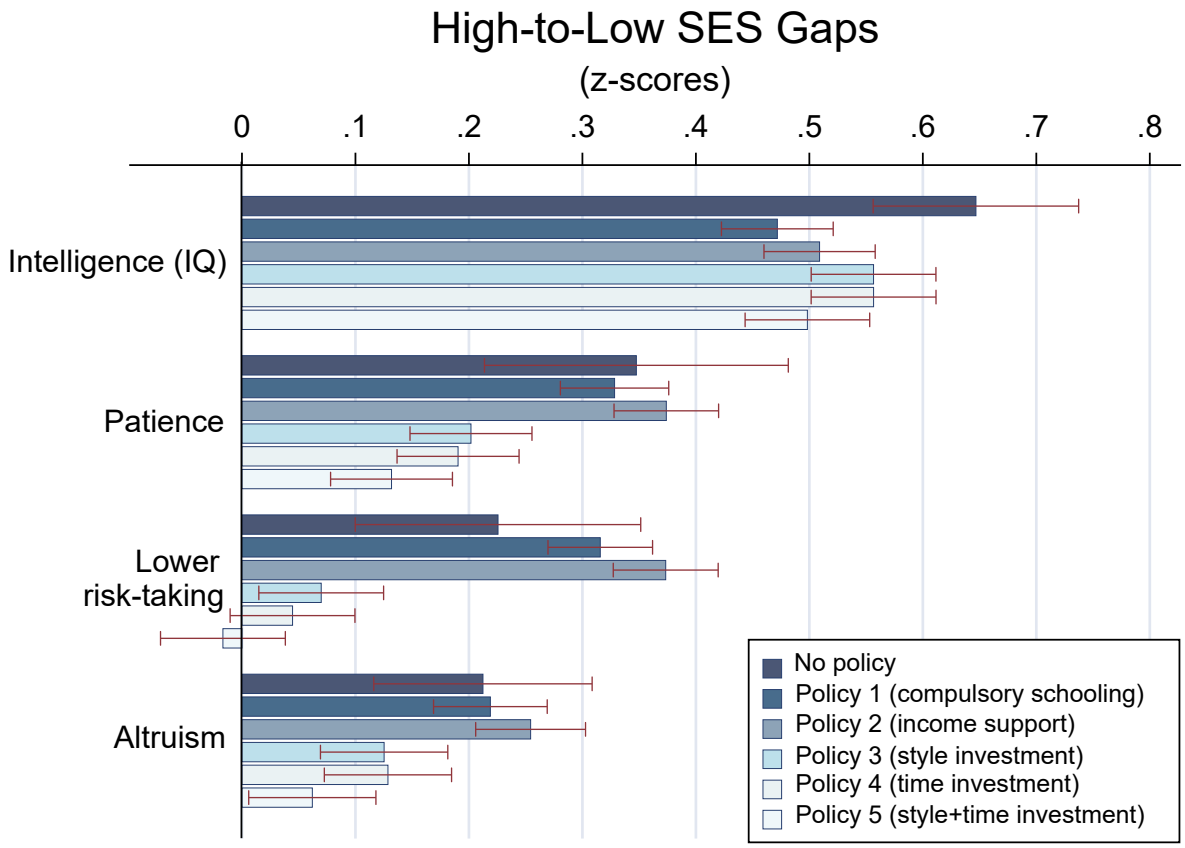

Figure 4: The first bars show the results of the main analysis, see figure 1. The other bars show gaps in IQ and economic preferences between elementary school children from high SES and low SES families, as they would occur if the respective policy was put in place. In order to estimate the effects, IQ and preferences are regressed on the SES dummy. Error bars show bootstrapped SEs.

Figure 4 provides a graphical representation of what the SES gaps would look like in the presence of each of the five policies (bars 2-6 in each panel) when compared to the raw SES gap documented in figure 1 (top bar in each panel).[36] We find that an increase in

[36] All corresponding estimates are displayed in table A6.

parental education and family income would be most effective in closing the SES gap in IQ.[37] This result is in line with, e.g., Dahl and Lochner (2012), who find a positive effect of income support on children's academic achievement, and Lindqvist and Vestman (2011), who find that an extension of maternal compulsory education in Sweden increased child IQ. Regarding preferences, the impact of a respective compulsory schooling or income support policy on patience, risk preferences and altruism would be small or even negative. The intuition for this result is that these policies would reduce the investment gap by relatively little (see rows 3-4 of table A6) and that the positive level effect would be countervailed by a negative productivity effect. Figure 4 also shows that a direct change in parental investments (policies 3-5) would have a substantial positive effect on children from low SES families, in particular with respect to economic preferences. A policy that raised both parenting style investments and parental time investments by 20% of a standard deviation would nearly close the SES gap for patience and altruism, while it would fully close the gap for risk-taking. The gap in IQ, i.e., the trait for which maternal IQ is particularly important (but unchanged), would only decrease by around 15%.[38]

5 Discussion and conclusion

Our results show that SES is a systematic predictor of a child's IQ and economic preferences. Already during elementary school, children from families with higher SES score higher in IQ tests, are more patient, less risk-taking and more altruistic. The SES gaps in IQ and economic preferences are of sizable magnitude and remain similar when representative population weights are applied. The overall pattern of results suggests that childhood circumstances cumulate, given that low parental education and low parental income a fortiori affect the formation of preferences and IQ if both are present in a single family. In order to understand the underlying mechanisms, we provide a coherent framework of how parental investments and maternal IQ and preferences influence child outcomes, in which SES can influence both the level of investments and their overall productivity. Within this framework, we show that disparities in the level of parental investments hold substantial importance regarding the SES gaps in economic preferences and, to a lesser extent, IQ.

For patience and IQ, there exists abundant evidence showing that higher levels favor important outcomes in life since they are associated with higher levels of education

[37] We allow education to affect income using the estimates reported in table A13.

[38] We are unaware of any other studies investigating the impact of parental investments on child economic preferences. However, our findings are somewhat in line with literature showing that non-cognitive traits are often more easily malleable than cognitive traits in response to an exogenous change in investments (see, e.g., Heckman, Pinto, and Savelyev, 2013).

(Shoda, Mischel, and Peake, 1990; Heckman and Vytlacil, 2001; Cadena and Keys, 2015), income (Heckman, Stixrud, and Urzua, 2006; Hanushek and Woessmann, 2008; Golsteyn, Grönqvist, and Lindahl, 2014) and better health (Chabris et al., 2008; Sutter et al., 2013; Golsteyn, Grönqvist, and Lindahl, 2014).[39] Moreover, altruism is positively associated with success of groups and cooperative behavior in various domains of life as well as with individual life satisfaction (Rustagi, Engel, and Kosfeld, 2010; Carpenter and Seki, 2011; Becker et al., 2012; Aknin et al., 2013; Burks et al., 2016). In this sense, our results suggest that, on average, children from families with lower SES are disadvantaged.

