

Compensation or Reinforcement? The Stratification of Parental Responses to Children's Early Ability

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Abstract Theory and empirical evidence suggest that parents allocate their investments unequally among their children, thus inducing within-family inequality. We investigate whether parents reinforce or compensate for initial ability differences between their children as well as whether these parental responses vary by family socioeconomic status (SES). Using the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B) and a twin fixed-effects approach to address unobserved heterogeneity, we find that parental responses to early ability differences between their children do vary by family SES. Contrary to prior findings, we find that advantaged parents provide more cognitive stimulation to higher-ability children, and lower-class parents do not respond to ability differences. No analogous stratification in parental responses to birth weight is found, suggesting that parents' responses vary across domains of child endowments. The reinforcing responses to early ability by high-SES parents do not, however, exacerbate ability differences among children because parental responses have little effect on children's later cognitive performance in this twin sample.

Keywords Child development · Cognitive performance · Parental involvement · Within-family inequality · Twin fixed effects

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Introduction

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Parental involvement is associated with positive child outcomes, including higher levels of child well-being and better educational outcomes (El Nokali et al. 2010; Harris et al. 1998; Kaushal et al. 2011; Wang et al. 2014; Yeung et al. 2002), and it varies by social class (Bianchi et al. 2004; Gracia 2014; Guryan et al. 2008; Hoff 2003; Hsin and Felfe 2014; Kalil et al. 2012; Lareau 2011). Given this, involvement by parents may be a mechanism underlying the intergenerational transmission of educational attainment (Breen and Jonsson 2005) and the diverging destinies of children from advantaged and disadvantaged households (McLanahan 2004).

Researchers have also argued that parental involvement varies between children within the same family (Becker 1991; Becker and Tomes 1976; Behrman et al. 1982; Griliches 1979). Empirical studies have supported the notion that parents do not invest equally in their children (Aizer and Cunha 2012; Behrman et al. 1994; Datar et al. 2010; Del Bono et al. 2012; Frijsters et al. 2013; Halla and Zweimüller 2014; Hsin 2012; Restrepo 2016; Rosales-Rueda 2014; Yi et al. 2015), but less is known about whether parents' allocation of resources among siblings varies by family SES and about the role of such variation in the intergenerational transmission of advantage.

At a theoretical level, Becker and Tomes (1976) formulated a classic model of intrahousehold resource allocation predicting that parents will invest more in the human capital of the more-able child in order to maximize their returns. An alternative view was introduced by Griliches (1979) and Behrman et al. (1982), who argued that inequality aversion may trump efficiency concerns such that parents may try to equalize outcomes between their children by providing more support to the less-able child.

To test parental responses to child endowments, research has used diverse measures of endowments, reaching contradicting results. Some studies have found evidence of reinforcing parental responses (Aizer and Cunha 2012; Behrman et al. 1994; Datar et al. 2010; Frijsters et al. 2013; Rosales-Rueda 2014; Yi et al. 2015), while others have found compensating behavior (Behrman et al. 1982; Del Bono et al. 2012; Griliches 1979; Halla and Zweimüller 2014). Most of these studies used data on siblings and focused on parental responses to differences in siblings' birth weight. To date, only two studies that we are aware of analyzed differences in parental responses by family socioeconomic standing. Both focused on birth weight as a measure of child endowments and found evidence for compensating behavior among highly educated parents and reinforcing responses among parents with lower levels of education (Hsin 2012; Restrepo 2016).

This study examines the stratification of parental responses to children's early ability. Building on prior research, we test whether parents' responses to children's early ability vary by parents' SES, using a sample of twins derived from the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B). This article offers several contributions to an emerging body of research. Although most prior research has used birth weight as a measure of early endowments, we use two direct measures of children's early ability and test whether the relationship between early ability and cognitive outcomes later in childhood depends on parental responses to early ability. Although most studies have compared parental responses across siblings, we use a twin fixed-effects strategy, providing an enhanced control for age-specific unobserved differences between children coming from the same family (see also Lynch and

Brooks 2013). Finally, we rely on three waves of data to provide a comprehensive account of how parental responses matter for children's cognitive development by including early ability and parental involvement as predictors of the child's cognitive outcomes in the preschool years. This approach allows us to quantify not only parental responses to early ability differences between their children but also the extent to which these responses shape children's later cognitive outcomes, contributing to within-family inequality.

To preview our results, we find that, on average, parents provide more cognitive stimulation to the twin with higher early ability. These reinforcing parental responses are concentrated in high-SES families. At the same time, these parental responses do not mediate the effects of early ability on cognitive performance at a later age in this twin sample.

Theoretical Framework and Prior Research

Parental Involvement Responses to Children's Endowments

Theory suggests that parents respond to their children's early endowments, but the direction of this response is not clear. Economic models have proposed that parental behavior depends on efficiency concerns about the returns on their investments, and on parents' preferences—in particular, aversion to inequality between children (Becker 1991; Becker and Tomes 1976; Behrman et al. 1982; Griliches 1979). Under the assumption that the cost of investing in children's human capital declines as the child's level of endowment increases, efficiency concerns will induce parents to invest more in the human capital of the higher-endowment child. By doing so, parents will reinforce endowment differences if indeed parental investments positively affect later skills and attainment (Becker 1991; Becker and Tomes 1976).

However, parents' aversion to inequality between their children could offset efficiency concerns (Behrman et al. 1982; Griliches 1979). Equity concerns would lead parents not to accept even a small decrease in human capital returns of the less-endowed child to achieve an increase in the returns of the more-endowed child. If inequality aversion is strong enough, parents will attempt to fully compensate for ability differences.

Recent studies addressing these hypotheses in developed countries have offered inconsistent findings. Some studies found reinforcing responses (Aizer and Cunha 2012; Behrman et al. 1994; Datar et al. 2010; Frijsters et al. 2013; Rosales-Rueda 2014; Yi et al. 2015), others found compensating behavior (Behrman et al. 1982; Del Bono et al. 2012; Griliches 1979; Halla and Zweimüller 2014), and yet others found neutrality in parental involvement (Lynch and Brooks 2013).

Furthermore, prior research has largely restricted the measure of child endowment to birth weight. Although birth weight is a relevant measure of health at the starting gate of life, parents may react differently to other domains of endowments, such as children's cognitive ability. Research examining parental responses to children's early cognitive skills is scarce because of the difficulty of finding a measure of ability that is exogenous to parental behavior. For example, a pioneering study by Frijsters et al. (2013) used handedness to instrument early ability. However, handedness may change

during the time when important parental investment decisions are made, so it is not clear that it provides an adequate instrument to identify child's early ability as a determinant of parental involvement. The generalizability of findings based on birth weight to other domains of child endowments is therefore an open question.

