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Determinants of noncognitive skills: Mediating effects of siblings' interaction and parenting quality

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Abstract

This paper sheds light on the formation process of noncognitive skills by examining the determinants of a host of personality traits. Using data from the National Survey of Midlife Development in the United States (MIDUS), for individuals in larger families (three or more children), we find having a same-sex sibling leads to improved long-run noncognitive skills and positive personality traits. The latter result is driven entirely by females. We examine potential mechanisms by exploring the links between parental investment and sibling interactions. The results could possibly speak to public actions to enhance child development and human capital accumulation.

KEYWORDS
noncognitive skills, parenting style, same-sex siblings, sibling interactions

JEL CLASSIFICATION
D31, J12, J13, J24, I12, I24

1 | INTRODUCTION

Cunha and Heckman's (2007) seminal research on the theory of the evolution of skills during childhood and adolescence sparked a broad inquiry in the economic literature on the determinants of noncognitive outcomes or socio-emotional skills (socio-emotional skills are defined as attitudes and knowledge "necessary to understand and manage emotions, set and achieve positive goals, establish and maintain positive relationships, and make responsible decisions" [Ajwad et al., 2014; Almlund et al., 2011]). Recent empirical studies have found that the family size, time allocation, and even the fall of the Berlin Wall are all predictors of a child's socio-emotional skills and behaviors (Fiorini & Keane, 2014; Gill & Kleinjans, 2020; Juhn et al., 2015).

This paper extends the rapidly growing literature on the formation of skills by analyzing the relationships between sibling sex composition and noncognitive skills and exploring various mediating sources for the observed effects. The contribution of the paper is threefold. First, to our knowledge, no previous research systematically analyzed the effect of

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Abbreviations: ARPA, American Rescue Plan Act of March 2021; CAA, Consolidated Appropriations Act passed in December 2020; CARES, Coronavirus Aid, Relief, and Economic Security Act of March 2020; ECLS-K, 1998–1999 Early Childhood Longitudinal Study administered by the National Center for Education Statistics; ESSER, Elementary and Secondary School Emergency Relief created under the CARES Act; H1, Hypothesis 1; H2, Hypothesis 2; MIDUS, National Survey of Midlife Development in the United States; MIDUS I, National Survey of Midlife Development in the United States, First Wave, conducted in 1995–1996; MIDUS II, National Survey of Midlife Development in the United States, Second Wave, administered in 2004–2006; OLS, Ordinary Least Squares; STEM, Science, Technology, Engineering, and Mathematics.

same-sex siblings on noncognitive outcomes for adults later in life in the United States. Our study is close in spirit to previous studies that used sibling sex composition to understand a host of outcomes. Cyron et al. (2017) used sibling sex composition as an identification strategy to analyze determinants of noncognitive traits, recognizing sibling sex composition of at least the two firstborn children are arguably exogenous. But that study used data limited just to children from kindergarten to eighth grade.

Another related study used a similar identification strategy to look at noncognitive personality traits, but it is based on sibling sex composition for adolescents 10–16 years old in Great Britain (Bart et al., 2020). Shahbazian (2021) analyzes the association between sibling gender configuration and STEM degree outcomes for the Danish population. An earlier study looked at sibling sex composition on women's education and earnings for men and women between 1920 and 1965 in the United States and found that gender composition affected educational attainment for women. Women with brothers received more education than women raised with only sister, controlling for family size (Butcher, 1994).

The existing literature establishes a clear relationship between sibling gender composition and cognitive outcomes such as education.[1] To the extent that relationships between gender composition of siblings and cognitive outcomes hold and the effects differ for males and females, sibling sex composition should also influence the formation of noncognitive skills, since these traits ultimately impact cognitive outcomes, such as education, earnings, and physical health. Furthermore, such sibling influence should be different for boys and girls in their noncognitive formation process, controlling for family size.

This study takes advantage of the rich data on socio-emotional skills and personality traits offered by the National Survey of Midlife Development in the United States (MIDUS), a nationally representative sample of adults 25–74 years old. It evaluates the long-run relationship between sibling sex composition and a host of noncognitive skill sets, namely *insight into past*, *foresight and anticipation*, *mastery*, *persistence*, *planning*, *positive reappraisals*, *self-sufficiency*, and *Big Five personality traits* (the Big Five personality traits include agreeableness, conscientiousness, emotional stability, extroversion, and openness to experience [Nyhus & Pons, 2012]).