Differences in children's preferences and IQ are important as they predict functioning in childhood as well as adult outcomes. In particular, children's IQ and social behavior are positively correlated with their success at school (Reynolds, Temple, and Ou, 2010; Almlund et al., 2011). Among children and adolescents, impatience is associated with a higher likelihood of drinking alcohol and smoking, a higher body mass index, a lower propensity to save, worse grades, more disciplinary conduct violations at school and a lower likelihood to complete high school in time (Castillo et al., 2011; Castillo, Jordan, and Petrie, 2015). Like adults, more risk-averse children and adolescents are less likely to be overweight or obese (Sutter et al., 2013). Moreover, Moffitt et al. (2011) argue that childhood differences in preferences determine later life outcomes for two reasons: first, they affect the accumulation of later skills and preferences through self-productivity and cross-fertilization (Heckman, 2007); and second, they are decisive because they affect early decisions, which can have irreversible and lasting effects. As an example, higher levels of self-control and patience among teenagers are associated with a lower prevalence of school dropout, substance abuse and unplanned pregnancies. In this respect, our results contribute to literature showing that gaps in economic opportunities open up early in life (Case, Lubotsky, and Paxson, 2002; Heckman, 2007).[40]

[39]Concerning attitudes towards risk, there is no obvious optimal degree of risk aversion that is independent from the environment in which an individual lives. Doepke and Zilibotti (2017) introduce the distinction between endogenous and exogenous risk to which individuals are exposed. While exogenous risks cannot be avoided, taking an endogenous risk is a deliberate decision that depends on the individual risk attitude. Moreover, with respect to endogenous risks, it is difficult to claim that there is an "optimal" level of risk attitude. For example, Dohmen et al. (2011) document that a higher willingness to take risks is associated with behaviors that are typically perceived as both detrimental (e.g., smoking) or supportive to good health (e.g., exercising).

[40]Using estimates from studies that present their results in terms of standard deviations, we derive that the cognitive skill gap maps into hourly wage differences of, e.g., 16.8% ($= 0.65 * 25.9\%$) for male and 22.2% for female high school graduates (Heckman, Stixrud, and Urzua, 2006) and a GPA difference of 23.1% of a standard deviation (Humphries and Kosse, 2017). The SES gap in patience maps into a 12.6% difference in the probability of underage drinking (Sutter et al., 2013) and into a 4.9% difference in disciplinary referrals in school (Castillo et al., 2011). The gap in risk-taking maps into a 4.5% difference in the probability of being a smoker (Dohmen et al., 2011). The SES gap in altruism maps into an about 5% difference in the probability to donate or volunteer (Falk et al., 2016).

Given that patience, risk-taking and altruism determine the shape of the utility function, our results also have implications for economic modeling. First, we show that individuals already systematically differ in economic preferences at relatively young ages. It may thus be beneficial to capture these heterogeneities in theoretical or empirical models of economic decision-making, e.g., regarding school choice or the engagement in risky behaviors. Second, differences in socio-economic conditions shape economic preferences, which in turn determine economic decision-making and outcomes, suggesting that preferences and IQ are mediating variables regarding the relationship between SES across generations. Third, our results suggest that fundamental characteristics of the utility function are not fixed or determined at birth, but rather endogenously formed through parental investments early in life, such that familial investments may have implications for utility maximization at later stages. Regarding the transferability of our results to theoretical and empirical models of economic choice, it is important that economic preferences were elicited by means of revealed preferences in incentivized experiments, which are commonly used to approximate the shape of the utility function.

In contrast to other studies, we use one coherent framework to study the gaps in IQ and key economic preferences and document that, at elementary school age, they all systematically differ by SES. Only such a comprehensive perspective can provide insights into the simultaneous determination of "risk factors" that are related to SES. This is important because economic preferences and IQ do typically not affect single decisions and life-outcomes in an isolated manner, but rather jointly (Heckman, Stixrud, and Urzua, 2006; Ida and Goto, 2009; Becker et al., 2012; Sutter et al., 2013). For example, one would expect that individuals who are at the same time risk-taking and impatient are more likely to engage in addictive behaviors such as smoking, drinking or gambling (Ida and Goto, 2009; Sutter et al., 2013). Our results document that, on average, children from families with lower SES are less patient *and* more risk-taking. Thus, they tend to combine characteristics that make them more vulnerable to addictive behaviors. Moreover, children from families with higher SES are more intelligent *and* more prosocial. In this regard, Deming (2017) shows pronounced employment and wage growth for jobs requiring the combination of high cognitive and high social skills. Regarding education attainment, the pattern of lower discount rates and more intelligence of children from high SES families makes it more likely for them to obtain higher levels of education. Altogether, systematic differences in a child's IQ and economic preferences by parental SES result in a tendency to favor social immobility.

Our results also deliver insights regarding the importance and functioning of parental investments. In line with previous studies (e.g., Guryan, Hurst, and Kearney, 2008; Cobb-

Clark, Salamanca, and Zhu, 2016), we document that high SES families significantly outperform low SES families when it comes to both parenting style and time investments. Their day-to-day interactions with the child are more likely to be characterized by a warm and forthcoming parenting style and they spend a larger fraction of their time on stimulating activities. Interestingly, time investments are more strongly affected by parental education, while a positive parenting style is more strongly associated with household income. Both types of investments in turn are important for the development of IQ and economic preferences. In particular, risk-taking and patience are relatively strongly determined by time investments, while a positive parenting style and time matter similarly for the formation of IQ and altruism. Our results also indicate a large degree of substitutability between both types of investments and vis-à-vis maternal characteristics. This implies that even parents with, e.g., low levels of patience can improve their children's patience through investments and, even more so, since their overall investment productivity is no lower than for high SES families.

Finally, our results allow us to derive implications about the impact of policies that enhance socio-economic resources or parental investments, respectively. Congruent with the literature (Lindqvist and Vestman, 2011; Dahl and Lochner, 2012), we find that parental compulsory schooling or household income policies are relatively more effective in closing the SES gap in IQ, but less effective in altering the SES gaps in economic preferences. By contrast, policies that directly target investments are most effective in closing the SES gaps in economic preferences. Specifically, a policy raising both parenting style and time investments among low SES families by 20% of a standard deviation would close roughly two-thirds of the gaps in patience and altruism, and it would fully close the SES gap in risk-taking. This finding is akin to literature showing that non-cognitive traits are often more easily malleable than cognitive traits in response to a change in early childhood investments (see, e.g., Heckman et al., 2010; Heckman, Pinto, and Savelyev, 2013), although these papers do not focus specifically on the development of economic preferences. In future research, it would thus be informative to ascertain whether early childhood interventions targeted at parental investments (such as Doyle et al., 2017) unveil effects on child economic preferences that are of a similar magnitude as those predicted in this study.

