# Socioeconomic Status and Inequalities in Children's IQ and Economic Preferences

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This paper explores inequalities in IQ and economic preferences between children from families of high and low socioeconomic status (SES). We document that children from high-SES families are more intelligent, patient, and altruistic as well as less risk seeking. To understand the underlying mechanisms, we propose a framework of how SES, parental investments, as well as maternal IQ and preferences influence a

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child's IQ and preferences. Our results indicate that disparities in the level of parental investments hold substantial importance. In light of the importance of IQ and preferences for behaviors and outcomes, our findings offer an explanation for social immobility.

## I. 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, and job performance as well as 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) and have higher educational attainment, occupational success, income, and wealth (Ventura 2003; DellaVigna and Paserman 2005; Eckel, Johnson, and Montmarquette 2005; Golsteyn, Grönqvist, and Lindahl 2014; Cadena and Keys 2015; Dohmen et al. 2018) as well as better health outcomes (Fuchs 1982; Bickel, Odum, and Madden 1999; Kirby, Petry, and Bickel 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 and Falk 2011; Dohmen et al. 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 1 provides a comprehensive summary of the empirical evidence.[1]

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[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).

TABLE 1
IQ, ECONOMIC PREFERENCES, AND LIFE OUTCOMES

| | | | | | Preferences | | |
|---|---|---|---|---|---|---|---|
| Paper | Data Set | Outcomes | Results | IQ | Time | Risk | Social |
| Åkerlund et al. 2016 | SBC, administrative data | Crime | * | X | X | O | O |
| Almås et al. 2016 | Private | Education | m | x | X | X | O |
| Anderson and Mellor 2008 | Private | Health | * | O | O | X | O |
| Baran, Sapienza, and Zingales 2010 | TCMLS | Donations | * | O | O | O | X |
| Barsky et al. 1997 | HRS | Health, personal finance | * | O | O | X | O |
| Becker et al. 2012 | GSOEP | Education, labor market, health, satisfaction | * | O | X | X | X |
| Belzil and Leonardi 2007 | SHIW | Education | * | O | O | X | O |
| Bickel, Odum, and Madden 1999 | Private | Health | * | O | X | O | O |
| Bonin et al. 2007 | GSOEP | Labor market | * | O | O | X | O |
| Borghans and Golsteyn 2006 | DNB | Health | m | O | X | O | O |
| Borghans, ter Weel, and Weinberg 2008 | BSS, BCS, BIBB-IAB | Labor market | m | O | O | O | x |
| Burks et al. 2015 | Private | Education | m | X | X | X | x |
| Burks et al. 2016 | Private | Labor market | * | O | O | O | X |
| Cadena and Keys 2015 | NLSY | Education, labor market, health | * | O | X | O | O |
| Caliendo, Fossen, and Kritikos 2010 | GSOEP | Labor market | * | O | O | X | O |
| Castillo et al. 2011 | Private | Education | * | O | X | O | O |
| Castillo, Jordan, and Petrie 2019 | Private | Education | * | O | X | O | O |
| Carpenter and Seki 2011 | Private | Labor market | * | O | O | O | X |
| Cawley, Heckman, and Vytlacil 2001 | NLSY | Labor market | * | X | O | O | O |
| Chabris et al. 2008 | Private | Health, personal finance | m | O | X | O | O |
| Dawson and Henley 2015 | Private | Labor market | * | O | O | X | O |
| Deming 2017 | NLSY79, NLSY97 | Labor market | * | x | O | O | x |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Delaney, Harmonb, and Ryanc 2013 | IUS | Education | m | O | X | X | O |
| DellaVigna and Paserman 2005 | PSID, NLSY | Labor market | * | O | X | O | O |
| Dohmen et al. 2009 | GSOEP | Labor market | * | O | O | O | X |
| Dohmen et al. 2011 | GSOEP | Labor market, health, personal finance | * | O | O | X | O |
| Dohmen and Falk 2011 | Private | Labor market | * | O | O | X | O |
| Eckel, Johnson, and Montmarquette 2005 | Private | Personal finance | m | O | X | X | O |
| Falk et al. 2018 | GPS | Education, labor market, health, personal finance, social interaction | * | X | X | X | X |
| Fuchs 1982 | Private | Education, health | * | O | X | O | O |
| Gensowski 2018 | Terman | Education, labor market | * | X | O | O | O |
| Golsteyn, Grönqvist, and Lindahl 2014 | SBC | Education, labor market, health | * | O | X | O | O |
| Groves 2005 | NLSW, NCDS | Labor market | * | X | O | O | x |
| Guiso and Paiella 2008 | SHIW | Education, labor market, health, personal finance | m | O | O | X | O |
| Hanushek and Woessmann 2008 | Multiple | Labor market | * | x | O | O | O |
| Harrison, Lau, and Rutström 2010 | Private | Health | * | O | X | X | O |
| Heckman and Vytlacil 2001 | NLSY | Education, labor market | * | x | O | O | O |
| Heckman, Stixrud, and Urzua 2006 | NLSY79 | Labor market, education, health | * | x | O | O | O |
| Heckman, Pinto, and Savelyev 2013 | Perry | Education, labor market, health | * | X | O | O | O |
| Heineck and Anger 2010 | GSOEP | Labor market | m | X | O | O | x |
| Hong, Kubik, and Stein 2004 | HRS | Personal finance | * | O | O | X | O |
| Hsieh, Parker, and van Praag 2017 | Private | Labor market | * | O | O | X | O |
| Humphries and Kosse 2017 | GSOEP | Education | m | X | X | X | O |
| Jaeger et al. 2010 | GSOEP | Labor market, migration | * | O | O | X | O |
| Karlan 2005 | Private | Personal finance | * | O | O | O | X |