Second, the paper extends our knowledge of the impact of parenting style. The economics literature contains limited research on the economics of parenting style in child development due to limited data availability. Fiorini and Keane (2014) is the first economic research documenting the link between parenting strategies and child's noncognitive skills. That study focuses on the short-run effect of maternal parenting inputs on children's noncognitive outcomes in Australia. This paper takes a more comprehensive approach, assessing the role of family size, sibling gender composition, and parenting styles (e.g., in discipling and being affectionate) on adults' long-term noncognitive outcomes.

Third, the paper takes advantage of data on sibling sex composition and the interplay of parental child-rearing strategies to identify relationships in the data. Under strict budget constraints, parental investment in a particular child's education could depend on the presence of a female sibling because the returns to education differ for men and women (Amin, 2009). In contrast, noncognitive development might be influenced by same-sex siblings, following cross-disciplinary research that points to sex segregation in various activities, including leisure and housework, as well as differential parental treatments based on children's sex composition (McHale et al., 1999).

Building on this research, we consider two main approaches to defining sibling sex composition. First, we distinguish between individuals who have one or more siblings of the same sex and those with siblings of the opposite sex. Second, we decompose the effect of having at least one same-sex sibling by separately comparing individuals with only same-sex siblings and mixed-sex compositions to those with opposite-sex siblings.

We find several notable results about the relationship between sibling sex composition and noncognitive outcomes. First, in small families, the sex composition of siblings does not significantly correspond to development of noncognitive skills. In large families, having same-sex siblings has a beneficial relationship to noncognitive skills, as shown by OLS and propensity score matching estimates. Same-sex siblings correspond to an increase in the index measuring socio-emotional skills and personality traits by 0.235 and 0.177 standard deviations, respectively. When we investigate gender heterogeneity, we find those positive results to be driven by the presence of female siblings.

Also, when we disaggregate the measures of socio-emotional skills by types of skills, we find those who grow up with same-sex siblings tend to be more *persistent*, are more likely to *plan their future*, and tend to *engage in positive reappraisal of adverse events*. After establishing a positive relationship between sibling sex composition and noncognitive outcomes, we investigate further the potential mediating forces. We find that growing up with at least

one same-sex sibling significantly reduces the probability of abuse by a sibling (as reported in the survey), suggesting that the quality of sibling interactions matters. We also find some evidence that fathers' disciplining of the oldest daughter in the family is a positive mediating source of the beneficial effect of same-sex siblings on noncognitive skills in large families.

We also identify areas of future research raised by our findings and highlight the potential policy relevance of this paper. Currently, the Covid-19 pandemic is putting additional pressure and stress on youth everywhere. In schools, educators, parents, and administrators are citing social and emotional well-being as major challenges facing students, with experts predicting that mental-health challenges will likely have a knock-on effect on academics going forward. This paper contributes to our understanding of possible sources of emotional stress for youth connected to family environment, which might prove beneficial to inform policies that address youth mental and noncognitive health.

2 | HYPOTHESES AND MEDIATING FORCES BASED ON EVIDENCE FROM RESEARCH

We posit two hypotheses, and discuss evidence from existing research supporting the hypotheses:

H1 *Children with same-sex siblings should have better personality traits and socio-emotional skills than those who have only opposite-sex siblings.*

H2 *The effect of having same-sex siblings on personality traits and socio-emotional skills is more likely to be observed in large families.*

2.1 | Family relationship and social influences

Regarding H1, we identify three main explanations based on evidence from research on why sibling sex composition might affect personality traits and socio-emotional skills, and what potential mediating channels exist. Same-sex siblings might have better noncognitive skills based on *reference group theory*, which suggests that having a sibling of a specific gender might result in different parental treatment, depending on the parents' reference group or who the parents compare their children with. Although traditionally associated with the sociology and psychology literature, there is a wide range of applications of *reference group theory* in economic research, based on the idea that economic agents perform social comparisons and derive utility or dis-utility from such comparisons. Reference group theory has been applied in research that looks at behavior for savings, consumption, labor supply, and fairness, among other behaviors (Falk & Knell, 2004; Kemper, 2016).