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A Appendix

A.1 Literature

Table A1: IQ, economic preferences and life outcomes

Paper	Data set	Outcomes	Results	IQ	Time preferences	Risk preferences	Social preferences
Åkerlund et al. (2016)	SBC, Adm. data	Crime	■	●	●	○	○
Almås et al. (2016)	Private	Education	□	◍	●	●	○
Anderson and Mellor (2008)	Private	Health	■	○	○	●	○
Baran, Sapienza, and Zingales (2010)	TCMLS	Donations	■	○	○	○	●
Barsky et al. (1997)	HRS	Health, Personal Finance	■	○	○	●	○
Becker et al. (2012)	GSOEP	Educ., Labor Market, Health, Satisf.	■	○	●	●	●
Belzil and Leonardi (2007)	SHIW	Education	■	○	○	●	○
Bickel, Odum, and Madden (1999)	Private	Health	■	○	●	○	○
Bonin et al. (2007)	GSOEP	Labor Market	■	○	○	●	○
Borghans and Golsteyn (2006)	DNB	Health	□	○	●	○	○
Borghans et al. (2008*b*)	BSS, BCS, BIBB	Labor Market	□	○	○	○	◍
Burks et al. (2015)	Private	Education	□	●	●	●	◍
Burks et al. (2016)	Private	Labor Market	■	○	○	○	●
Cadena and Keys (2015)	NLSY	Education, Labor Market, Health	■	○	●	○	○
Caliendo, Fossen, and Kritikos (2010)	GSOEP	Labor Market	■	○	○	●	○
Castillo et al. (2011)	Private	Education	■	○	●	○	○
Castillo, Jordan, and Petrie (2015)	Private	Education	■	○	●	○	○
Carpenter and Seki (2011)	Private	Labor Market	■	○	○	○	●
Cawley, Heckman, and Vytlacil (2001)	NLSY	Labor Market	■	●	○	○	○
Chabris et al. (2008)	Private	Health, Pers. Finance	□	○	●	○	○
Dawson and Henley (2015)	Private	Labor Market	■	○	○	●	○
Deming (2017)	NLSY79, NLSY97	Labor Market	■	◍	○	○	◍
Delaney, Harmonb, and Ryanc (2013)	IUS	Education	□	○	●	●	○
DellaVigna and Paserman (2005)	PSID, NLSY	Labor Market	■	○	●	○	○
Dohmen et al. (2009)	GSOEP	Labor Market	■	○	○	○	●
Dohmen et al. (2011)	GSOEP	Labor Market, Health, Pers. Finance	■	○	○	●	○
Dohmen and Falk (2011)	Private	Labor Market	■	○	○	●	○
Dohmen et al. (2016)	Private	Development, Growth	■	○	●	○	○
Eckel, Johnson, and Montmarquette (2005)	Private	Personal Finance	□	○	●	●	○
Falk et al. (2015)	Private	Education, Labor Market, Health	■	○	●	●	●
ctd.		Personal Finance, Social Interaction					
Fuchs (1982)	Private	Education, Health	■	○	●	○	○
Gensowski (2014)	Terman	Education, Labor Market	■	●	○	○	○
Golsteyn, Grönqvist, and Lindahl (2014)	SBC	Education, Labor Market, Health	■	○	●	○	○
Groves (2005)	NLSW, NCDS	Labor Market	■	●	○	○	◍
Guiso and Paiella (2008)	SHIW	Educ., Labor M., Health, Pers. Fin.	□	○	○	●	○
Hanushek and Woessmann (2008)	Multiple	Labor Market	■	◍	○	○	○
Harrison, Lau, and Rutström (2010)	Private	Health	■	○	●	●	○
Heckman and Vytlacil (2001)	NLSY	Education, Labor Market	■	◍	○	○	○
Heckman, Stixrud, and Urzua (2006)	NLSY79	Labor Market, Education, Health	■	◍	○	○	○
Heckman, Pinto, and Savelyev (2013)	Perry	Education, Labor Market, Health	■	●	○	○	○

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Table A1 – *Continued from previous page*

Heineck and Anger (2010)	GSOEP	Labor Market	□	●	○	○	◍
Hong, Kubik, and Stein (2004)	HRS	Personal Finance	■	○	○	●	○
Hsieh, Parker, and van Praag (2017)	Private	Labor Market	■	○	○	●	○
Humphries and Kosse (2017)	GSOEP	Education	□	●	●	●	○
Jaeger et al. (2010)	GSOEP	Labor Market, Migration	■	○	○	●	○
Karlan (2005)	Private	Personal Finance	■	○	○	○	●
Kimball, Sahm, and Shapiro (2008)	HRS	Personal Finance	■	○	○	●	○
Kirby, Petry, and Bickel (1999)	Private	Health	■	○	●	○	○
Kirby and Petry (2004)	Private	Health	□	○	●	○	○
Kosfeld and Rustagi (2015)	Private	Labor Market	■	○	○	○	●
Leibbrandt (2012)	Private	Performance in Open-Air Markets	■	○	○	○	●
Meier and Sprenger (2010)	Private	Personal Finance	□	○	●	○	○
Mischel, Shoda, and Rodriguez (1989)	Private	Education	■	○	●	○	○
Reynolds, Temple, and Ou (2010)	CLS	Education	■	◍	○	○	◍
Rustagi, Engel, and Kosfeld (2010)	Private	Labor Market	■	○	○	○	●
Rustichini et al. (2016)	Private	Labor Market, Health, Pers. Finance	□	●	●	●	○
Schmidt and Hunter (2004)	Multiple	Labor Market	■	●	○	○	○
Strenze (2007)	Multiple	Education, Labor Market	■	●	○	○	○
Sutter et al. (2013)	Private	Education, Health, Pers. Finance	■	○	●	●	○
Ventura (2003)	SHIW	Health, Personal Finance	□	○	●	○	○

Notes: Table shows papers that demonstrate the role of IQ, time preferences, risk preferences, social preferences for outcomes. ■ – Significant effects. □ – Mixed effects. ● - Used. ◍ – Somewhat used. ○ – Not used. Data sets: AddHealth– The National Longitudinal Study of Adolescent to Adult Health, BIBB-IAB data– Data of the Bundesinstitut für Berufsbildung and the Institute for Employment Research, BCS– British Cohort Study, BSS– British Skills Survey, GSOEP– German Socio-Economic Panel, CLS– Chicago Longitudinal Study, DNB– DNB Household Survey, HILDA– Household Income and Labour Dynamics in Australia, HRS– Health and Retirement Survey, IUS– Irish University Study, NELS– National Education Longitudinal Study of 1988, NLSW– National Longitudinal Survey of Young Women, NLSY– The National Longitudinal Survey of Youth, NLSY79– The National Longitudinal Survey of Youth 1979, NLSY97– National Longitudinal Survey of Youth 1997, NLS-72– National Longitudinal Study of the High School Class of 72, Perry– Perry Preschool Project, PSID– Panel Survey of Income Dynamics, SBC– Stockholm Birth Cohort Study, SHIW– Bank of Italy Survey of Household Income and Wealth, TCMLS– Templeton-Chicago MBA Longitudinal Study, Terman– Survey by Lewis Terman started at Stanford in 1921/22.