The Stratification of Parental Responses to Children's Endowments

To date, most research has examined parental responses to child endowments at the aggregate level without considering socioeconomic heterogeneity. Sociological insights, however, have suggested that these responses may vary with family SES given social class differences in economic constraints and parental practices and orientations (Lareau 2011). Lower-class parents may be more likely to favor the high-endowment child as a strategy to reduce the risk of investment, reinforcing early ability differences (Conley 2004, 2008). In contrast, upper-class parents may be able to afford costly compensatory efforts.

An alternative approach suggests that high-SES families are more likely to reinforce differences in children's early ability. Advantaged families may invest more in the human capital of the more-able child but then provide direct transfers in the form of gifts or bequests to the less-able child in order to compensate for overall economic well-being (Becker 1991; Becker and Tomes 1976). As a result, wealthier parents reinforce through human capital investments but compensate with their nonhuman capital transfers later in life. Disadvantaged families, largely unable to make nonhuman capital transfers, may experience a conflict between efficiency and equality concerns. These concerns may fully offset each other, resulting in a neutral strategy in which they devote equal attention to all children. In sum, the socioeconomic heterogeneity in parental responses to differences in children's early ability is an open empirical question.

A different literature is relevant for this question: namely, research on the influence of early—particularly, prenatal—exposures on outcomes during childhood and its variation by social class. For example, Almond et al. (2009) showed that the negative effect of prenatal exposure to radioactivity following the Chernobyl explosion on cognitive outcomes is concentrated among children with lower-educated fathers. Similarly, Torche and Echevarría (2011) found negative effects of a low birth weight on test scores only among children from lower-educated mothers but no effects among their higher-educated counterparts. In turn, Figlio et al. (2014) and Oreopoulos et al. (2008) found no class differences in the effect of birth weight on educational outcomes.

These studies examined class variation in the consequences of prenatal exposures, but they did not address the mechanisms bringing about class differences. A potential mechanism is the stratification in parental responses to child endowments. To our knowledge, only two studies have focused on such variation in behavioral responses. Both used birth weight as a measure of child endowments and found that the negative effect of a low birth weight on parental investments varies by the SES of the parents (Hsin 2012; Restrepo 2016). Consistent with Conley (2004, 2008), these studies indicated that low-SES parents reinforce the disadvantage associated with a low birth weight while high-SES parents compensate for birth weight differences between their children.

Birth weight, however, may not generalize to other dimensions of children's endowments and abilities, and parent's responses may vary depending on the type of disadvantage they observe in their children. For instance, parents could try to

compensate for birth weight differences because low birth weight provides a clear signal sanctioned by medical professionals, but this behavior may not extend to cognitive abilities that are harder to detect, to understand, or to formulate as a problem. Parents may also find it more rewarding to interact with a child who learns faster and responds quicker to stimuli, further exacerbating differences in cognitive ability. Furthermore, these mechanisms may vary by parental socioeconomic resources. In sum, parents may combine different responses to different dimensions of their children's endowments in a complex portfolio that may vary by SES and over the child's life course.

A further question is which group is driving the socioeconomic differences in parental involvement. SES variation in parental responses can emerge from either low- or high-SES families departing from a neutral response. We test whether the gap in parental behavior emerges from reinforcing or compensating responses among the lower class or the upper class. This distinction is central to advance theory about the stratification of parental behavioral responses and to draw policy implications.

Figure 1 summarizes our theoretical expectations about the relationship between child's early ability, parental responses, and child's later cognitive performance. Early ability is expected to have a direct effect on later cognitive performance but also an indirect effect mediated by parental involvement. The main questions guiding our analysis are whether parents reinforce or compensate for early ability differences between their children and whether parental responses vary by SES. Our empirical analysis tests all paths included in Fig. 1 to provide a comprehensive account, including both determinants and consequences of parental involvement and its stratification.

Data and Methods

Data

We use data from the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B) (U. S. Department of Education, National Center for Education Statistics 2009). The ECLS-B is a panel survey following a cohort of children born in the United States in 2001 from birth until kindergarten entry. The study collects information

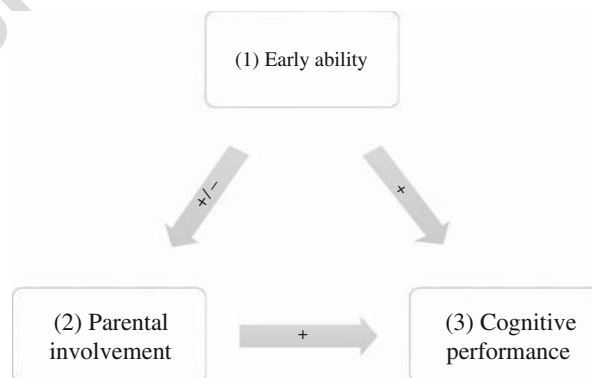


Fig. 1 Expected relations among early child ability, parental involvement, and cognitive performance at a later age

on characteristics of children, their families, and their environment. We exploit the longitudinal nature of the data by using information from Wave 1 (when children are approximately 10 months old), Wave 2 (age 2), and Wave 3 (age 4). The study is based on a nationally representative sample of about 14,000 children.¹ In the first wave of the survey, 10,700 children participated. The sample size was 9,850 in Wave 2 and 8,900 in Wave 3.

A special feature of the ECLS-B is the oversampling of twins. To examine resource allocation within families and to control for unobserved heterogeneity, we restrict the sample to twins. The final analytical sample consists of about 1,600 twins (i.e., 800 twin pairs).

Several variables, including our measures of early ability, parental involvement, and cognitive performance at age 4, have missing values. To address this issue, we implement multiple imputation using a chained equations routine with 20 imputations (Allison 2002). All variables used in the analysis, including those used to estimate the models reported in Online Resource 1, are included in the imputation models. However, following von Hippel's (2007) recommendation, we do not use imputed values of dependent variables in the respective regression models. For that reason, sample sizes differ slightly across different dependent variables. As a test of robustness, we conducted all analyses on a sample of twins without imputed data. The estimates from these models are substantively identical to the multiply imputed models. In particular, all our conclusions are confirmed by these results (see the results predicting parental cognitive stimulation in Table S3 in Online Resource 1; all other models are available upon request).²

Variables

Our main independent variable is child's early ability. We use two variables to measure this concept. The first variable is a composite measure of four developmental milestones measured in the first survey wave, when children are, on average, 10 months old. These indicators are the age (in months) at which the child started crawling, sitting without support, walking with help, and pulling to stand, as reported by parents. Earlier achievement of these developmental milestones is associated with better cognitive performance and higher educational outcomes (Murray et al. 2007; Taanila et al. 2005). A plausible mechanism for this association is that partially overlapping systems of the brain regulate both infant motor development and executive function at a later age (Ridler et al. 2006). These developmental milestones are the first cues that parents can observe and interpret as pointing to the cognitive potential of their children.