In this case, we assume that parents' child-rearing behavior is determined by the children's sex composition and the desire to equalize children's outcomes. The *reference group* for comparing a child's outcome is determined by the child's siblings' sex composition. To illustrate, consider two families, one with two boys and one girl and the other with one boy and two girls. In the first case, since there are two boys the parents will compare the boys' achievements. However, in the second case, the reference group for the only boy would be his sisters. Although some social psychologists might disagree, research in economics has assumed that people's standard of reference is exogenously given (is the same for everyone), resting on the idea that the social environment determines the reference/comparison standard for everyone (Fehr & Schmidt, 1999). We make a similar assumption when testing H1.

H1's presumption on same-sex siblings and noncognitive outcomes also has to do with the children-parent relationship. We assume that the sex composition of siblings might influence the relationship of children with parents, with same-sex siblings being more likely to have a concordant parental relationship (van Ijzendoorn et al., 2000). Given the similarity of attachment, same-sex siblings are more likely than opposite-sex siblings to socialize with their parents, which might result in better emotional skills. Whereas a child with no same-sex siblings might feel excluded and be negatively affected by the possible differential treatment from the parents, and therefore not socialize as much with the rest of the family, which might result in less lifetime emotional skills for that child.

In addition to the relationship between siblings' sex composition and noncognitive outcomes, which are mediated by *group reference* considerations and children-parents' relationship, as argued thus far, the literature highlights other

mediating parental factors in support of H1—notably, the role of children's sex configuration in parents' decision-making process regarding staying married or getting a divorce. Previous research shows that the probability of getting a divorce depends on the sex of a first-born in terms of a lower likelihood of divorce if the firstborn is a boy, perhaps due to a preference of fathers for sons (Dahl & Moretti, 2008).

Another connection comes from parental labor market participation decisions. Research suggests that a father's labor supply is possibly more responsive to a son's birth than to the birth of a daughter (Lundberg & Rose, 2002). Following this evidence, we expect marital status and labor market participation decisions are other parental factors that could mediate the effect of siblings' sex composition in H1.

Second, H1 is supported by evidence from both theoretical and empirical literature on *behavioral and social influences*. While these theories are rooted in psychology, some influential work in economics has considered peer group effects, with a focus on parent/sibling relationships (Akerlof, 1997; Bernheim, 1994; Hill et al., 2001). Empirical economic research has shown that siblings induce such destructive behaviors as smoking, drinking, and marijuana use (Altonji et al., 2017; Averett et al., 2011). The sex-identification of siblings is one key feature of the within-family socialization channel.

We expect that the family socialization and noncognitive development channel should be more pronounced with same-sex siblings if sex segregation in various activities, including leisure and housework exists, as research has argued (McHale et al., 1999). Given this research, we expect a child's interests, behaviors, and activities will be influenced by interactions with their siblings. Therefore, in testing H1, we expect *socialization* with brothers and sisters, measured in the data, to be a mediating indicator influencing the formation of noncognitive outcomes.

As a third justification for positing the hypothesis H1, we believe it is supported by previous literature on *behavioral and social influences* and *peer group effects* (Berndt, 1992; Furman & Buhrmester, 1992). We expect that the sibling sex composition will define one's peer experiences, because adolescents with opposite-sex siblings are more likely to seek out friends with closer sex-typed identification—that is, a boy with a sister might tend to form closer relationships with other boys. By the same token, a girl with a brother may value highly emotional intimacy with her other female friends. Sibling sex composition should affect the quality of relationships with peers.

For example, a girl who grows up with a sister may have a more emotionally intimate relationship with her friends. In contrast, a girl with brothers may be more likely to exhibit more masculine or tough behavior when interacting with peers (Updegraff et al., 2000). In testing H1, following these studies, to the extent that sibling sex assignments or categorization define the child's within-family socialization patterns and the quality of the relationship with peers, we expect that these everyday experiences would have long-term and pervasive developmental consequences, affecting noncognitive skills.