A.2 Additional tables

Table A2: SES gaps in IQ, patience, risk-taking, and altruism

	IQ	Patience	Risk-taking	Altruism
	(1)	(2)	(3)	(4)
Low SES	−0.647	−0.348	0.226	−0.212
Standard errors:				
a. Bootstrapped SE	(0.091)***	(0.140)**	(0.124)*	(0.096)**
b. OLS/OIM SE	(0.091)***	(0.134)***	(0.126)*	(0.096)**
c. Huber-White SE	(0.091)***	(0.135)**	(0.127)*	(0.094)**
Observations	435	435	435	435

Notes: The table shows coefficients of regressions, in which IQ or economic preferences are regressed on a low SES dummy that equals 1 for low and 0 for high SES families. Columns (1) and (4) are estimated using OLS. In columns (2) and (3), we take the censoring of the respective dependent variables into account and use Tobit. Standard errors are displayed in parentheses. We report three alternative estimates of standard errors: bootstrapped standard errors (1000 bootstrap replications) in line a., OLS standard errors (column (1) and (4)) and observed information matrix (OIM) standard errors for the Tobit models (column (2) and (3)) in line b., and Huber-White standard errors in line c.. Significance at * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A3: IQ/economic preferences and teenage life outcomes

	Success in school	Social participation	Juvenile offending
IQ	0.303***	0.136**	−0.022
Patience	0.110**	0.110**	−0.057
Risk-taking	−0.164***	−0.032	0.199***
Altruism	0.156***	−0.010	−0.132**

Notes: Displayed correlations are Pearson correlation coefficients. Success in school is measured by grade point average (converted such that higher grades are better). Social participation and juvenile offending are survey measures. For details see Section A.6. N(Success in school) = 344, N(Social participation) = 347 and N(Juvenile offending) = 348, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: Gender gaps in IQ, patience, risk-taking, and altruism and SES gaps by gender

	IQ		**Patience**		**Risk-taking**		**Altruism**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	0.097	0.119	0.576***	0.536***	0.527***	0.339**	−0.393***	−0.483***
	(0.090)	(0.138)	(0.132)	(0.138)	(0.129)	(0.135)	(0.095)	(0.123)
Low SES	−0.646***	−0.626***	−0.351**	−0.104	0.228*	0.095	−0.214**	−0.299**
	(0.091)	(0.139)	(0.137)	(0.142)	(0.120)	(0.132)	(0.094)	(0.128)
Male		−0.040		−0.260		0.094		0.163
x low SES		(0.181)		(0.198)		(0.181)		(0.185)
Observations	435	435	435	435	435	435	435	435

Notes: In columns (1), (3), (5) and (7), the table shows coefficients of regressions, in which IQ or economic preferences are regressed on a male dummy (1 for boys, 0 for girls) and a low SES dummy that equals 1 for low and 0 for high SES families. Columns (1) and (7) are estimated using OLS. In columns (3) and (5), we take the censoring of the respective dependent variables into account and use Tobit. We find no gender difference in IQ, but boys are significantly more patient, more risk-taking, and less altruistic than girls. In columns (2), (4), (6) and (8), we add the interaction term "Male x low SES". We use OLS for all four regressions to ease comparison of the the coefficient of the interaction term. The results show that the SES gaps in IQ and economic preferences do not differ significantly for boys and girls. Bootstrapped standard errors (1000 bootstrap replications) are displayed in parentheses. Significance at * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A5: SES gaps by risk domain

	Risk-averse	Risk-neutral	Risk-seeking
	(1)	(2)	(3)
Low SES	0.011	−0.079*	0.068*
	(0.047)	(0.045)	(0.041)
Observations	435	435	435

Notes: The table shows coefficients of linear probability estimations, in which a binary indicator of the respective risk preference category is regressed on a low SES dummy that equals 1 for low and 0 for high SES families. The dependent variable equals 1 if a child is classified as risk-averse (risk-neutral, risk-seeking) and 0 otherwise. Section 2.3.2 contains the exact definitions of the risk preference categories. Bootstrapped standard errors (1000 bootstrap replications) are displayed in parentheses. Significance at * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A6: Child IQ and preference changes in response to changes in parental resources or parental investments

Policies	**Actual**		**Compulsory educ min 13 years**		**Income support min 1,065 EUR**		**Style +0.2 sd**		**Time +0.2 sd**		**Style and time +0.2 sd**	
	SES Gap	SE	SES Gap	SE	SES Gap	SE	SES Gap	SE	SES Gap	SE	SES Gap	SE
Developmental inputs												
Education	4.071	(0.242)	2.600	(0.172)	4.072	(.242)	4.072	(0.242)	4.072	(0.242)	4.072	(0.242)
Income	838.760	(53.805)	746.205	(54.761)	678.905	(51.371)	838.761	(53.804)	838.761	(53.805)	838.761	(53.805)
Style	0.249	(0.092)	0.177	(0.077)	0.147	(0.078)	0.062	(0.091)	0.262	(0.091)	0.062	(0.091)
Time	0.761	(0.088)	0.514	(0.067)	0.673	(0.071)	0.761	(0.088)	0.561	(0.088)	0.561	(0.088)
Child IQ and preferences												
IQ	0.647	(0.105)	0.472	(0.054)	0.509	(0.055)	0.557	(0.059)	0.557	(0.059)	0.498	(0.059)
Patience	0.348	(0.148)	0.328	(0.047)	0.374	(0.047)	0.202	(0.052)	0.190	(0.052)	0.131	(0.052)
Risk-taking	0.226	(0.125)	0.316	(0.047)	0.373	(0.048)	0.070	(0.056)	0.044	(0.056)	−0.017	(0.056)
Altruism	0.212	(0.101)	0.219	(0.052)	0.254	(0.050)	0.125	(0.057)	0.129	(0.057)	0.062	(0.057)

Notes: The table displays SES gaps of developmental inputs and child outputs. The first column presents the actual gap. The other columns represent predicted gaps as they would prevail in response to five different policy changes: (1) A compulsory schooling policy which requires both parents to obtain 13 years of education (A-level equivalent). (2) A (tax-neutral) income support policy to poor families, which raises the incomes of poor families to the threshold level of 1,065 EUR. (3) A policy which raises parenting style investments by 20% of a standard deviation. (4) A policy which raises parental time investments by 20% of a standard deviation. (5) A policy which raises both parenting style investments and parental time investments by 20% of a standard deviation. Counterfactual outcomes for affected families are predicted using estimates of model equations (1) and (2). Counterfactual incomes in response to a compulsory education policy (1) were computed using estimates of equation (A6). The table shows coefficients of regressions where the respective developmental input or outcome is regressed on a low SES dummy. Standard errors are bootstrapped using 1,000 bootstrap replications.

A.3 Additional figures

Figure A1: Toys arranged in four categories (example). To measure risk and social preferences, we introduced an experimental currency called "stars". After the interview, children could exchange the number of stars that they had collected for toys. The toys were arranged in four categories that visibly increased in value and attractiveness. The children knew that with more stars they could choose a toy from a higher category. To ensure that each star was valuable, we converted any remaining stars into Lego bricks, after the child had chosen his/her toy.