We create a measure of early child development by combining the four indicators (crawling, sitting, walking, and standing) using principal component analysis and standardize it to have a mean of 0 and a standard deviation of 1—with a higher value

¹ All sample sizes reported in this article are rounded to the nearest 50 in line with the data use license. The information on the initial sample and the sample sizes in the different waves is taken from documentation provided online (<https://nces.ed.gov/ecls/birth.asp>).

² Statistical analysis was performed using Stata 12. The replication do-file is available as Online Resource 2. Qualified researchers can apply to access the data with the Institute of Education Sciences (IES) of the United States Department of Education/ National Center for Education Statistics (NCES) (<https://nces.ed.gov/pubsearch/licenses.asp>).

indicating an earlier development and, hence, a higher level of early ability. The four indicators strongly load into a single component, which captures most of the shared variation across indicators. This result indicates that these indicators are determined by the same latent concept. Note that not all children had achieved each developmental milestone at the time their parents were interviewed. To retain these censored cases, if the child had not yet reached the milestone, we recode the particular variable as 15 months; this decision is based on the fact that the oldest age at which children in the sample were reported to achieve a milestone was 14 months. To test for robustness, we replicated all models adding an indicator variable for such cases. Results (available upon request) are substantively identical to those reported here. Furthermore, given that children with developmental delays may exert undue influence on the findings, we reestimated all models excluding any children with delays. Results remain unchanged (Table S4 in Online Resource 1). Table 1 reports descriptive statistics on the four developmental milestone indicators used to construct this measure.

Our measure of early child development satisfies two important requirements for this study. First, these developmental milestones are observed and reported by parents, as opposed to being measured by the researcher. This is an important condition because parents need to observe children's ability in order to respond with reinforcing or compensating behavior (Attanasio 2015). Second, child development is measured very early in the child's life, at approximately 10 months. Early measurement overcomes limitations of prior research, which has used indicators observed later in life (Frijsters et al. 2013).

However, this measure of early ability is not without limitations. Specifically, it may not be completely exogenous to parental behavior if parents observe and respond to ability differences before children are 10 months old, plausibly contributing to these gaps. Although this is an important consideration, ability is measured as early as we can observe infant development with our data (or with any twin data source of acceptable quality currently available). We are also not aware of any research showing that parental behavior influences the point in time in which twins are able to master the four motor skills that operationalize our measure of early child development.

To address potential limitations of the early ability measure reported by parents, we use an alternative measure—namely, the short form of the Bayley Scales of Infant

Table 1 Variables used to construct the measure of early child development

		Mean	SD	N
t1.3	Age Sitting Without Support	6.673	2.170	10,650
t1.4	Age When Started Crawling	8.472	3.094	10,650
t1.5	Age Pulled Self to Stand	9.307	2.916	10,650
t1.6	Age Walking With Help	10.365	3.038	10,700

Notes: The variable was constructed and standardized using information on the full sample, which includes the twin sample, singletons, and multiple birth children with missing information on the other children born at the same time. All variables were censored at age 15 months (see text). Sample sizes are rounded to the nearest 50 because this is required in the data use license. Descriptive statistics refer to the valid observations before multiple imputation of missing data.

Source: Early Child Longitudinal Study, Birth Cohort (ECLS-B).

Development—also measured in the first survey wave when the children were on average 10 months old. The Bayley Scales are a standard set of assessments used to evaluate the motor and cognitive development of infants and toddlers aged 1 to 42 months (Bayley 1993). We use information on the ~~short form (research edition)~~ of the Bayley Scales implemented in the ECLS-B (Andreassen and Fletcher 2005) and obtain the average of the motor and the mental score. We standardize this variable to have a mean of 0 and a standard deviation of 1. We label the resulting measure Bayley Short Form (BSF) score.

Similar to our measure of early child development, previous research has shown that the Bayley test scores are predictive of later cognitive outcomes (Aizer and Cunha 2012). The correlation between the BSF score and the measure of early child development presented above in our twin sample is 0.542 (see Table S1 in Online Resource 1), indicating that they capture very similar but not identical attributes.

The main outcome of interest is the child's cognitive performance at age 4. We operationalize it through scores in reading and mathematics tests, which we average to obtain a measure of overall cognitive performance. We standardize the resulting variable to have a mean of 0 and a standard deviation of 1.

We measure parental responses through a measure of the quality of the parents' interaction with the child when children are approximately age 2 (second wave of the survey) obtained via the Two Bags Task (Andreassen and Fletcher 2007). The Two Bags Task is an expert-coded measure based on a 10-minute videotaped interaction between parent and child. The parent is given two bags, one including a book and the other including toys, which the parent uses to interact with the child. The test is conducted with both twins one after the other: firstborn twins were observed first on odd-numbered interview days, and second-born twins went first on even-numbered days.

The Two Bags Task measures six parental behavior dimensions, including positive regard, intrusiveness, cognitive stimulation, negative regard, detachment, and sensitivity. These scores are measured on a scale from 1 to 7, with a higher score implying more parental support. Our analysis uses the measure of parental cognitive stimulation, which captures parental behavior with respect to the domain of child's ability that is the focus of this analysis. This measure refers to how well the parent stimulates the development of cognitive and perceptual as well as language skills, while taking into account the child's level of development. We standardize the measure to have a mean of 0 and a standard deviation of 1.

The limitations of this measure include the short observation period of the parent-child interaction and the fact that parents are aware of being observed. Its main advantages are that it is based on independent observations of actual interactions and is coded using a standard protocol. Although prior research has mostly relied on parents' self-reports of their involvement, this measure likely provides a more consistent assessment that can be compared across families.

Family socioeconomic standing is measured through parental education, household income, and SES (a composite index based on equally weighted measures of father's and mother's education, father's and mother's labor force status, father's and mother's occupation, and household income). We dichotomize each indicator creating an "upper class" and a "lower class" group. In the case of parental education, the dichotomous recoding distinguishes parents with some college education or more from those with no college education, using the highest level of education of either parent. For household

income, we distinguish between families with a household income higher than \$50,000 at the time of the first survey wave and all other families. With respect to family SES, we distinguish parents in approximately the bottom three quintiles from those in the top two quintiles. We report results for the overall sample and separately for each SES group.

Analytical Strategy

The analysis is based on twin fixed-effects models. This approach relates within-twin pair differences in early ability with within-twin pair differences in parental responses and cognitive performance to identify the causal effect of early ability. Because twins share the same family circumstances and uterine environment, this strategy alleviates the problem of unobserved selectivity resulting from maternal- or pregnancy-related factors related to child development. As a result, differences in early ability between twins can be treated as exogenous.³

Previous studies have focused on siblings rather than twin comparisons. Given that siblings are born at different points in time, time-specific unobserved confounders may bias the effect of early ability in family fixed-effects designs. For example, family resources and maternal behavior during pregnancy may differ between siblings in ways that correlate with post-birth parental behavior. Because family fixed-effects models may not provide unbiased and consistent estimates of the effects of child endowments on parental responses, researchers have suggested the use of instrumental variables (IV) to render early ability exogenous in these types of models (Frijsters et al. 2013). However, we are not aware of any instrument for children's early ability that would convincingly meet the exclusion restriction.