2.2 | Differences between small and large families

We turn now to providing the evidence in support of hypothesis H2 concerning the size of the family and noncognitive outcomes. Research suggests that both parental investments in children and sibling influences differ by family size. In small families, parents can more easily invest in their children to equalize children's outcomes, as these families may have more financial resources or human capital (Amin, 2009) (analysis of the MIDUS data reported in Appendix TableA.2 in Supporting Information S1 confirms differences in socio-economic characteristics, such as parental schooling and being on welfare, based on the size of the family or the number of siblings).

For large families, resource dilution may become an issue. Studies suggest that mothers who have more children are more likely to be less educated and with more significant difficulties achieving work-life balance. And insufficient time involvement with children may adversely affect child development (Hsin & Felfe, 2014). In sum, in large families, parents might be less able to equalize children's outcomes due to time and financial constraints or willingness.

Each additional sibling serves as an essential resource for a child to mitigate and possibly offset any harmful effects of inadequate parenting involvement and financial resources. Interactions with siblings promote social and interpersonal skills, which might curb behavior problems (Downey & Condron, 2004). In large families, children are more likely to have more siblings of the same sex who socialize better. To the extent this is true, sibling influences should be more pronounced in these large families.

However, a larger family size implies lower parental investment per child, while growing up with more same-sex siblings might yield more favorable outcomes. It is unclear which effect will dominate, making this an open research question.

3 | DATA

Data for this study come from both publicly available and restricted versions of the MIDUS, which provides "a groundbreaking assessment" of psychological factors and, in addition to the Big Five personality traits often included in the economic surveys, also offers information on a wide array of socio-emotional skills—namely, *mastery*, *persistence*, *planning*, *positive reappraisals*, *foresight and anticipation*, *insight into past*, and *self-sufficiency*. The survey investigates the psychological well-being and health outcomes in midlife, but it also includes, among other variables, educational attainment, employment history, total family earnings, marital status, and family structure.

The MacArthur Foundation Research Network on Successful Midlife Development conducted the MIDUS survey, a nationally representative survey of individuals aged 25–74, selected using random digit dialing. We use the data from the first wave, conducted in 1995–1996 (MIDUS I) to complete our primary analysis. Some previous studies have used the 1998–1999 Early Childhood Longitudinal Study ECLS-K administered by the National Center for Education Statistics (Cyron et al., 2017). That dataset also includes sibling sex composition measures and noncognitive outcomes.

MIDUS has several advantages over the ECLS-K. First, it covers 50 cohorts of individuals aged 25–74, while ECLS-K focuses only on one cohort—the kindergarten class of 1998–1999. Second, MIDUS grants a possibility to assess the long-term effects of sibling sex composition on noncognitive skills, and ECLS-K only allows estimation of the short-run effects because skills were assessed in childhood, and, due to the large sample attrition and associated selection bias, only the data collected in the first grade can be used. Finally, MIDUS includes a wide set of noncognitive skills (persistence, self-sufficiency, mastery, extroversion, conscientiousness, agreeableness, etc.), and ECLS-K reports only two outcomes (approaches to learning and self-control).

We utilize data from the second wave, administered in 2004–2006 (MIDUS II) to perform robustness checks. A total of 3487 respondents completed the telephone interview followed by self-administered questionnaires, with a response rate of 87%, or 3034 respondents.

The first wave of the survey, MIDUS I, contains a set of questions about their psychological traits. Following the literature, which distinguishes between socio-emotional skills and personality traits and emphasizes the differences between the two domains, we divide 53 Likert scale variables in the data into two groups and construct an *index of socio-emotional skills* and *an index of personality traits* (Ajwad et al., 2014). Each variable takes one of four values: 1, A lot; 2, Some; 3, A little; 4, Not at all. We have recoded the variables so that a higher value corresponds to a better outcome (Table in the Appendix A.3 in Supporting Information S1 illustrates the variation of the responses to the noncognitive skill questions, indicating that the index classifies many respondents as "a lot" and "some," but there is considerable variation in these variables).