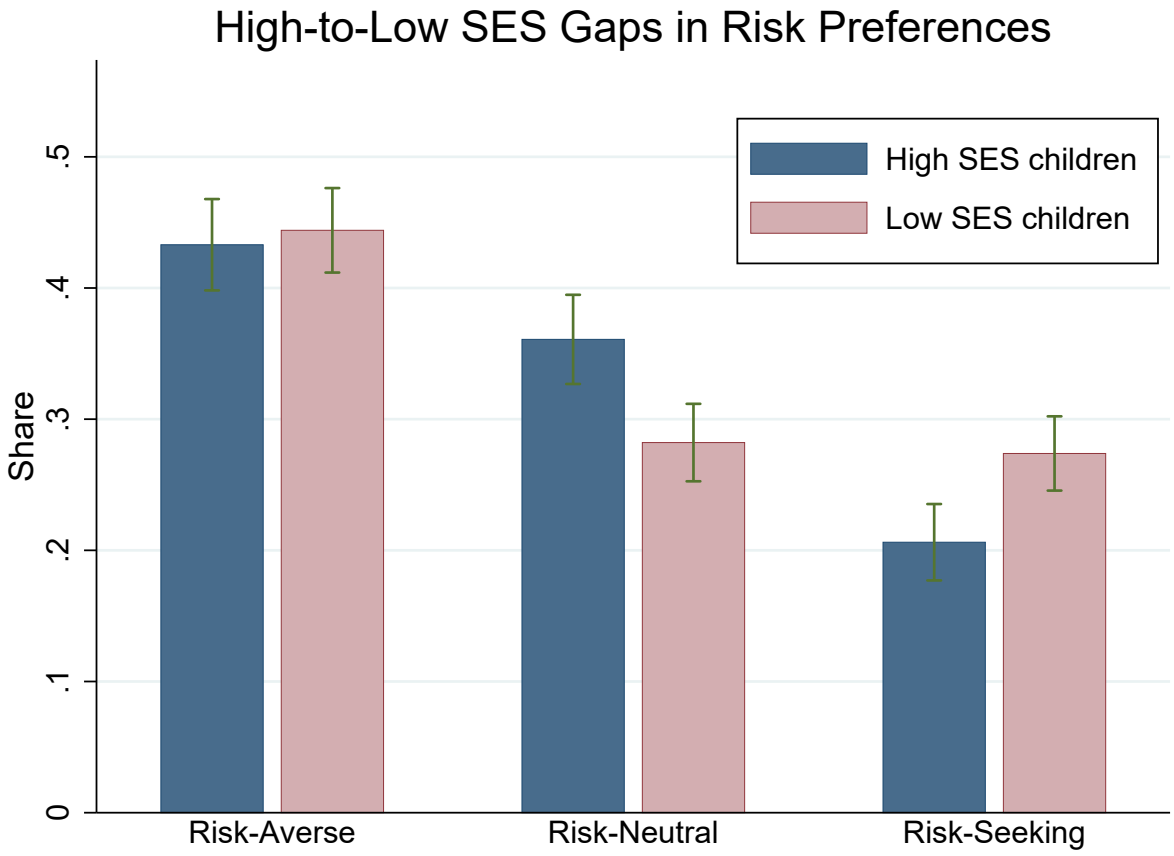


Figure A2: The figure displays the shares of children categorized as risk-averse, risk-neutral or risk-seeking by SES (for definitions of the risk categories, see Section 2.3.2). Error bars indicate bootstrapped standard errors (1000 bootstrap replications). Table A5 provides test results on whether the shares differ significantly by SES.

A.4 Robustness checks: weighting

A.4.1 Weighting scheme 1: representative population

To allow for representative interpretable evidence, we compare our sample to the population of families in Germany. The comparison comprises parental SES, as well as maternal intellect, maternal patience, maternal willingness to take risks and maternal altruism. As a reference, we make use of data from the German Socio-Economic Panel (SOEP) (Wagner, Frick, and Schupp, 2007). The data are collected yearly and are representative of the German population. Today, the SOEP consists of more than 20,000 individuals in more than 10,000 households. We compare the families in our sample to families with children under the age of 14 in the SOEP. In order to compare the samples along all dimensions which are of importance for our study, we elicited SES in the same way as in the SOEP and used the same validated survey questions about maternal intellect and economic preferences in both data sets.

For both samples we use the SES definition described in Section 2.2. Concerning patience, we use the measure validated by Vischer et al. (2013), and for risk preferences, we employ the measure validated by Dohmen et al. (2011). As a proxy for altruism, we use a measure of the Big Five dimension agreeableness. For details on this measure and its relation to social preferences, see Becker et al. (2012). As a proxy for intelligence, we use a measure of the Big Five dimension openness/intellect. For a discussion on the relation of IQ and openness/intellect and an example of this approach see Rustichini et al. (2016). For a detailed description of the Big Five inventory used for the mothers in our sample and in the SOEP, see Gerlitz and Schupp (2005).

Table A7 shows how the measures described above compare between our sample and the SOEP sample. The share of high SES families in our sample is moderately higher than in the SOEP (44.6% vs. 37.8%). In order to compare the samples in terms of intellect and economic preferences, we standardized the measures using the SOEP as a reference, i.e., the mean in the SOEP is zero in all dimensions. For our sample, we find that mothers are more intelligent, more willing to take risks, and more altruistic than mothers of children in the SOEP. There is no significant difference in patience. These findings are in line with the observation that high SES families are slightly over-represented in our sample.

In order to check to what extent these deviations from a representative sample affect our results, we re-weight our data according to the SES, preference and skill distribution in the SOEP. To calculate these weights, we generate 32 groups based on the combination of the binary SES criterion and median splits of the four skill and preference dimensions. We re-weigh the observations in our sample to produce the same distribution over the 32 groups

Table A7: Comparison to a representative sample

Variable	SOEP	Analyzed sample	Sign. difference
Share high SES	37.8 %	44.6 %	***
Maternal intellect	0.0	0.422	***
Maternal patience	0.0	0.086	
Maternal willingness to take risk	0.0	0.576	***
Maternal altruism	0.0	0.283	***

Notes: Family characteristics of the analyzed sample ($N = 435$) and in the SOEP ($N = 1,812$). t-tests indicate significant differences at * p < 0.1, ** p < 0.05, *** p < 0.01.

as in the SOEP using inverse probability weights. We also use these weights whenever we standardize a measure. The re-weighted main results are displayed in Figure A3. The resulting effect sizes are very similar to those from the unweighted regression, suggesting that selective participation does not bias our results.

A.4.2 Weighting scheme 2: attrition

As described in Section 2.1 we conducted two rounds of data collection within one developmental period. The sample in data collection 1 consists of 519 children and their mothers. 442 of these families also took part in the second data collection. For 435 children (83.8%), we can construct a balanced data set with all required information (preference and skill measures of children and mothers, SES and investment measures). For these 435 families we have two measures of each dimension of interest (from the children), collected within one developmental period.

To check for selective attrition related to socio-economic background, economic preferences, or IQ of the child, we re-weight the observed data using inverse probability weighting (IPW). The predictions come from a probit model of a binary selection indicator (indicating if an observation is either only available in data collection 1 ($N = 84$) or in the balanced data set ($N = 435$)) as a function of parental SES, child IQ, patience, risk-taking and altruism measured in data collection 1. We repeated the main analysis shown in Figure 1 using these weights. The results of the regressions using IPW are shown in Figure A3. The effects sizes are very similar to the unweighted effect sizes, suggesting that selective attrition does not bias our results.