TABLE 1 (*Continued*)

| | | | | | Preferences | | |
|---|---|---|---|---|---|---|---|
| Paper | Data Set | Outcomes | Results | IQ | Time | Risk | Social |
| Kimball, Sahm, and Shapiro 2008 | HRS | Personal finance | * | O | O | X | O |
| Kirby, Petry, and Bickel 1999 | Private | Health | * | O | X | O | O |
| Kirby and Petry 2004 | Private | Health | m | O | X | O | O |
| Kosfeld and Rustagi 2015 | Private | Labor market | * | O | O | O | X |
| Leibbrandt 2012 | Private | Performance in open-air markets | * | O | O | O | X |
| Meier and Sprenger 2010 | Private | Personal finance | m | O | X | O | O |
| Mischel, Shoda, and Rodriguez 1989 | Private | Education | * | O | X | O | O |
| Reynolds, Temple, and Ou 2010 | CLS | Education | * | x | O | O | x |
| Rustagi, Engel, and Kosfeld 2010 | Private | Labor market | * | O | O | O | X |
| Rustichini et al. 2016 | Private | Labor market, health, personal finance | m | X | X | X | O |
| Schmidt and Hunter 2004 | Multiple | Labor market | * | X | O | O | O |
| Strenze 2007 | Multiple | Education, labor market | * | X | O | O | O |
| Sunde et al. 2021 | Private | Developmental, growth | * | O | X | O | O |
| Sutter et al. 2013 | Private | Education, health, personal finance | * | O | X | X | O |
| Ventura 2003 | SHIW | Health, personal finance | m | O | X | O | O |

Note.—The table shows papers that demonstrate the role of IQ, time preferences, risk preferences, and social preferences for outcomes. * = significant effects; m = mixed effects; X = used; x = somewhat used; O = not used. Data sets: BIBB-IAB data = data from Bundesinstitut für Berufsbildung and Institute for Employment Research; BCS = British Cohort Study; BSS = British Skills Survey; GSOEP = German Socioeconomic Panel; CLS = Chicago Longitudinal Study; DNB = De Nederlandsche Bank Household Survey; GPS = Global Preferences Survey; HRS = Health and Retirement Survey; IUS = Irish University Study; NCDS = National Child Development Study; NLSW = National Longitudinal Survey of Young Women; NLSY = National Longitudinal Survey of Youth; NLSY79 = National Longitudinal Survey of Youth 1979; NLSY97 = National Longitudinal Survey of Youth 1997; 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.

IQ and preferences are associated with key outcomes not only 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 2019). 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]

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 (Hübner and Vannoorenberghe 2015; Falk et al. 2018; Sunde et al. 2021). 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 the 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 socioeconomic 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 socioeconomic 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

[2] Related literature in psychology on childhood temperament documents (1) that childhood temperament predicts functioning in childhood, (2) the existence of some continuity in IQ and temperament development from early childhood to early adulthood, and (3) 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).

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; Doepke and Zilibotti 2017; Cobb-Clark, Salamanca, and Zhu 2019), 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 socioeconomic environment. Children from families with higher SES are significantly more patient and altruistic and 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 the black-white achievement gaps in the United States and are larger than the estimated effects of most 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 socioeconomic 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 3-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

[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.

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 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 socioeconomic differences in child IQ and preferences are mostly due to differences in parental inputs—that is, 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.

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 III provides descriptive evidence on gaps in IQ and preferences between children from high- and low-SES households. Section IV presents and estimates a framework of how maternal IQ and preferences, household income, and parental education and investments interact to form a child's preferences and IQ. In section V, we discuss the implications of our findings and conclude.

[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 measured only 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 socioemotional behavior, cognitive development, and family adversity (see, e.g., Burchinal et al. 2000; Obradović et al. 2010; and references therein). This work follows a different tradition, and the measures are usually not incentivized.

## II. 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.

### A. *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% ($N = 1{,}874$) 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 families with low income, low parental education, or single parents ($N = 700$) to obtain a large sample of socioeconomically 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 it was categorized as low education if neither parent has obtained a university entrance certificate. Second, we invited a randomly chosen subgroup of 150 families 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 (for details, see also Falk and Kosse 2021).[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

[7] The sample is based on the briq family panel (Falk and Kosse 2021). It consists of all untreated families that took part in the first two rounds of data collection and show no missing data in the key variables used in this paper.