Using 28 survey questions and applying an iterated principal component analysis, we created the *index of socio-emotional skills*, following Foley et al. (2014), which is standard to the literature. The index includes the following measures:

- *Foresight and anticipation*, reflecting a person's understanding of the consequences of their actions.
- *Insight into past*, showing one's ability to learn from past experiences and applying them in the present.
- *Mastery*, reflecting one's belief about the ability to reach goals.
- *Persistence*, measuring a person's ability to complete tasks and reach the set goals.
- *Planning*, showing to what extent a person is future-oriented and tends to plan their future.
- *Positive reappraisals*, showing one's ability to overcome difficulties and staying positive.
- *Self-sufficiency*, indicating the degree to which a person can deal with the problems on their own, rather than asking for help from others.

(Appendix TableA.4 in Supporting Information S1 reports the factor loadings for three factors with eigenvalues larger than one. In the empirical analysis, we utilize only factor 1, naming it the *index of socio-emotional skills*, because most of the factor loadings are large in this case, as shown in bold. Therefore, factor 1 is the best predictor of one's *foresight and anticipation*, *insight into the past*, *mastery*, *persistence*, *planning*, *and positive reappraisals*).

The presence of same-sex siblings raises the possibility of several skill sets and enhances the quality of the child's within-family socialization with siblings and parents (McHale et al., 1999; van Ijzendoorn et al., 2000). As a result, these children should be more likely to grow up in a loving and supportive environment that can establish the foundation for *developing a positive mindset*, *enhancing self-confidence*, and improving *the ability to reach goals*. Therefore, we expect

that the same-sex siblings will affect the following three skills with the highest factor loadings (reported in Table A.4 in Supporting Information S1), and all other noncognitive skills: (a) *I do what I can do to make things better*; (b) *When I encounter problems, I don't give up until I solve them*; and (c) *I can usually find a bright side to the situation*.

(Table A.5 in Supporting Information S1 presents the factor loadings from a principal component analysis based on 25 survey questions about Big Five personality traits). Given that all factor loadings (except five of them) are the largest for factor 1, we use it as an *index of personality traits* that reflect one's *agreeableness, conscientiousness, extroversion, and openness to experience*. We standardize the two indexes to have a mean of zero with unit variance. (Following Rubin [1996], to preserve observations, we input missing values for 1 out of 53 variables, which is an average number of imputed values for a given variable of about 15, or 0.5%. The results are robust to using a subsample with no imputation as well.)

The survey asks the respondents to provide information about the number of older and younger/same-aged brothers/sisters. From their answers, we create three dichotomous sibling sex composition variables, *any same-sex siblings, only same-sex siblings*, and *mixed-sex siblings*, and two continuous variables, *number of same-sex siblings* and *percentage of same-sex siblings*. The *any same-sex siblings* variable takes the value one if a respondent has at least one sibling of the same sex and zero otherwise. Individuals who have same-sex siblings could either have all siblings of their sex (*only same-sex siblings* = 1) or have brothers and sisters (*mixed-sex siblings* = 1).

Table 1 shows the summary statistics for different classifications of sibling sex composition by family size and gender. On average, 80% of respondents have at least one sibling of the same sex, and this share increases from 62% for a small family with up to two siblings to 94% for a large family with three or more siblings. One out of eight individuals have all siblings of the same sex (*only same-sex siblings* = 1), and approximately three-fourths have both brothers and sisters (*mixed-sex siblings* = 1). Also, on average, each respondent has 1.71 siblings or 35% of same-sex siblings (Table A.6 in Supporting Information S1 shows the distribution of individuals by the number of siblings). These sample statistics are quite similar for males and females.

In addition to rich information on socio-emotional skills and sibling sex composition, MIDUS1 also includes a series of questions focusing on outcomes in childhood, which we also explore. The dataset contains information about physical and verbal abuse inflicted by parents, the amount of affection received from parents in childhood, and the rules imposed by each parent. Using parental input items, we construct indicators for parental affection, parental abuse, and parental discipline. We use principal component analysis to construct these indices (the results of the principal components are not in the paper but are available upon request). In addition, to examine the role of siblings and peers in child development, we create an indicator for abuse by a sibling and an indicator for abuse by a peer.