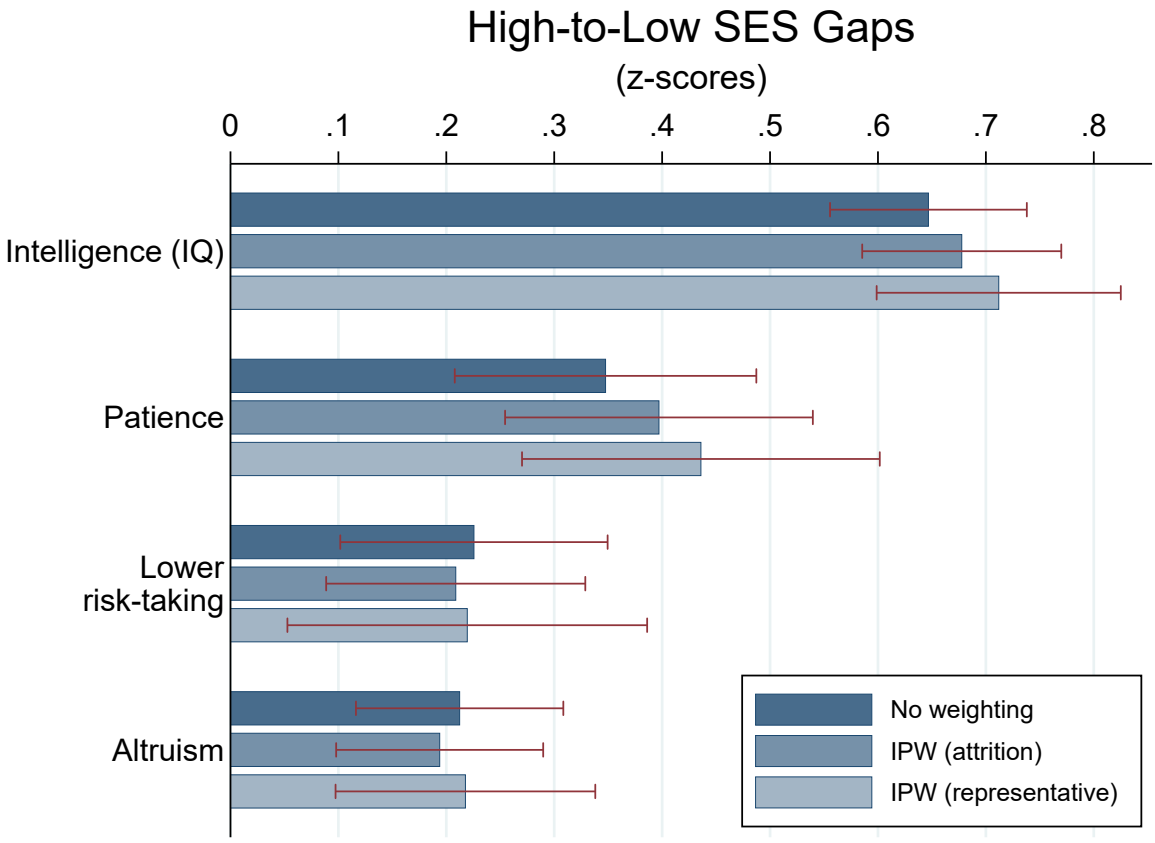


Figure A3: The figure displays gaps in IQ and economic preferences between elementary school children from high and low SES families. The horizontal bars represent coefficients of a dummy variable that equals 1 for high and 0 for low SES households in regressions of IQ or preferences on this SES dummy (OLS for IQ and altruism, Tobit for patience and risk-taking). The first, dark blue set of bars show the results of the unweighted main analysis as in Figure 1. The second light blue and third grey set of bars show weighted least-square (IPW) estimates, respectively addressing possible selective attrition or the lack of representativeness of our sample. Error bars indicate bootstrapped standard errors, for the IPW estimates obtained using the BWR-scheme (bootstrap with replacement) by Kolenikov (2010).

A.5 Test-retest stability of experimental measures of preferences

In our sample of elementary school children, the Spearman Rank correlations between our measures taken in data collection 1 and our measures taken in data collection 2 (16 months in between) are 0.301 for time preferences, 0.292 for risk preferences, and 0.382 for altruism ($p < 0.01$ for all preferences). To put these test-retest properties into perspective, we compare them to those obtained from data on young adults (for details on the data, see Falk et al., 2016). For this group of young adults age-adapted experimental measures on the same preference domains were collected twice with only one week in between. Although

based on adults, and despite the small time interval between measurements, these data display test-retest correlations which, except for patience, are only slightly higher than the ones we find in our data, see table A8.

Table A8: Stability of preferences: test-retest Spearman correlations

Sample	**Patience**	**Risk-taking**	**Altruism**
Elementary school children	$\rho = 0.301$ (16-month interval)	$\rho = 0.292$ (16-month interval)	$\rho = 0.382$ (16-month interval)
Young adults	$\rho = 0.672$ (1-week interval)	$\rho = 0.347$ (1-week interval)	$\rho = 0.445$ (1-week interval)

Notes: For details on the sample of young adults, see Falk et al. (2016).

It seems unlikely that preferences of adults have changed within a one-week interval. The observed variation in both samples therefore suggests that most of the instability across data collections is due to measurement error rather than variation in the underlying preferences. Additional evidence in support of the stability of preferences of children comes from, e.g., Mischel, Shoda, and Rodriguez (1989), Moffitt et al. (2011), Golsteyn, Grönqvist, and Lindahl (2014) and Cadena and Keys (2015), who show that measures elicited during childhood have predictive power for teenage and adult outcomes. Related evidence using our own data is presented in Section A.6 and table A3.

A.6 Follow-up surveys: teenage outcomes

In the years 2015 and 2016 which is four and five years after the first data collection, we collected follow-up data on teenage outcomes of the children in our sample. In 2016 the participants are on average 13 years old and we were able to collect information on about 80% (348 of 435) of the sample that is used in the main analysis in Section 3 (see Table A3).

In 2016 we asked mothers and children to state the most recent grades of the child in the subjects of mathematics, German language and first foreign language. To calculate the grade point average (GPA), we take the average of mothers' and children's reports and average over these three (main) subjects. For convenience, we recode the data such that higher grades indicate better performance.

As a proxy for juvenile offending we asked the teenagers in 2016 to state on a 4-point scale how often they intentionally damaged or destroyed something which they did not own.

To measure social participation we asked the participants in 2015 to state on a 5-point scale how often they participate in youth group activities (as, e.g., boy scouts or environmental

groups), sports activities or playing music. We aggregate the three ratings to yield one joint score.

A.7 Robustness checks: experimental protocol

In table A9 we repeat the analysis shown in table A2, adding control variables which might have influenced the experimental measures. A possible concern is potential heterogeneity in the valuation of incentives due to varying disposable resources or income effects (in-experiment wealth). We therefore include controls for the children's weekly amount of pocket money and the number of stars which they had already earned during the sequence of experiments before each respective experiment took place. In column (1) we additionally add the variable risk-taking to control for potential perceived payment uncertainty in the piggy-bank experiment.[41] Comparing results in tables A2 and A9 shows that the estimated SES gaps are not biased by these potential confounding factors.