[8] The parents answered a short screening questionnaire about the socioeconomic characteristics of the household and consented to let their children participate in the study and (if selected) to let them take part in a 1-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] During the interviews, 96% of the children were accompanied by their biological mother, 2% by their biological father, three 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. 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.

university students (mostly graduates) of psychology or education science and lasted about 1 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 and 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 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 socioeconomic background of the family. Third, they were asked to provide information on the childhood environment, including measures of parenting style, parent-child activities, an assessment of how satisfied the parents were with their child's development, as well as some information about the children's fathers. 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 nonrandom selection, we compare our sample along several dimensions with the German Socioeconomic 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 with 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 B1; tables A1–A6, B1–B17 are available online).

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 that account for systematic differences in SES, maternal IQ, and maternal preferences between our sample and the representative SOEP data (for details, see appendix sec. B.1.1). We then use these weights to estimate the moments of the population distribution. Last, we standardize our measures of child IQ and economic

[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.

[11] For a detailed description of the maternal preference and IQ measures, see appendix sec. B.2.

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 nonrandom attrition (attrition is 16.2%; see appendix sec. B.1.2 for a description of the weighting scheme).

### B. *Socioeconomic 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 classify a family as having low SES if either one or both of the following conditions are met: (1) the parents are low educated, that is, neither parent has obtained a university entrance certificate; or (2) net equivalence household income lies below the 30th percentile of the German income distribution.[12] All other families are classified as having high SES.

Later, we also use parental education and household income as continuous measures of a child's socioeconomic background. For education, we construct a measure comprising the overall number of years of education averaged over mothers and fathers, that is, including vocational training and university education. For income, we use net monthly household equivalence income, computed in line with standard procedures from the Organization for Economic Cooperation and Development and Eurostat (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: 44% of the children with low-educated parents experience both low parental education and low family income as two forms of socioeconomic disadvantage.

### C. *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

[12] The monthly net household equivalence income threshold of 1,065 euros is calculated on the basis of representative household data (SOEP 2010). It closely aligns with the official poverty line (e.g., 1,033 euros 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 a value of 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.

measurement tools, which were carefully pretested 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 fig. A1; figs. A1, A2, B1–B4 are available online). A reward with the monetary equivalent of 4 euros was guaranteed. Each star collected in the experiments increased the value of the reward by 0.15 euros. For comparison, note that the mean amount of pocket money in our sample was about 1.5 euros 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 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, for example, for multi-item survey measures of personality traits (for details, see appendix sec. B.3).[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 nonrandom measurement error, and allows for a straightforward comparison across individuals.

### 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

[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 appendix sec. B.3. 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 SES. Hence, in empirical models of SES, with preferences as dependent variables, measurement error is likely captured by the error term.

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 1 week after the interview. To ensure that the children were certain to receive the money, 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. We also handed out contact details for questions or requests.

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. 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 chose 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

[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.

two variations of the game (situation A vs. situation B) were played was randomized. The coin-flipping experiment is thus a simple, vivid way to assess risk preferences. It is easier to understand than, for example, 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.

In later analyses, we also investigate whether children operate in the risk-averse, risk-neutral, or risk-seeking domain. 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.

### 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 himself/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 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 was a child living in a nearby city. In the other game, the child lived in an African country. Children knew that the African child did not live together with his parents since they were either ill or dead. In both versions, children were endowed with six stars. After the children distributed the stars between the two bags, the interviewer checked that they understood how many stars they and the other child would receive. If the children did not understand the resulting allocation, the rules were

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

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]

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.

### 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 Hamburg-Wechsler-Intelligenztest für Kinder (HAWIK IV), which is the German version of the well-established Wechsler IQ test for children (Petermann and Petermann 2010). Children were presented with 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.

## III. 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

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

[20] Because of time constraints, we had to restrict the test to 14 items. We chose those 14 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).

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 IQ and economic preferences on a dummy variable that equals 1 for high-SES households 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 ($p < .01$) and are more patient ($p < .05$), less risk-taking ($p < .1$), and more altruistic ($p < .05$) than children from families of low SES (see table A1 for the corresponding regression results).[21] The differences by SES are sizable. High-SES children have a 65% of a standard deviation higher IQ and 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.

These effect sizes are substantial when compared with racial gaps or the impact of most childhood interventions. Regarding patience and IQ, the SES gaps exceed half the size of the black-white achievement test gap in the United States (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 childcare or school-based interventions. In a meta-analysis, Duncan and Magnuson (2013) find a weighted average impact of early childcare 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; Almås et al. 2016; Castillo, Jordan, and Petrie 2019), 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

[21] For comparison, in table A1 we report three different estimates of standard errors. The different estimates are very similar, but bootstrapped standard errors are slightly more conservative than ordinary least squares or White standard errors. Therefore, we report $p$-values based on bootstrapped standard errors for all regressions in this study.

[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; Heckman, Pinto, and Savelyev 2013).