4 | EMPIRICAL FRAMEWORK

We estimate a reduced-form empirical model of the relationship between sibling sex composition and noncognitive traits. The basic model explains noncognitive outcomes for persons i with the following equation:

TABLE 1 Summary statistics for sibling sex composition variables

	All			Males			Females		
Panel A	**1+ siblings**	**1–2 siblings**	**3+ siblings**	**1+ siblings**	**1–2 siblings**	**3+ siblings**	**1+ siblings**	**1-2 siblings**	**3+ siblings**
Any same-sex sibling	0.80	0.62	0.94	0.80	0.63	0.95	0.79	0.61	0.92
Number of same-sex siblings	1.71	0.76	2.46	1.71	0.78	2.50	1.70	0.74	2.42
Percentage of same-sex siblings	35.44	29.18	40.42	36.42	30.24	41.66	34.53	28.13	39.33
Panel B	**2+ siblings**	**2 siblings**	**3+ siblings**	**2+ siblings**	**2 siblings**	**3+ siblings**	**2+ siblings**	**2 siblings**	**3+ siblings**
Only same-sex siblings	0.12	0.27	0.06	0.13	0.29	0.07	0.11	0.24	0.06
Mixed-sex composition of siblings	0.76	0.48	0.87	0.75	0.46	0.88	0.76	0.50	0.87

Source: MIDUS I.

$$\text{Outcome}_i = \alpha + \beta \left[\text{Any same-sex sibling}\right]_i + X_i\theta + e_i, \tag{1}$$

where Outcome is one of the measures of noncognitive traits for individual i. A dummy variable *Any same-sex sibling* indicates whether a person has at least one sibling of the same sex and is the variable of interest. Essentially, the idea is to compare outcomes for two groups of individuals: Those who have at least one sibling of the same sex and those with all siblings of the opposite sex.

The vector X contains controls for age (dummies for four age categories: 36–45 years old, 46–55, 56–65, 66–75), sex (an indicator for a female respondent), birth order (dummies for a second, third, fourth, fifth, and sixth or higher birth order), number of siblings, and number of siblings squared. Unfortunately, we cannot control for the age gap between siblings because the MIDUS does not include information about this aspect of sibship. However, according to Downey and Condron (2004), there is no association between sibling spacing and the formation of skills, in particular social skills.

The error term represents unobserved child-specific characteristics assumed to be uncorrelated with the measure of sibling sex composition. We estimate model (1) with ordinary least squares (OLS) using heteroscedasticity-robust standard errors. The coefficient β captures the effect of sibling sex configuration on noncognitive traits.

Given that parenting practices and sibling socialization patterns may differ between individuals with only same-sex siblings and those with a mixed-sex sibling configuration, we decompose the effect of having any same-sex sibling. The following specification is non-parametric because it allows an effect to differ by type of sibship:

$$\text{Outcome}_i = \alpha + \delta[\text{Only same-sex siblings}]_i + \gamma[\text{Mixed-sex siblings}]_i + X_i\theta + e_i, \tag{2}$$

where Only same-sex siblings equals one if a boy has only brothers and a girl has only sisters and zero otherwise; Mixed-sex siblings equals one if an individual i has brothers and sisters and zero otherwise. As before, the comparison group consists of people who have only *opposite-sex siblings*. By estimating Equation (2), we can distinguish between individuals with only same-sex siblings and those who have siblings of both sexes. The within-family variation in the Mixed-sex siblings variable is possible only for the respondents with at least two siblings (three children in total). Therefore, we estimate Equation (2) just for these types of respondents.

Parents could choose the sex configuration of their children in selective abortion due to a preference for having a son. However, in the US, such practices are not the norm. Therefore, we follow the approach in the literature and treat sibling sex composition as exogenous for any given family size (Amin, 2009). Therefore, we use OLS to estimate the unobservable model parameters. We also follow the literature by carrying out the analysis separately for small families, those with one or two siblings, and large families, those with at least three siblings. This provides enough variation in sibling sex composition. For example, in a family of four, birth order differs for each child, but the sibling sex distribution might be the same for all or several children. As a robustness check, we estimate separate models for children with one, two, three, and four siblings, reaching the same conclusion. Results not reported but available upon request.