Formally, the twin fixed-effects model can be written as follows:

$$Y_{ij} - Y_{ik} = \beta(A_{ij} - A_{ik}) + \delta(\mathbf{X}_{ij} - \mathbf{X}_{ik}) + (\alpha_i - \alpha_i) + (\varepsilon_{ij} - \varepsilon_{ik}), \quad (1)$$

where Y is the outcome (parental involvement, children's cognitive performance); the subscript i refers to the family; and subscripts j and k index each of the twins. A is a measure of our explanatory variable—children's early ability; \mathbf{X} is a vector of control variables; α_i captures any unobserved factor pertaining to the family, the mother, or the birth that is shared by both twins; and ε_{ij} and ε_{ik} are individual-specific error terms. By expressing all variables as between-twins differences, the fixed-effects model controls for unobserved heterogeneity at the family, mother, and birth level. Given that we use a within-twin pairs estimator, only attributes that vary within twin pairs can be included as control variables into the models. We control for child's sex in all models.

Restricting the analysis to twins raises the important question about representativeness of the sample and whether our twin-based findings can be generalized to the larger population of children. As an initial assessment, we compare descriptive statistics of our twin sample and the population of singletons in the ECLS-B data in Table 2. We find some differences between parents of twins and singletons—with parents of twins

³ Separate analysis by zygosity would be an interesting extension. Monozygotic twins share all their genes and would provide a powerful control for genetic endowments. However, the large number of missing values for zygosity and the unreliability of the measure resulted in very small sample sizes, thus preventing the analysis.

being older and more socioeconomically advantaged as measured by education, household income, and SES. Twins have, on average, a considerably lower birth weight than singletons. In addition, twins seem to have lower levels of early ability and slightly lower cognitive outcomes. Still, substantial overlap exists between the two groups. To examine the generalizability of the findings, we reweighted the sample of twins to make it similar to the sample of singletons in terms of observed parental characteristics (including maternal age, parental education, and all other family background variables included in Table 2) using a propensity score weighting approach. Propensity score-reweighted models result in virtually identical results and are reported in Table S5 in Online Resource 1.

Another important concern is that parental interactions with and responses to twins may be different from interactions and investments in siblings (Datar et al. 2010). Because twins are the same age, they share more experiences than siblings, and it may be difficult for parents to differentiate the extent or content of their interactions between twins. Figure 2 shows the variation in parental cognitive stimulation within twin pairs. Some discrepancy in parental cognitive stimulation exists for approximately 45 % of families. For most of these families, the differences between twins are a one-point change on the parental cognitive stimulation measure ranging from 1 to 7. This suggests that meaningful variation exists between twins but, of course, does not imply

Table 2 Comparison of descriptive statistics between singletons and twins

		Singleton Sample (N = 8,850)		Twin Sample (N = 1,600)			
		Mean	SD	Mean	SD	SD _{within}	SD _{between}
t2.4	Female	0.489	0.500	0.502	0.500	0.299	0.401
t2.5	White, Non-Hispanic	0.531	0.499	0.614	0.487	— ^a	— ^a
t2.6	Maternal Age at Birth	27.224	6.177	29.267	5.969	— ^a	— ^a
t2.7	Parent Has Some College or More	0.565	0.496	0.656	0.475	— ^a	— ^a
t2.8	Household Income >\$50,000	0.351	0.477	0.448	0.497	— ^a	— ^a
t2.9	Family SES in the Two Top Quintiles	0.387	0.487	0.492	0.500	— ^a	— ^a
t2.10	Nonresident Father	0.200	0.400	0.171	0.376	— ^a	— ^a
t2.11	Parents Divorced	0.039	0.193	0.030	0.171	— ^a	— ^a
t2.12	Parental Death	0.004	0.061	0.005	0.068	— ^a	— ^a
t2.13	Early Child Development	0.192	0.866	−0.280	1.046	0.442	0.998
t2.14	Bayley Short Form (BSF) Score	0.194	0.964	−0.301	0.908	0.271	0.866
t2.15	Cognitive Performance at Age 4 (Average of Mathematics and Reading Scores)	−0.012	0.953	−0.128	0.929	0.270	0.897
t2.16	Parental Cognitive Stimulation	0.055	1.016	0.037	1.022	0.364	0.941
t2.17	Birth Weight (Continuous, Standardized)	0.473	0.641	−0.597	0.663	0.225	0.708

Notes: Sample sizes are rounded to the nearest 50 because this is required in the data use license. All descriptive statistics refer to the valid observations before multiple imputation of missing data. Survey weights are used to obtain singleton's and twin's means and standard deviations.

Source: Early Child Longitudinal Study, Birth Cohort (ECLS-B).

^a Variable does not vary between twins.

that the differences between twins are fully comparable with the differences between siblings. If variation between siblings were wider than variation between twins, then our results would likely provide conservative (lower-bound) estimates of the role of parental responses. Furthermore, children may be directly affected by their twins. For these twin-twin interactions to bias the parameter estimates of interest, however, they would need to be correlated with both parental responses and outcomes of interest.

Results

The Effect of Early Ability on Later Cognitive Performance

We begin by examining the effect of early ability measured at approximately 10 months on cognitive performance at approximately age 4 (Table 3). This corresponds to the path from 1 to 3 in Fig. 1, for which we expect a positive relationship.

Model 1 in Table 3 shows that early child development at 10 months has a positive impact on later cognitive performance in the entire sample. On average, a 1 standard deviation increase in early ability leads to approximately a 0.090 standard deviation increase in later cognitive performance at age 4. The association between early ability and later cognitive performance does not vary by family socioeconomic standing, regardless of whether we use education, SES, or income (Models 2–4). Across measures of family socioeconomic standing, the effect of early child development on test scores at age 4 is somewhat stronger among low-SES families, but the social class differences are not statistically significant.

Very similar results emerge when we use the BSF score instead of early child development as the measure of children's early ability. A 1 standard deviation increase in the BSF score leads to an increase by approximately 0.153 of a standard deviation in later cognitive performance at age 4. Again, class differences fail to reach significance at the conventional .05 level across all indicators of socioeconomic standing, indicating social class homogeneity in the association between children's early and late development. The effects of early ability on later cognitive performance are, therefore, substantively the same, independent of whether we use a measure of early ability observed and reported by the parents or measured by a well-established test of infant cognitive ability.