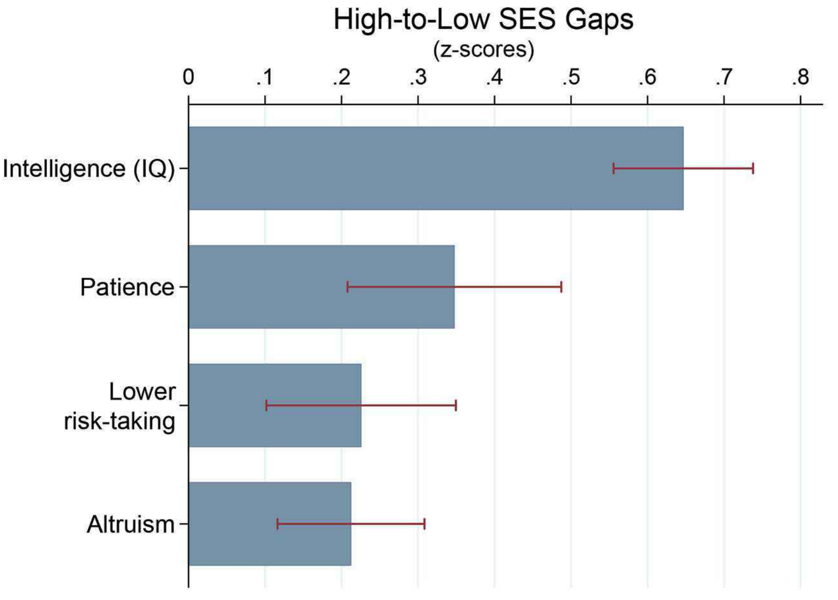


FIG. 1.—Gaps in IQ and economic preferences between elementary school children from high- and low-SES families. The horizontal bars represent coefficients of a dummy variable that equals 1 for high-SES and 0 for low-SES households in regressions of IQ or preferences on this SES dummy (ordinary least squares for IQ and altruism, Tobit for patience and risk-taking). Error bars show bootstrapped standard errors (1,000 bootstrap replications).

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, and so on.[23] SES thus evokes the simultaneous determination of risk factors that favor social immobility and marginalization. For example, individuals who are both less intelligent and less patient are likely to obtain lower levels of education. Table A2 shows how preference profiles relate to important teenage life outcomes in our data. It displays correlation coefficients between our child preference and IQ measures and teenage life outcomes from follow-up surveys collected 4–5 years after the first data collection (for details on the teenage data, see appendix sec. B.5). The results indicate that those

[23] These findings also suggest that SES drives part of the observed preference correlations displayed in table B3. For a discussion of the correlation pattern, see appendix sec. B.4.

profiles that prevail in high-SES families (high IQ, high patience, low risk-taking, high altruism) translate into more educational success, more social participation, and less juvenile offending during adolescence.[24] These results also hold conditioning on parental SES (compare panels B and C in table A2).

In the online 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 appendix sec. B.1). Second, we add control variables that account for potential SES-related differences in perceptions of the experimental procedures (see appendix sec. B.6) and validation of incentives (see appendix sec. B.7). Here, we show that our results are unaffected by procedural perceptions, 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 appendix sec. B.8). Fourth, we show that the differences in IQ and economic preferences by SES do not significantly differ for boys and girls (see table A3). Last, in table B7 we show that our findings do not change when we account for single parenthood. For a detailed discussion, see appendix section B.9.

As an alternative 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%, $p = .814$; see table A4). However, a higher share of high-SES children are risk neutral (36.1% vs. 28.2%, $p < .1$), whereas a higher share of low-SES children are risk seeking (20.6% vs. 27.4%, $p < .1$). 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.[25]

[24] For recent evidence on the relation of skills/personality and political or social participation, see Holbein (2017) and Hufe and Peichl (2020).

[25] 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.

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 and/or low income. We repeat the analysis shown in figure 1 but now subdivide the low-SES category into (1) low parental education only, (2) low parental income only, and (3) 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 and 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