Table A9: Robustness check: SES gaps in IQ, patience, risk-taking and altruism with additional control variables

	Patience	Risk-taking	Altruism
	(1)	(2)	(3)
Low SES	−0.402***	0.207*	−0.219**
	(0.135)	(0.123)	(0.097)
Control variables:			
Amount pocket money	X	X	X
In-experiment wealth	X	X	X
Risk-taking	X		
Observations	433	433	433

Notes: In columns (1) and (2), we use a Tobit model. Column (3) is estimated using OLS. Bootstrapped standard errors (1000 bootstrap replications) are displayed in parentheses. Two observations are missing due to missing information on pocket money. Significance at * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The results in table A9 and A2 are qualitatively the same.

[41] Note that in order to prevent in-experiment wealth effects we put aside the money earned in each experiment in an extra, closed paper bag. To eliminate uncertainty of future payments we explicitly addressed the letter (delivering the delayed money) to the children themselves, wrote the address on the envelope and put the saved amount of money in the envelope while the children were watching. We also handed out contact details for questions or requests.

A.8 Robustness checks: parental education

Throughout the paper our measure of parental education is the average years of education of both mother and father. This could be misleading if the educational attainment of mother and father is very heterogeneous within a family and/or if the relation between education and children's IQ and preferences is different for mother and father. In this respect it is important to point out that – in line with evidence of assortative mating – years of education of mother and father are highly correlated (Spearman's $\rho = 0.616, p < 0.01$).

In table A10 we display results on the association between parental education and children's IQ and preferences separately for mothers and fathers. Given the strong correlation in educational attainment it is not surprising that the correlations with IQ and preferences of children are very similar.

Table A10: Robustness: parental years of education

	IQ	Patience	Risk-taking	Altruism
	(1)	(2)	(3)	(4)
Average years of education	0.119***	0.085***	−0.037*	0.047***
	(0.016)	(0.022)	(0.022)	(0.016)
Maternal years of education	0.108***	0.075***	−0.038*	0.040***
	(0.014)	(0.020)	(0.020)	(0.014)
Paternal years of education	0.084***	0.062***	−0.047**	0.037**
	(0.015)	(0.022)	(0.023)	(0.018)

Notes: The table shows coefficients of regressions in which the respective skill or preference is regressed on a constant and either average or maternal or paternal years of education 1. Columns 1 and 4 are estimated using OLS. In columns 2 and 3 we take the censoring of the respective dependent variable into account and estimate a Tobit model. Bootstrapped standard errors (1000 bootstrap replications) are displayed in parentheses. The number of observations is 435 except for the regressions using paternal education which, due to missing information, only rely on 351 observations. * p < 0.1, ** p < 0.05, *** p < 0.01.

A.9 Empirical relations among IQ and preferences

Table A11 displays the Spearman correlations among our four measures of interest. The overall correlation pattern is mostly in line with that found for adults: positive correlations between IQ and patience are found, e.g., in Dohmen et al. (2010) and Humphries and Kosse (2017). Burks et al. (2009) also indicate a positive correlation between patience and risk-taking. For large scale evidence on the relations at the country level, see Falk et al. (2015). Angerer et al. (2015a) present related results concerning altruism.

Table A11: Spearman correlations among IQ and economic preferences

	IQ	Patience	Risk taking	Altruism
IQ	1			
Patience	0.290***	1		
Risk-taking	-0.063	0.100**	1	
Altruism	0.119**	-0.099**	-0.223***	1

Notes: $N = 435$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.10 Parental investments and maternal traits

A.10.1 Parental investment measures

The information on parenting style and time investments are collected via the questionnaire answered by mothers.[42] To estimate latent parenting styles, we use three indicators of parenting style investments (for an overview and a detailed description of the parenting style measures, see Thönnissen et al., 2015, and the references therein).[43] First, *parental warmth* (two items: (i) "I show my child with words and gestures that I like him/her." (ii) "I praise my child.") measures the extent to which parents praise their child and their tendency to show love and affection. Second, *psychological and behavioral control* (four items: (i) "If my child does something against my will, I punish him/her." (ii) "I make it clear to my child that he/she is not to break the rules or question my decisions." (iii) "I think my child is ungrateful when he/she does not obey me." (iv) "I do not talk to my child for a while when he/she did something wrong.") indicates child punishments. Third, parental *monitoring* (two items: (i) "When my child goes out, I know exactly where he/she is." (ii) "When my child goes out, I ask what he/she did and experienced.") indicates the

[42]The data on time investments were collected in both data collections; we therefore use averages to reduce measurement error. Parenting styles are assumed to be stable within one developmental period. Therefore, and because of time constraints for data collection, information on parenting style was only elicited in data collection 2.

[43]In sum, we use eight items which are rated on a 5-point Likert scale respectively.

degree to which parents are informed about the whereabouts and doings of their child. These eight items are used to extract one latent parenting style factor as explained in Section 4.3.1.

Parental quality time investments are constructed from a short time diary in which parents report the frequency of a large number of activities with the child during the past two weeks. Highly interactive joint activities comprise, e.g., joint meals, playing board games and playing an instrument together. Joint activities which require a low degree of interaction comprise, e.g., grocery shopping, watching TV and playing video games. In the analysis, our measure of parental time investment is the share of highly interactive activities (see Section 4.3.1). This approach allows us to hold the maternal time budget for non-work related activities fix, which in itself might be a function of familial contexts that are outside of our framework, such as the number of children or the number of available caregivers.

Table A12 provides summary statistics of each of the above measures for high and low socio-economic status families, as well as the estimated loadings in the measurement system of the parenting style factor. It shows that, with the exception of parental warmth, high socio-economic status parents score significantly higher on all investment indicators.

Table A12: Parental investment measures

Variables	μ_h	μ_l	**diff**	**p-value**	**loading**
Parental warmth	0.070	0.214	−0.144	0.12	0.347
Parental control	−0.300	−0.062	−0.238	0.01	−0.050
Parental monitoring	0.230	0.047	0.184	0.03	1
Share of highly interactive activities	0.549	0.519	0.03	0.00	-

Notes: μ_h and μ_l indicate mean values for the high and low SES groups respectively. Reported p-values correspond to a t-test for the equality of means.

A.10.2 Maternal skills and preferences

Our measure of maternal IQ is based on the Standard Progressive Matrices Plus test (SPM Plus, 10 item short version). The measure of IQ corresponds to the standardized number of correct answers. IQ has been shown to be very stable for adults (see, Borghans et al., 2008, for a discussion). Therefore, and due to time constraints, maternal IQ was only elicited in data collection 2.

Concerning maternal preferences we use questionnaire measures validated by Falk et al. (2016).[44] For maternal time preference we use the measure: "When it comes to financial decisions, how do you assess your willingness to abstain from things today so that you will be able to afford more tomorrow. Please indicate on the scale, where the value 0 means 'not at all willing to abstain today' and the value 10 means 'very willing to abstain today'".

For maternal risk preferences we use the measure "How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please indicate on the scale, where the value 0 means: 'not at all willing to take risks' and the value 10 means: 'very willing to take risks'". For a detailed discussed on this item see also Dohmen et al. (2011).