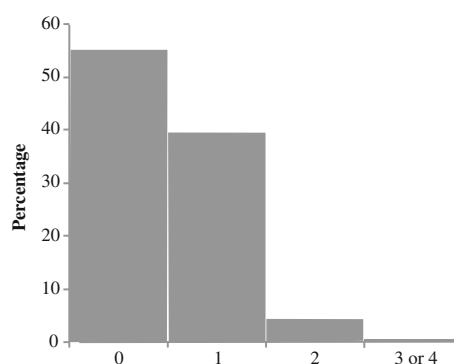


Fig. 2 Variation in parental cognitive stimulation within twin pairs (in absolute values), $N = 1,000$ (500 twin pairs), estimates are calculated on the nonimputed sample

Table 3 Twin fixed-effects models of the effect of early ability on cognitive performance at age 4

		Parental Education		Household Income		Family SES	
	All	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
t3.5	Panel A. Measure of Early Ability = Early Child Development						
t3.6	Early child development ^a	0.090**	0.100*	0.084*	0.102**	0.077 [†]	0.100**
t3.7	Female	(0.028)	(0.040)	(0.036)	(0.033)	(0.046)	(0.032)
t3.8		0.070 [†]	−0.022	0.104*	0.009	0.123*	−0.007
t3.9	<i>N</i>	(0.040)	(0.057)	(0.051)	(0.050)	(0.061)	(0.051)
t3.10		1,300	450	900	700	600	650
t3.11	Panel B. Measure of Early Ability = Bayley Short Form (BSF) Score						
t3.12	BSF score ^a	0.153**	0.123 [†]	0.175**	0.113*	0.212*	0.112 [†]
t3.13		(0.049)	(0.074)	(0.066)	(0.056)	(0.091)	(0.059)
t3.14	Female	0.075 [†]	−0.023	0.113*	0.014	0.128*	−0.004
t3.15		(0.040)	(0.057)	(0.050)	(0.048)	(0.061)	(0.050)
t3.16	<i>N</i>	1,300	450	900	700	600	650

Notes: Cluster-robust standard errors are shown in parentheses. Sample sizes are rounded to the nearest 50 because this is required in the data use license.

Source: Early Child Longitudinal Study, Birth Cohort (ECLS-B).

^a Measured at, on average, age 10 months.

[†] $p < .10$; * $p < .05$; ** $p < .01$ (two-tailed tests)

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We now turn to the main question of this analysis: the relationship between early ability and parental involvement (path from 1 to 2 in Fig. 1). This relationship will be positive if parents reinforce and negative if parents compensate for ability differences between their children. Furthermore, the relationship may vary by family SES. If such variation exists, we ask whether it emerges from departures from a neutral strategy among lower-class or upper-class families.

Table 4 shows the effect of child ability at 10 months on parental involvement, measured through parental cognitive stimulation at age 2. Model 1 examines whether parents engage in compensatory or reinforcing behavior in the entire population. Model 1 shows a positive effect of early child ability on parental cognitive stimulation, indicating that parents reinforce early ability differences. The overall effect is modest but significant. On average, a 1 standard deviation increase in children's early ability results in a 0.112 standard deviation increase in parental responses. (The effect size is similar but fails to reach significance at the .05 level when using the BSF score.)

Models 2–7 in Table 4 address the question about variation in parental responses across SES. The answer is clear: high-SES parents provide more cognitive stimulation to their high-ability twin, whereas low-SES parents do not respond to differences in ability between their twins. Socioeconomic variation in parental responses is consistent across all three indicators of socioeconomic standing (education, household income,

Table 4 Twin fixed-effects models of the effect of early ability on parental cognitive stimulation at age

		Parental Education		Household Income		Family SES	
	All	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A. Measure of Early Ability = Early Child Development							
Early child development ^a	0.112**	0.017	0.170**	-0.030	0.267**	0.078 [†]	0.156*
	(0.041)	(0.051)	(0.056)	(0.049)	(0.055)	(0.047)	(0.072)
Female	0.012	0.099	-0.018	-0.076	0.063	-0.015	0.028
	(0.057)	(0.109)	(0.067)	(0.090)	(0.070)	(0.091)	(0.074)
N	1,050	350	700	550	500	550	550
Panel B. Measure of Early Ability = Bayley Short Form (BSF) Score							
BSF score ^a	0.076	-0.005	0.126	-0.042	0.254*	-0.021	0.220 [†]
	(0.075)	(0.083)	(0.110)	(0.090)	(0.126)	(0.089)	(0.127)
Female	0.010	0.098	-0.018	-0.073	0.083	-0.028	0.039
	(0.057)	(0.109)	(0.067)	(0.090)	(0.073)	(0.090)	(0.074)
N	1,050	350	700	550	500	550	550

Notes: Cluster-robust standard errors are shown in parentheses. Sample sizes are rounded to the nearest 50 because this is required in the data use license.

Source: Early Child Longitudinal Study, Birth Cohort (ECLS-B).

^a Measured at, on average, age 10 months.

[†] $p < .10$; * $p < .05$; ** $p < .01$ (two-tailed tests)

and composite SES). Among advantaged parents, a 1 standard deviation difference in ability between twins results in a 0.156 to 0.267 standard deviation increase in parental cognitive stimulation; lower-class families do not respond to children's ability with either compensatory or reinforcing behavior. Accordingly, the socioeconomic difference in parental responses is entirely driven by the behavior of high-SES parents. Using the BSF score to measure children's early ability yields similar results about the stratification of parental responses (panel B).⁴ Again, reinforcing parental responses are concentrated among high-SES families, with effect sizes ranging between 0.126 and 0.254 standard deviation increases.

A potential confounder of the effect of early ability on parental responses is infant temperament: parents might react to their children's temperament, which may be correlated with early ability. To account for this potential confounder, we combined four indicators from the first survey wave ("(child) is fussy or irritable," "(child) goes from whimper to crying," "(child) demands attention and company," "(child) needs help to fall asleep") by means of a principal component analysis and extracted the first component to create a "temperament index." The parameter estimates of models controlling for temperament (reported in Table S10 in Online Resource 1) were substantively identical to those reported in the main text. To further account for the

⁴ We conducted additional analyses by using the motor and the mental components of the Bayley Short Form separately. For both predictors, we found evidence for reinforcement among high-SES families, but the response was stronger for the motor component. These models are reported Table S8 in Online Resource 1.

robustness of the findings, we used alternative coding strategies for family background by splitting each indicator—parents' education, income, and SES—into four quartiles. Results were consistent with the reported findings. These models are reported in Table S11 in Online Resource 1.