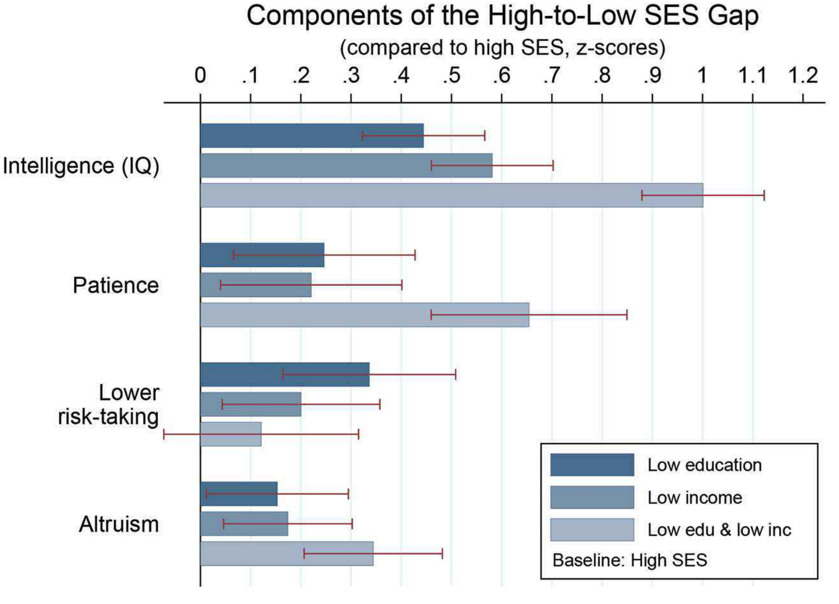


FIG. 2.—Gaps in IQ and economic preferences between elementary school children from different socioeconomic backgrounds. The horizontal bars indicate differences between the baseline category high SES (neither low parental education nor low income) and each respective low-SES subgroup. The bars indicate absolute values of coefficients of three dummy variables in regressions of IQ or preferences on the three dummies (ordinary least squares 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. Error bars show bootstrapped standard errors (1,000 bootstrap replications).

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.

Table A5 complements the analysis shown in figure 2 by using income and education as continuous variables. We regress IQ and economic preferences on average years of parental education, household income, and their interaction. The results largely confirm the pattern shown in figure 2. More education and income are related to higher IQ, patience, and altruism as well as less risk-taking in children. The effect is most pronounced for IQ and on a similar level for time, risk, and social preferences. The interaction effects are usually relatively small compared with the main effects (except for patience), which indicates that the low-SES effect is pronounced for children from families that have low levels of education and low income.

## IV. SES and the Development of Preferences and IQ: A Conceptual Framework

In section III, 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.

### A. *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

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

where $\gamma_j^\ell \in [0, 1]$ are production shares such that $\Sigma_j^J \gamma_j^\ell = 1$, $\phi^\ell \in [-\infty, 1]$ is an elasticity parameter, and $\varepsilon = 1/(1 - \phi^\ell)$ represents the elasticity of substitution in the inputs that generate IQ and preferences. Moreover, $e^{\eta\ell}$ reflects unobserved random shocks. Factor inputs are as follows: $M^\ell$ denotes the maternal characteristic that corresponds to $P^\ell$, $I^S$ is a positive parenting style, and $I^T$ denotes time investments. $M^\ell$ enters the production function to capture the direct transmission of IQ and preferences, which can take place socially or genetically. Our data do not allow us to distinguish between social, genetic, or other factors in the direct transmission of IQ and preferences through $M^\ell$. However, as an example, one may imagine that if a mother acts very altruistically, the child likely imitates that behavior.[26]

$\Pi_{\text{SES}}$ in equation (1) denotes a factor-neutral SES-specific productivity parameter. It captures productivity differences that arise if, for example, the same amount of input 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 if, for example, 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 $P^\ell$, 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 ($\gamma$) and the factor-neutral productivity parameter may vary freely across characteristics.

The above production function focuses on parenting style, parental time investments, and maternal characteristics as key inputs. Other factors—such as material wealth, the abundance of consumer products, or the quality of housing—are not explicitly modeled and may enter only via the inputs or via $\Pi_{\text{SES}}$. The focus on parental time and style investments is motivated by a large literature in psychology that puts interactions with caregivers at the forefront of child development (e.g., Skinner 1953; Rogoff 1990; Bowlby 2008; Eisenberg, Spinrad, and Knafo-Noam 2015).[27] Yet other determinants of child IQ and preferences are likely

[26] 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. (2020) for social preferences.

[27] For evidence on the role of role models and interaction for the development of prosociality, see Kosse et al. (2020).

captured in $M$. Examples are the genetic disposition of the mother with respect to any of the characteristics $\ell$ or her role model behavior. The focus of the above equation is thus the relationship between parental SES, parental investments, and child IQ or preferences. Additional information on the different components of $M$ would be required to capture how, for example, social, genetic, and other factors (differentially) affect both SES and the productivity parameter $\Pi_{\text{SES}}$.

### B. *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 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 socioeconomic environment in which a family lives and that parenting style may affect children's preferences. Moreover, Burton, Phipps, and Curtis (2002) show that both socioeconomic 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:

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

where $M^P$ denotes a vector of maternal IQ and preferences, SES comprises education and income as measures of SES, and $X_i$ is a vector of household characteristics. $\epsilon_I^m$ with $m \in \{S, T\}$ are error terms, which may correlate across investment equations. In addition, as discussed in section IV.C.3, $\epsilon_I^m$ may correlate with $\eta_i^\ell$, that is, 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). They also have the resources available to replace their time for more basic tasks, such as house cleaning, gardening, or driving kids to school, freeing up time for more high-value interactions with children (see, e.g., Doepke and Zilibotti 2019). 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 $\Pi_{\text{SES}}$ in equation (1). Mothers in turn can use their IQ and preferences to produce education and household income. Appendix section B.10 describes this relationship.

## *C. Estimation Strategy*

### 1. Parenting Style and Time Investments

This section explains how we measure parenting style and time investments (for further details, see appendix sec. B.11.1).[28] 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 in the form of a mixture distribution to extract latent parenting style, where a higher value reflects warm and child-oriented parenting but also a high degree of monitoring, while a lower value is associated with a higher degree of punishment (for details, see appendix sec. B.13). 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 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

[28] Our analysis relies on the assumption that maternal responses about inputs proxy parental investments more generally. In appendix sec. B.12, we discuss the related literature and use SOEP data to verify this claim.

to hold the maternal time budget for non-work-related activities fixed, which might itself be a function of other familial contexts, such as the number of children or the number of available caregivers.[29] For details, see appendix section B.11.1.