To measure maternal altruism, mothers played two binary hypothetical dictator games in which they could distribute money (in euro) between themselves and another mother: in decision A they could choose between the distributions (16, 4) and (10, 10) and in decision B they could choose between the distributions (6, 18) and (10, 10).[45] The first value indicates their own monetary amount; the second value indicates the amount for the receiving mother. Our measure of maternal altruism is the sum of altruistic choices ((10, 10) in decision A and (6, 18) in decision B).[46]

A.10.3 Satisfaction with child development

Our aim is to approximate the process of a child's IQ and preference development until mid-childhood. However, we only observe parenting style and time investments at one particular developmental stage. Thus, our model estimates might be biased if the parental investments, parenting style and quality time respond to recent unobserved developmental shocks. We therefore developed a survey question, which specifically asks parents about their satisfaction with the child's developmental process.

To measure how satisfied mothers are with the development of their child, we asked the question: "All together, how satisfied are you with your child's development in the last year?" Answers were given on an 11-point scale with 0 meaning "completely dissatisfied" and 10 meaning "completely satisfied". As all measures directly related to children this

[44] We do not have this information on both parents. Instead, we use the term "mother" to indicate the main caregiver. Empirically, e.g., Dohmen et al. (2012) document a strong positive correlation of preferences within married couples that is consistent with positive assortative mating. Positive assortative mating based on preferences is further predicted by the models of Bisin and Verdier (2000, 2001) on the cultural transmission of preferences.

[45] Falk et al. (2016) show that, in the context of social preferences, hypothetical decisions are good proxies for incentivized decisions.

[46] Due to time constraints, maternal altruism was only elicited in the first data collection.

measure was elicited in both data collections, which allows us to use the mean over both points in time.

A.11 Linking maternal traits to SES

Mothers can use their IQ and preferences to produce education. To illustrate this relationship, we link education and income (as measures of socio-economic status) to maternal traits by specifying a simple reduced-form system of equations as:

$$\begin{aligned} E_i &= \beta_0^E + \beta_C^E M_i^C + \beta_T^E M_i^T + \beta_R^E M_i^R + \beta_A^E M_i^A + \beta_Z^E Z_i + u_i^E \\ y_i &= \beta_0^y + \beta_C^y M_i^C + \beta_T^y M_i^T + \beta_R^y M_i^R + \beta_A^y M_i^A + \beta_E^y E_i + \beta_Z^y Z_i + u_i^y \end{aligned} \tag{A6}$$

where E denotes parental education, y_i is log equivalence household income, and Z_i is a vector of control variables comprising a measure of single parenthood, the number of siblings, and the child's age. Moreover, for a given mother, the errors may correlate across equations, with $\mathrm{E}[u_i^E u_i^y | M, E, Z] = \sigma^S$. The above system of equations (A6) serves two purposes. First, estimates from the above system of equations help us to better understand the extent to which socio-economic status explains intergenerational correlations in IQ and preferences. Second, they provide an additional form of anchoring, that is, a link between traits and economic outcome variables. Such anchoring can be informative above and beyond the natural anchoring of our variables in incentivized experimental behaviors.

Table A13: Parental SES

	High SES (1)		Parental education (2)		Log HH income (3)	
IQ	0.145***	(0.023)	0.969***	(0.151)	0.075***	(0.021)
Altruism	−0.020	(0.024)	−0.189	(0.149)	0.028	(0.020)
Patience	0.051**	(0.025)	0.526***	(0.144)	0.000	(0.019)
Risk	0.026	(0.023)	0.267**	(0.134)	0.032*	(0.019)
Parental education					0.075***	(0.008)
Observations	435		435		435	

Notes: Standard errors (in parentheses) are bootstrapped using 1000 bootstrap replications. The equation for log HH income comprises a dummy for single parenthood, parental age and parental age squared. Significance at * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A13 presents results on the relationship between socio-economic status and maternal traits. The results in column 2 suggest that maternal IQ and maternal patience are strongly related to the average education level in the household. In particular, we find that maternal intelligence is the strongest predictor of education, to the extent that a one standard deviation increase in maternal IQ maps into 0.97 additional years of education. The

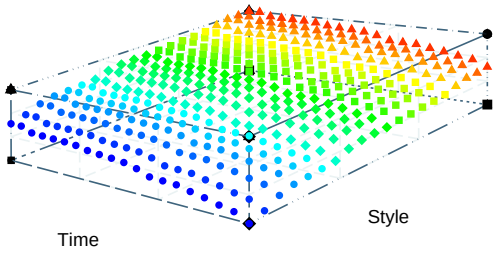
coefficients of maternal patience and her willingness to take risks are roughly half and one third of the size of the intelligence effect, but also highly significant. This result is in line with predictions of standard human capital models, which predict a negative relationship between the (subjective) discount rate and the number of years of education (Ben-Porath, 1967). The acquired level of education can be used to generate household income either through market work or via improved marriage market opportunities. Column 3 of table A13 shows that the return to an additional year of education amounts to around 7.5 percent of household income in our data. In addition, we find that IQ and willingness to take risk are positively related to household income. A one standard deviation increase in IQ raises household income by 7.5 percent and a one standard deviation increase in the willingness to take risks raises it by 3.2 percent.

A.12 Child IQ and preferences by ventile of parental investments

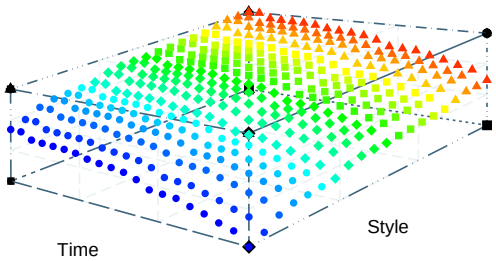
Figure A4 displays child outcomes for each ventile of the respective parental investment distribution. It shows that parenting styles are particularly important for the production of altruism, while time investments matter mostly for risk-taking. The graph also shows that changes in parenting styles and time investments are least effective in producing differences in child IQ and altruism, as long as the corresponding maternal characteristics are kept unchanged. The importance of an altruistic caregiver for the formation of altruism confirms the findings reported in Kosse et al. (2016).

Figure A4: Parental investments and child IQ and preferences

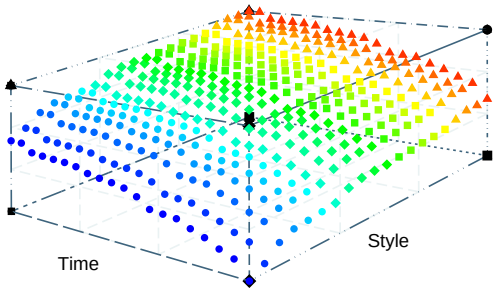
(a) IQ



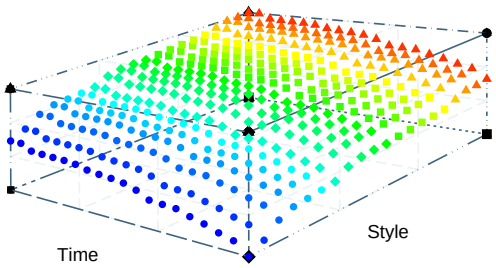
(b) Patience



(c) Lower risk-taking



(d) Altruism



Notes: The figure displays how child IQ and preferences (displayed in standard deviations on the y-axis) respond to parental investments. We use the standard convention that higher ventiles are associated with higher values of the variable.