Finally, we tested whether parents respond to early child abilities along the other five dimensions of parental behavior (positive regard, intrusiveness, negative regard, detachment, and sensitivity) and found no evidence for parental responses with respect to these dimensions. In addition, we found no variation by family socioeconomic standing in responses to early child ability along these dimensions of parental involvement. These findings align with our expectations that these parental behaviors do not directly aim at improving children's cognitive performance. (We report all these models in Table S2 in Online Resource 1.)

Does Parental Involvement Mediate the Effect of Early Ability on Later Cognitive Performance?

Our findings consistently indicate that high-SES parents provide more cognitive stimulation to their higher-ability child, whereas low-SES parents provide the same stimulation to both children, regardless of ability. We cannot, however, claim that advantaged parents reinforce early ability differences. Their behavioral responses will reinforce only if they have an effect on the child's later cognitive development. We thus add this piece to the analysis. This component is captured by the association between parental involvement (2) and children's later cognitive performance (3) in Fig. 1. Table 5 examines the role of parental responses in connecting early child ability to later cognitive performance. This analysis builds on Table 3, adding parental cognitive stimulation as a potential mediator linking children's early ability to children's cognitive performance at age 4 years.

The results by comparing the estimates of early ability in Tables 3 and 5 suggest that parental involvement responses do not mediate the effect of early ability on children's later cognitive performance. The coefficients capturing the effect of early ability on later performance remain unchanged after the control for parental cognitive stimulation is added to the models, suggesting that parental responses do not play a mediating role. This finding is the same whether we use the measure of early child development (panel A) or the BSF score to operationalize early child ability (panel B). The reason for the negligible mediating role of parental responses is the insignificant association between parents' responses and children's cognitive performance at age 4. As shown in Table 6, the effect of parental cognitive stimulation on cognitive performance at age 4 is small in magnitude and fails to reach significance at the conventional .05 level.

The mediation analysis reported in Table 5 cannot be given a causal interpretation because parental responses are not randomly allocated, violating the sequential ignorability assumption (Imai et al. 2011). For example, if parents engage in compensatory behavior, giving more attention to the child with lower early ability, then the association between parental involvement and later cognitive performance would appear to be negative simply because parents help the less-able child. However, the pattern of effects found in this analysis does not support such source of unobserved selectivity. In fact, we have found that high-SES parents reinforce early ability, whereas lower-class parents follow a neutral strategy. As a result, the null effect of parental

Table 5 Twin fixed-effects models of the effects of early ability and parental cognitive stimulation on cognitive performance at age 4

t5.2		Parental Education		Household Income		Family SES		
t5.3	All	Low	High	Low	High	Low	High	
t5.4	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
t5.5	Panel A. Measure of Early Ability = Early Child Development							
t5.6	Early child development ^a	0.089**	0.100*	0.082*	0.103**	0.076 [†]	0.099**	0.078 [†]
t5.7		(0.028)	(0.040)	(0.036)	(0.033)	(0.046)	(0.032)	(0.044)
t5.8	Parental cognitive stimulation	0.019	0.022	0.019	0.029	0.007	0.028	0.009
t5.9		(0.028)	(0.045)	(0.035)	(0.029)	(0.050)	(0.031)	(0.047)
t5.10	Female	0.068 [†]	−0.026	0.103*	0.009	0.121 [†]	−0.008	0.119*
t5.11		(0.040)	(0.057)	(0.051)	(0.050)	(0.061)	(0.051)	(0.057)
t5.12	N	1,300	450	900	700	600	650	650
t5.13	Panel B. Measure of Early Ability = Bayley Short Form (BSF) Score							
t5.14	BSF score ^a	0.152**	0.123 [†]	0.173**	0.113*	0.210*	0.113 [†]	0.201*
t5.15		(0.049)	(0.073)	(0.066)	(0.055)	(0.091)	(0.058)	(0.084)
t5.16	Parental cognitive stimulation	0.021	0.021	0.022	0.028	0.007	0.032	0.007
t5.17		(0.028)	(0.044)	(0.035)	(0.029)	(0.049)	(0.031)	(0.047)
t5.18	Female	0.074 [†]	−0.027	0.112*	0.014	0.126*	−0.004	0.126*
t5.19		(0.040)	(0.057)	(0.050)	(0.048)	(0.061)	(0.050)	(0.057)
t5.20	N	1,300	450	900	700	600	650	650

Notes: Cluster-robust standard errors are shown in parentheses. Sample sizes are rounded to the nearest 50 because this is required in the data use license.

Source: Early Child Longitudinal Study, Birth Cohort (ECLS-B).

^a Measured at, on average, age 10 months.

[†] $p < .10$; * $p < .05$; ** $p < .01$ (two-tailed tests)

involvement on children's cognitive performance reported in Table 5 is not likely to be driven by the negative selectivity of the children who receive more support. In sum, we find that high-SES parents provide more cognitive stimulation to their more-able twin, but that such investments do not seem to translate into enhanced cognitive development. Parental responses among advantaged families, while reinforcing in their *allocation*, appear not to be reinforcing in their *consequences*.

To test the robustness of this null finding, we examined the effect of parental involvement on children's cognitive performance at age 5 (using Wave 4 of the ECLS-B) in addition to age 4 and on children's socioemotional development at age 4. In both cases, we found positive but substantively small and statistically insignificant effects of parental involvement net of early ability (results available in Table S6 (cognitive performance at age 5) and Table S7 (socioemotional development) in Online Resource 1).

The fact that we do not find an effect of parental responses on later cognitive performance (or socioemotional development) conditional on early ability should not be read as conclusive, however. The insignificance of the parameter estimates could be partly due to measurement error in the parental response measure or to limited variation

Table 6 Twin fixed-effects models of the effects of parental cognitive stimulation at age 2 on cognitive performance at age 4

t6.2			Parental Education		Household Income		Family SES	
t6.3		All	Low	High	Low	High	Low	High
t6.4		(1)	(2)	(3)	(4)	(5)	(6)	(7)
t6.5	Parental Cognitive Stimulation	0.024	0.023	0.026	0.027	0.018	0.032	0.015
t6.6		(0.028)	(0.046)	(0.036)	(0.030)	(0.049)	(0.032)	(0.047)
t6.7	Female	0.067 [†]	−0.030	0.103*	0.008	0.119 [†]	−0.011	0.120*
t6.8		(0.040)	(0.057)	(0.051)	(0.049)	(0.062)	(0.050)	(0.057)
t6.9	<i>N</i>	1,300	450	900	700	600	650	650

Notes: Cluster-robust standard errors are shown in parentheses. Sample sizes are rounded to the nearest 50 because this is required in the data use license.

Source: Early Child Longitudinal Study, Birth Cohort (ECLS-B).

[†] $p < .10$; * $p < .05$ (two-tailed tests)

among twins, even though there seems to be sufficient variation to capture an effect of early ability on parental cognitive stimulation. It could also be due to spillover effects in the way that the twin who receives more reinforcement influences her/his twin positively. This null finding calls for further research examining other outcomes during childhood and using alternative data sources and operational measures.