### 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 (appendix sec. B.2 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 sec. II.B). 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

$$\ln(P_i^\ell) = \ln(\Pi_{\text{SES}}^\ell) + \frac{1}{\phi^\ell}\ln[\gamma_M^\ell M_i^{\ell\phi^\ell} + \gamma_s{}^\ell I_i^{S\phi^\ell} + \gamma_t{}^\ell I_i^{T\phi^\ell}] + \eta_i^\ell \tag{3}$$

for all $\ell \in \{IQ, P, R, A\}$. To ensure that our measures of maternal IQ, preferences, and time investments are nonnegative, 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 parenting factor. $\Pi_{\text{SES}}^\ell$ 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. $\Pi_{\text{SES}}^\ell$ thus captures any productivity differences across SES that are not due to level differences in investments or maternal IQ and economic preferences.

[29] 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.

### 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.[30] Cunha, Heckman, and Schennach (2010) model the unobserved heterogeneity as latent variables, while Attanasio et al. (2020) employ a control function approach. Because of the small size of our sample and the fact that we focus on two different types of parental investments, we follow a different strategy.[31] 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:

$$\begin{aligned} \eta_i^\ell &= \gamma_\alpha^\ell \alpha_i + \varepsilon_i^\ell, \\ \epsilon_i^m &= \delta_\alpha^m \alpha_i + \nu_i^m, \end{aligned} \tag{4}$$

where $\eta_i^\ell \sim N(0, \sigma^{2^\ell})$ and $\epsilon_i^m \sim N(0, s^{2^m})$. Moreover, all idiosyncratic random shocks are assumed independent across equations and orthogonal to $\alpha_i$. Under these assumptions, the error terms across investment and technology equations are related only because of differences in parental satisfaction with their children's development. In our parent survey, we collected measures of $\alpha_i$, which we use according to equations (4) to deal with potential endogeneity issues (see appendix sec. B.11.2 for details).

## D. *Results: Model Estimates*

Figure 3 displays kernel density plots of standardized style and 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.

Table 2 displays the results of the parental investment system (eq. [2]). 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

[30] For a discussion, see Cunha, Heckman, and Schennach (2010) and Attanasio et al. (2020).

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

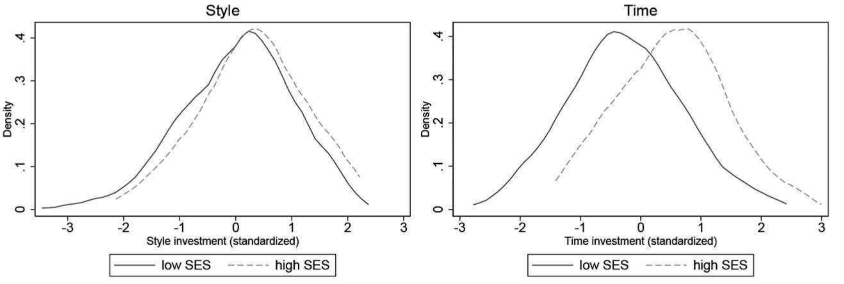


FIG. 3.—Kernel density plots of standardized investment measures by parental SES (Epanechnikov kernel, bandwidth = 0.33). Style investments: $p = .004$ ($t$-test), $p = .013$ (Kolmogorov-Smirnov test). Time investments: $p = .000$ ($t$-test), $p = .000$ (Kolmogorov-Smirnov test).

income, parental time investments are more strongly predicted by parental education. We can speculate only 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

TABLE 2
RELATIONSHIP BETWEEN SES AND PARENTAL INVESTMENTS

| | Parental Investments | | | |
|---|---|---|---|---|
| SES | Style | Time | Style | Time |
| High SES | .224** | .646*** | | |
| | (.090) | (.096) | | |
| Parental education | | | .018 | .117*** |
| | | | (.020) | (.017) |
| Log household income | | | .311*** | .178 |
| | | | (.118) | (.115) |
| Observations | 435 | 435 | 435 | 435 |

NOTE.—Standard errors (in parentheses) are bootstrapped using 1,000 bootstrap replications. Estimates are from a seemingly unrelated regression model. Control variables comprise maternal preferences and IQ, child age, the overall number of children in the household, an indicator of single parenthood, and a measure of parental satisfaction with the child's development. The coefficient for single parenthood is small and insignificant in all specifications (coefficient/$p$-value: 0.0955/.325, 0.004/.968, 0.135/.180, 0.001/.991).
** $p < .05$.
*** $p < .01$.

on child human capital development. Single parenthood proves largely unimportant for parental investments in our data (for a discussion, see appendix sec. B.9).