5 | RESULTS

5.1 | Effects on noncognitive skills

Table 2 presents the estimates of Equation (1) using the *index of personality traits* and the *index of socio-emotional skills* as dependent variables. A crucial result in Table 2 is that combining all respondents masks divergent effects for different-sized families. In Columns 1 and 4, which report the estimates for all individuals together, there is no significant relationship between the sex composition of one's siblings and noncognitive traits. In Columns 2 and 5, having same-sex siblings has an insignificant effect on noncognitive skills for individuals who grew up in small families.

It is worth noting that we have taken advantage of the longitudinal nature of the data to assess the stability of noncognitive skills in adulthood. More specifically, we estimate the following model:

$$\text{Outcome}_{it} = \alpha + \eta \text{MIDUS\_II}_t + \gamma_i + e_{it},$$

where i indexes the individual and t indexes the survey wave. The dependent variable is an *index of socio-emotional skills*, MIDUS_II_t is an indicator for the second wave of the survey, and γ_i represents individual fixed effects. We

TABLE 2 Effect of sibling sex composition on socio-emotional skills and personality traits

	Index of socio-emotional skills			Index of personality traits		
	All respondents, 1+ siblings	Respondent has 1 or 2 siblings	Respondent has 3+ siblings	All respondents, 1+ siblings	Respondent has 1 or 2 siblings	Respondent has 3+ siblings
Any same-sex sibling	0.017	−0.045	0.235**	0.046	0.005	0.177**
	(0.049)	(0.059)	(0.095)	(0.050)	(0.060)	(0.090)
Second-born child	−0.130***	−0.163***	−0.083	−0.065	−0.120**	0.031
	(0.047)	(0.059)	(0.080)	(0.046)	(0.059)	(0.074)
Third-born child	−0.207***	−0.313***	−0.104	−0.130**	−0.195**	−0.049
	(0.055)	(0.085)	(0.076)	(0.057)	(0.092)	(0.074)
Fourth-born child	−0.113		−0.058	−0.124		−0.076
	(0.072)		(0.080)	(0.071)		(0.078)
Fifth-born child	−0.197**		−0.157*	−0.225***		−0.177**
	(0.083)		(0.090)	(0.083)		(0.089)
Sixth-born or higher	−0.124		−0.083	−0.162		−0.107
	(0.087)		(0.095)	(0.087)		(0.094)
Female	−0.109***	−0.055	−0.145***	0.171***	0.274***	0.091
	(0.036)	(0.054)	(0.048)	(0.036)	(0.055)	(0.048)
36–45 years old	−0.092	−0.159**	−0.027	−0.180***	−0.195**	−0.156**
	(0.053)	(0.079)	(0.072)	(0.052)	(0.077)	(0.071)
46–55 years old	0.101	0.019	0.179**	−0.062	−0.114	−0.009
	(0.053)	(0.075)	(0.075)	(0.054)	(0.080)	(0.072)
56–65 years old	0.042	−0.121	0.176**	−0.051	−0.187**	0.061
	(0.056)	(0.083)	(0.076)	(0.054)	(0.080)	(0.073)
66–75 years old	−0.018	−0.122	0.068	−0.067	−0.183	0.028
	(0.066)	(0.102)	(0.089)	(0.066)	(0.102)	(0.087)
Number of siblings	0.025	0.023	0.029	0.022	−0.005	−0.011
	(0.029)	(0.061)	(0.052)	(0.031)	(0.062)	(0.055)
Number of siblings squared	−0.000		−0.001	−0.000		0.001
	(0.002)		(0.003)	(0.002)		(0.003)
Constant	0.057	0.180	−0.251	−0.046	0.072	−0.098
	(0.083)	(0.157)	(0.203)	(0.085)	(0.159)	(0.202)
Observations	2805	1244	1561	2818	1248	1570

Note: Each column reports the results of a separate model. Standard errors in parentheses.