Comparison With Research on Parental Responses Using Birth Weight as a Measure of Child Endowment

Virtually all prior research on parental responses has used birth weight as the measure of child endowments. This difference raises the important question about the exchangeability of birth weight and early cognitive ability as measures of children's early skills (Almond and Mazumder 2013). To address this question, we use birth weight as a measure of early child endowments. In our twin sample, the correlation between birth weight and early child development is .334, and the correlation between birth weight and the BSF score is .285 (Table S1 in Online Resource 1). These correlations are positive but moderate, suggesting that birth weight and early ability measure related but distinct dimensions of child endowments. Figure S1 in Online Resource 1 documents information about differences between twins in birth weight.

We examine whether the same pattern of parental responses emerges if we use birth weight instead of early ability as a measure of early endowments (Table 7) and assess whether parents respond to differences in their children's early ability net of birth weight differences (Table 8).

Table 7 offers twin fixed-effects models using birth weight instead of early ability as a measure of child endowment. We report results using two different specifications of birth weight. In panel A, we use a standardized version of birth weight measured in grams; in panel B, we employ an indicator of low birth weight, defined as a birth weight less than 2,500 g—a threshold that distinguishes births most at risk of mortality, morbidity, and developmental issues (Kline et al. 1989).

The estimates capturing the effect of birth weight consistently fail to reach significance at the .05 level, although they point in the direction of possible reinforcement. If we consider the low birth weight indicator, the sign of the parameter estimates is consistent with reinforcement among high-SES families—but again, they consistently fail to reach significance at any meaningful level. Admittedly, the standard errors of the estimates reported in Table 7 are large, suggesting that there may not be enough variation in birth weight between twins to obtain precise estimates, although enough variation exists to detect an effect of birth weight on cognitive performance at age 4, as reported in Table S9 in Online Resource 1.

These results depart from prior literature. Both Hsin (2012) and Restrepo (2016) reported compensatory responses to children's differences in birth weight among high-SES families and reinforcing behavior among low-SES families. The discrepancy with prior research may be due to different research designs (siblings in prior studies, twins in ours) or to different outcome variables (time use by Hsin (2012) and the home environment by Restrepo (2016), and observed parent-child interaction in our study). Regardless of the factors accounting for these discrepancies, our results suggest that parents react differently to alternative measures of children's early endowments and that findings about birth weight may not generalize to other domains of child endowments.

Finally, Table 8 examines whether the stratified pattern of parental responses to children's early ability persist after we control for differences in birth weight. Models are identical to Table 4 except that we add controls for birth weight (in the two aforementioned specifications, a standardized version of birth weight measured in grams and a low birth weight indicator variable). The results are clear: controlling for

Table 7 Twin fixed-effect models of the effect of birth weight on parental cognitive stimulation at age 2

t7.2		Parental Education			Household Income		Family SES	
t7.3		All	Low	High	Low	High	Low	High
t7.4		(1)	(2)	(3)	(4)	(5)	(6)	(7)
t7.5	Panel A. Measure of Birth Weight = Continuous							
t7.6	Birth weight	0.069	0.032	0.084	0.068	0.065	0.036	0.096
t7.7		(0.082)	(0.112)	(0.109)	(0.115)	(0.117)	(0.117)	(0.118)
t7.8	Female	0.014	0.101	−0.017	−0.060	0.073	−0.020	0.037
t7.9		(0.057)	(0.109)	(0.068)	(0.090)	(0.074)	(0.092)	(0.074)
t7.10	N	1,050	350	700	550	500	550	550
t7.11	Panel B. Measure of Birth Weight = Dummy Variable for Low Birth Weight (<2,500 g)							
t7.12	Low birth weight	−0.071	0.094	−0.131	0.006	−0.164	0.005	−0.143
t7.13		(0.083)	(0.129)	(0.105)	(0.127)	(0.107)	(0.132)	(0.104)
t7.14	Female	0.013	0.095	−0.012	−0.071	0.089	−0.026	0.043
t7.15		(0.058)	(0.108)	(0.069)	(0.090)	(0.075)	(0.090)	(0.075)
t7.16	N	1,050	350	700	550	500	550	550

Notes: Cluster-robust standard errors are shown in parentheses. Sample sizes are rounded to the nearest 50 because this is required in the data use license.

Source: Early Child Longitudinal Study, Birth Cohort (ECLS-B).

Table 8 Twin fixed-effects models of the effect of early ability on parental cognitive stimulation at age 2, controlling for birth weight

t8.2			Parental Education		Household Income		Family SES	
t8.3		All	Low	High	Low	High	Low	High
t8.4		(1)	(2)	(3)	(4)	(5)	(6)	(7)
t8.5	Panel A. Measure of Early Ability = Early Child Development; Measure of Birth Weight = Continuous							
t8.6	Early child development ^a	0.110**	0.014	0.169**	−0.037	0.266**	0.078	0.156*
t8.7		(0.042)	(0.055)	(0.056)	(0.052)	(0.055)	(0.050)	(0.072)
t8.8	Birth weight	0.045	0.022	0.079	0.080	0.041	−0.002	0.097
t8.9		(0.083)	(0.121)	(0.109)	(0.120)	(0.113)	(0.126)	(0.116)
t8.10	Female	0.018	0.101	−0.007	−0.064	0.067	−0.016	0.038
t8.11		(0.058)	(0.109)	(0.068)	(0.090)	(0.071)	(0.092)	(0.074)
t8.12	N	1,050	350	700	550	500	550	550
t8.13	Panel B. Measure of Early Ability = Bayley Short Form (BSF) Score; Measure of Birth Weight = Continuous							
t8.14	BSF score ^a	0.069	−0.010	0.119	−0.057	0.251*	−0.027	0.213 [†]
t8.15		(0.075)	(0.085)	(0.109)	(0.090)	(0.126)	(0.089)	(0.126)
t8.16	Birth weight	0.056	0.034	0.067	0.085	0.047	0.043	0.070
t8.17		(0.081)	(0.115)	(0.106)	(0.115)	(0.112)	(0.116)	(0.115)
t8.18	Female	0.017	0.101	−0.010	−0.061	0.088	−0.021	0.046
t8.19		(0.058)	(0.109)	(0.069)	(0.090)	(0.074)	(0.092)	(0.074)
t8.20	N	1,050	350	700	550	500	550	550
t8.21	Panel C. Measure of Early Ability = Early Child Development; Measure of Birth Weight = Dummy Variable for Low Birth Weight (<2,500 g)							
t8.22	Early child development ^a	0.113**	0.020	0.173**	−0.030	0.273**	0.079 [†]	0.167*
t8.23		(0.041)	(0.051)	(0.057)	(0.049)	(0.055)	(0.048)	(0.074)
t8.24	Low birth weight	−0.073	0.097	−0.144	0.004	−0.195*	0.020	−0.176 [†]
t8.25		(0.082)	(0.129)	(0.103)	(0.127)	(0.095)	(0.134)	(0.102)
t8.26	Female	0.020	0.096	0.001	−0.076	0.090	−0.017	0.048
t8.27		(0.058)	(0.109)	(0.069)	(0.090)	(0.071)	(0.091)	(0.076)
t8.28	N	1,050	350	700	550	500	550	550
t8.29	Panel D. Measure of Early Ability = Bayley Short Form (BSF) Score; Measure of Birth Weight = Dummy Variable for Low Birth Weight (<2,500 g)							
t8.30	BSF score ^a	0.071	0.002	0.117	−0.043	0.251*	−0.021	0.216 [†]
t8.31		(0.075)	(0.083)	(0.109)	(0.087)	(0.126)	(0.086)	(0.127)
t8.32	Low birth weight	−0.063	0.095	−0.120	−0.002	−0.158	0.001	−0.135
t8.33		(0.082)	(0.130)	(0.102)	(0.123)	(0.099)	(0.128)	(0.098)
t8.34	Female	0.016	0.095	−0.004	−0.073	0.105	−0.028	0.054
t8.35		(0.058)	(0.109)	(0.070)	(0.090)	(0.075)	(0.090)	(0.076)
t8.36	N	1,050	350	700	550	500	550	550