Table 3 reports the estimates of the CES production function. The table presents the estimated coefficients for inputs, the productivity parameter $\Pi_{\text{SES}}$, the elasticity parameter $\phi$ 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) or both. 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 SES of the parents, as $\Pi_{\text{SES}}$ is close to 1 in all models. This finding is key, as it suggests that the socioeconomic differences in child IQ and preferences documented in the first part of the paper are mostly due to differences in inputs. In other words, if low-SES families

TABLE 3
Production Function Estimates

| | IQ | Patience | Lower Risk-Taking | Altruism |
|---|---|---|---|---|
| SES productivity: | | | | |
| $\Pi_{\text{SES}}$ | 1.082 | .860 | .733† | .892 |
| | (.111) | (.107) | (.077) | (.100) |
| Inputs: | | | | |
| $M^{\ell}$ | .429*** | .349*** | .255*** | .344*** |
| | (.051) | (.056) | (.049) | (.053) |
| Style | .271*** | .285*** | .306*** | .329*** |
| | (.047) | (.054) | (.053) | (.050) |
| Time | .301*** | .367*** | .439*** | .327*** |
| | (.047) | (.058) | (.047) | (.047) |
| Satisfaction with child development: | | | | |
| $\gamma_{\alpha}$ | .984 | .985 | .987 | .990 |
| | (.008) | (.013) | (.010) | (.009) |
| Elasticity: | | | | |
| $\phi$ | .338* | .253 | .046 | .155 |
| | (.182) | (.287) | (.194) | (.126) |
| $\varepsilon$ | 1.511 | 1.340 | 1.049 | 1.183 |
| | (.414) | (.515) | (.213) | (.177) |
| Observations | 435 | 435 | 435 | 435 |

Note.—$\epsilon = 1/(1 - \phi^{\ell})$ represents the elasticity of substitution in the inputs that generate IQ and preferences. The reported standard errors (in parentheses) were bootstrapped using 1,000 bootstrap replications.

* Significantly different from zero at the 10% level.

*** Significantly different from zero at the 1% level.

† Significantly different from 1 at the 1% level.

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. This finding also suggests that our model does not leave out other important inputs related to unmodeled factors, such as the availability of consumer products or the quality of housing. If at all, these factors seem to tilt our results toward smaller gaps for low-SES children through $\Pi_{SES}$. Fourth, the elasticity of substitution in inputs is larger than 1 for the development of IQ and slightly larger than (but close to) 1 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 nonlinear 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 4 to illustrate the average effect of a 1 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, regarding time and risk preferences,

TABLE 4
PRODUCTION FUNCTION (AVERAGE MARGINAL EFFECTS)

| Marginal Effects | IQ | Patience | Lower Risk-Taking | Altruism |
|---|---|---|---|---|
| $\mathrm{AME}_{M^t}$ | .585*** | .442*** | .253*** | .554*** |
| | (.083) | (.102) | (.060) | (.110) |
| $\mathrm{AME}_{\mathrm{Style}}$ | .313*** | .343*** | .418*** | .424*** |
| | (.073) | (.093) | (.073) | (.069) |
| $\mathrm{AME}_{\mathrm{Time}}$ | .367*** | .464*** | .627*** | .436*** |
| | (.074) | (.122) | (.095) | (.081) |
| Observations | 435 | 435 | 435 | 435 |

NOTE.—Displayed marginal effects correspond to estimates shown in table 3. The reported standard errors (in parentheses) were computed using the delta method.
*** $p < .01$.

time investments are relatively more important than style investments.[32]

Our results are robust with respect to alternative model specifications. We start out by investigating whether single parenthood is sufficiently accounted for. First, to capture potential direct effects of lone motherhood, we include a single parenting indicator variable as an additional covariate to equation (3). Then, to assess potential heterogeneities in the production process, we also restrict our sample to two-parent families. The corresponding results are displayed in table B8 and discussed in appendix section B.9. The estimated effect sizes hardly change when single parenthood enters as a control variable, and even when we restrict the sample to two-parent households, our results remain largely unaltered, except for a slight increase in the importance of parenting styles. These results are in line with a literature showing that single parenthood is far more detrimental for child outcomes in the United States (McLanahan 2009) than in Germany (Francesconi, Jenkins, and Siedler 2010; Woessmann 2015). We proceed our robustness analysis by loosening the assumption that only one respective maternal trait may affect child IQ and preferences. Yet by including other maternal characteristics into the model, we find no evidence of direct effects (see table B14 of appendix sec. B.15) or differences in productivity among high- and low-IQ mothers (see table B15). Hence, high-IQ mothers do not seem to have an easier time producing child preferences than low-IQ mothers in our data. Last, we investigate how the aggregation of parenting styles and time investments affects our results. As for parenting styles, alternative ways to aggregate parental responses lead to different results if parental behaviors translate into IQ and preferences differentially or if the presence of covariates in the measurement system affects our estimates. If we use principal factor analysis without covariates and Bartlett (1937) scores, we find a somewhat smaller SES gap in parenting styles (see appendix sec. B.13). Moreover, the impact of parenting styles on child IQ and preferences slightly reduces for IQ and patience. It remains similar for risk-taking and altruism. Regarding parental time investments, our results remain similar when we use the absolute number of highly interactive activities as an alternative measure of parental time investments. There is, however, more variability in the absolute number of interactive activities among low-SES families than among high-SES families, and the estimated relationship of this measure with child outcomes is somewhat weaker (see appendix sec. B.16 for results and a discussion).

[32] In fig. B3, we use the estimates reported in table 3 to show graphically how a change in parental investments (by ventile) affects children's IQ and preferences.

*E. 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 nonlinear. Moreover, the levels of investment also relate to SES. Consequently, the above-reported coefficients are relatively uninformative when it comes to policy implications. Hence, while 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: (1) 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 antipoverty policies, such as the earned income tax credit in the United States (see, e.g., Oreopoulos, Page, and Stevens 2006; Dahl and Lochner 2012); and (2) 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; Doyle et al. 2017; Heckman et al. 2017; Attanasio et al. 2020; Baranov et al. 2020).[33] For example, Baranov et al. (2020) 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 nonabusive 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.[34]

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 as follows:

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

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

[34] Another policy would be to enhance maternal IQ and preferences. Note, however, that such a policy would be very long-term. Moreover, understanding its ramifications would require a more explicit model that captures the malleability of different maternal characteristics and their relation to SES.

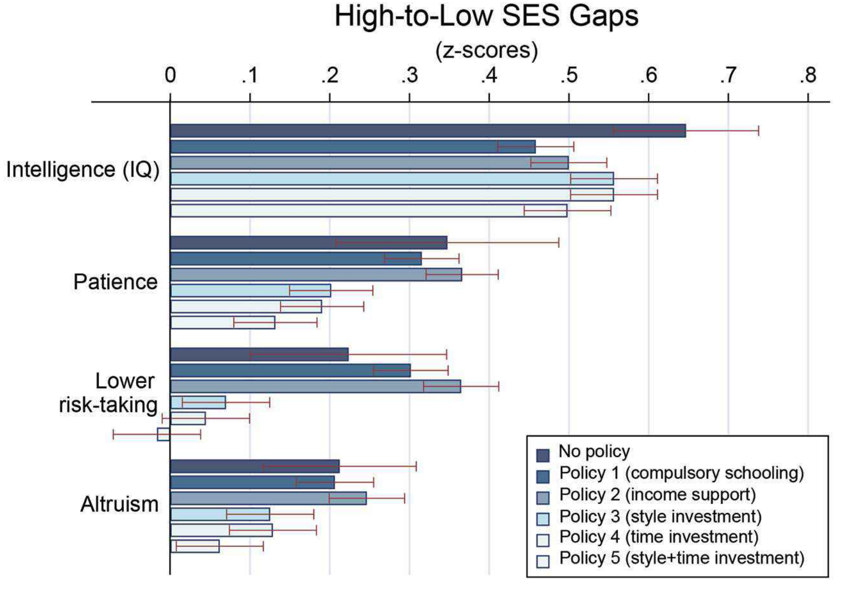


FIG. 4.—Top bars (dark blue) show the results of the main analysis (see fig. 1). Lower bars (lighter shades of blue) show gaps in IQ and economic preferences between elementary school children from high- and low-SES families as they would occur if the respective policy were put in place. In order to estimate the effects, predicted IQ and preferences are regressed on the SES dummy. Error bars show bootstrapped standard errors.

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 euros.
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 provides a graphical representation of what the SES gaps would look like in the presence of policies 1–5 (lower bars in each panel [lighter shades of blue]) when compared with the raw SES gap documented in figure 1 (top bar in each panel [dark blue]).[35] We find that an increase in parental education and family income would be most effective in closing the SES gap in IQ.[36] This result is in line with, for example, Dahl and Lochner (2012), who find a positive effect of income

[35] All corresponding estimates are displayed in table A6.
[36] We allow education to affect income using the estimates reported in table B10.

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 and 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—that is, the trait for which maternal IQ is particularly important (but unchanged)—would decrease by much less.[37]

## V. 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 and 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 can 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 (Shoda, Mischel, and Peake, Lindqvist and 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.

[37] 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 noncognitive 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).

2013; Golsteyn, Grönqvist, and Lindahl 2014).[38] 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 children's 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; Sutter et al. 2013; Castillo, Jordan, and Petrie 2019). 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).[39]

Given that patience, risk-taking, and altruism determine the shape of the utility function, our results also have implications for economic

[38] Concerning attitudes toward 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 (e.g., exercising) to good health.

[39] 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% ($=0.65 \times 25.9\%$) 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 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 approximately 5% difference in the probability to donate or volunteer (Falk et al. 2016).

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, for example, regarding school choice or the engagement in risky behaviors. Second, differences in socioeconomic 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 are 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 not typically 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 2019), 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 investments 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 low-SES parents can improve their children's patience through investments, as 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 socioeconomic 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, given our assumptions, 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 noncognitive 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, richer data on genetic, social, and other factors may help to uncover more precisely the mechanisms through which parental characteristics affect both SES and child characteristics. Moreover, future work may 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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