Notes: Cluster-robust standard errors are shown in parentheses. Sample sizes are rounded to the nearest 50 because this is required in the data use license.

Source: Early Child Longitudinal Study, Birth Cohort (ECLS-B).

^a Measured at, on average, age 10 months.

[†] $p < .10$; * $p < .05$; ** $p < .01$ (two-tailed tests)

birth weight differences between twins does not affect parent's responses to early ability. Net of child's birth weight, parents still display an overall reinforcing response to their children's differences in ability, and this response is still entirely driven by high-SES families. This finding further supports the claim that early ability and birth weight capture distinct dimensions of children's endowments.

Conclusion and Discussion

This analysis offers three main findings. First, parents provide more cognitive stimulation to the twin that shows higher levels of early ability. This finding is in line with results by some previous studies reporting reinforcing parental behavior (Aizer and Cunha 2012; Behrman et al. 1994; Datar et al. 2010; Frijsters et al. 2013; Rosales-Rueda 2014; Yi et al. 2015). It is also consistent with the intrafamily resource allocation model introduced by Becker and Tomes (1976), suggesting that parents reinforce human capital differences between their children but may compensate with direct nonhuman capital transfers later in life. Although this empirical finding is clear and consistent across alternative measures of cognitive ability, the interpretation is not conclusive. Parents may not be guided by the desire to reinforce ability differences but rather may find it easier, more pleasant, or more rewarding to interact with the child with higher ability. Further research including parental reports should help to clarify this point.

The focus of our analysis is on the socioeconomic heterogeneity in parental responses. The second finding speaks to this issue. We show that high-SES parents provide more cognitive stimulation to the higher-ability twin, whereas low-SES parents do not appear to respond to differences in their children's early skills by either compensating or reinforcing behavior. This finding is consistent across all measures of parental socioeconomic advantage (parental education, household income, and SES) and across two measures of children's early ability. This finding highlights the stratification of parental childrearing orientations. High-SES parents may be more likely to notice and scrutinize ability differences between their children (Lareau 2011). In any case, these results depart from previous studies based on sibling fixed-effects models, which report that lower-class parents reinforce birth weight differences by investing more in the child with higher birth weight whereas upper-class parents compensate by investing more in the child with lower birth weight (Hsin 2012; Restrepo 2016). In combination with prior research, our findings suggest that parents react differently to different types of child's endowments and that we cannot generalize results based on birth weight (Almond and Mazumder 2013).

The third finding from our study is that the additional cognitive stimulation that advantaged parents offer to their higher-ability twin does not widen differences in children's cognitive (or socioemotional) performance at age 4 or 5. The null association between parental support and children's later cognitive outcomes adds to a nascent body of research examining the causal effect of parental involvement on child outcomes. Although this finding is not conclusive because the null effect may be partly related to measurement error, it provides suggestive evidence that parental cognitive stimulation early in life does not widen inequality within families. Much survey research has studied the association between different dimensions of parental involvement and children's cognitive, behavioral, and emotional outcomes (El Nokali et al. 2010; Harris et al. 1998;

Kaushal et al. 2011; Milkie et al. 2015; Wang et al. 2014; Yeung et al. 2002), but virtually all these studies were cross-sectional and could not rule out confounding emerging from unobserved family- or pregnancy-specific factors. More conclusive evidence on the effects of cognitive stimulation and parental involvement during early childhood has recently emerged from randomized interventions that demonstrated positive short- and long-term effects (Attanasio et al. 2014; Gertler et al. 2014). These interventions are usually targeted to disadvantaged populations in developing nations, providing a blueprint for further analysis in the United States and other contexts that would add to evidence using twin fixed-effects models or other causal inference strategies to better account for unobserved heterogeneity.

Recent scholarship using child fixed-effects models to isolate the effect of children's time spent with mothers on their cognitive outcomes finds that educationally oriented time (but not total parental time) that children spend with their mother leads to higher test scores (Hsin and Felfe 2014). Our findings of a null effect of parental cognitive stimulation depart from the positive influence detected by Hsin and Felfe (2014). Different findings could be explained by differences in methodological approaches (twin fixed effects or child fixed effects), measures of parental involvement (parental cognitive stimulation or time spent with children), and ages at which the outcome is measured (early or late childhood). Diverging results highlight the need to expand this nascent body of research in order to understand when and which types of parental involvement benefit children's developmental outcomes, and whether these effects vary by SES.

Our findings suggest that a more sophisticated understanding of parental involvement may be needed, moving beyond an indistinct notion of "parental responses" given that parents may react differently to different types of child endowments. Research would also benefit from including diverse dimensions of involvement, including time spent with children, quality of time, cognitive stimulation, and investment in goods and educational materials.

We motivated this study by suggesting that parental responses may matter for the intergenerational transmission of advantage by inducing within-family inequality. What do our results imply for parental involvement as an underlying mechanism of intergenerational persistence? Because we do not find evidence that greater parental support to the higher-ability twin affects later cognitive outcomes, parental behavior—even if reinforcing in its allocation—is not found to be reinforcing in its consequences in this analysis. However, the main finding of this article remains that parental responses vary by SES and that advantaged families engage in reinforcing responses to differences in their children's cognitive skills, which in turn may affect children's educational achievement and attainment later in life. We hope that other studies will address this possibility, furthering a more comprehensive understanding of the stratification of parental responses and their consequences throughout the early life course.

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