***, ** indicate significance at the 1% and 5% levels, respectively.

find no empirical evidence that the noncognitive outcomes differ between the two waves of MIDUS that were administered 10 years apart. Not reported in a table, however, is that the coefficient on MIDUS_II is small in magnitude and statistically insignificant; it is equal to 0.022 and has a standard error of 0.021. This finding supports the notion that noncognitive skills are malleable in childhood and adolescence but are unlikely to change in adulthood. This statement also holds for the subsample of female respondents whose siblings are all male.

Turning back to Table 2, we observe the opposite effect for individuals who are members of large families. In such a case (Table 2, Columns 3 and 6), spending childhood with at least one sibling of the same sex has a beneficial impact on noncognitive traits. The point estimates in Columns 3 and 6 are large in magnitude. They imply that having at least one

sibling of the same sex improves socio-emotional skills by 0.235 standard deviations and personality traits by 0.177 standard deviations.

The coefficients on the demographic controls presented in Table 2 suggest that the noncognitive skills do not differ by age or family size but correlate with one's gender and the birth order. Although Conley (2000) evaluates the effects of sibling sex composition on a different outcome, education, our findings are consistent with this study. Conley (2000) shows that having same-sex siblings creates a competitive environment and subsequently leads to better outcomes, while coming from an opposite-sex sibling dyad is linked to lower achievement.

The main findings rest on comparing the outcomes of the respondents with *any same-sex sibling* and respondents with *only the opposite-sex siblings*, which raises the question of the similarity of the two subgroups. (In Table A.7 in Supporting Information S1, we show that sex composition is balanced on socio-economic and demographic characteristics. That is, within a given family size, the two subgroups are not statistically significantly different in terms of these factors.) This result suggests that we might reasonably isolate the independent influence of sibling sex composition on noncognitive skills.

As argued, while having only opposite-sex siblings might be less advantageous, the presence of at least one sibling of the opposite sex could facilitate one's development of social skills. Being a member of a mixed-sex configuration and having brothers and sisters may provide unique opportunities to experience sex-typed relationships in early childhood, to share sex-specific behavioral patterns, and to learn how to resolve conflict with an opposite-sex peer. To test this hypothesis, we decompose the effect of having *same-sex siblings* and present the results from estimating Equation (2) in Table 3.

Returning to Table 3, the sibling-sex-composition variables are not significant for noncognitive outcomes for respondents from small families. Still, the estimated effects of *only same-sex siblings* and *mixed-sex siblings* composition variables are highly significant for members of large families. Since the omitted category has all siblings of the opposite sex, these findings suggest that exposure to *only opposite-sex siblings* has a less beneficial impact on socio-emotional traits. Further analyses reveal that the implication of having only same-sex siblings and the influence of having siblings of both sexes are not statistically distinguishable from each other. In the analysis that follows we will focus on the large families, due to the absence of association between the child's type of sibship and noncognitive outcomes in the small families.

In Table 4, we use two continuous measures of sibling sex configuration—the *number of same-sex siblings* and the *percentage of same-sex siblings*. The results are consistent with Tables 2 and 3 and provide further reassurance of the strong influence of same-sex siblings in large families.

We also investigate the heterogeneity of the effect of sibling sex composition on the *index of socio-emotional skills* by gender. Interestingly, females drive the results. As shown in the Table A.8 in Supporting Information S1, growing up in

TABLE 3 Decomposition of the effect of having any same-sex sibling

	All respondents, 2+ siblings (1)	Respondent has 2 siblings (2)	Respondent has 3+ siblings (3)
Panel A: *Index of socio-emotional skills*			
Only same-sex siblings	−0.009	−0.167	0.270**
	(0.083)	(0.106)	(0.133)
Mixed-sex composition of siblings	0.096	0.019	0.230**
	(0.067)	(0.093)	(0.095)
Observations	2216	655	1561
Panel B: *Index of personality traits*			
Only same-sex siblings	0.130	0.072	0.236
	(0.082)	(0.108)	(0.123)
Mixed-sex composition of siblings	0.112	0.054	0.170
	(0.068)	(0.097)	(0.091)
Observations	2229	659	1570

Note: Each column within each panel reports the results of a separate model that also controls for respondent's age, gender, birth order, number of siblings, and number of siblings squared. Standard errors in parentheses.

** indicates significance at 5% level.

TABLE 4 Effect of sibling sex composition on socio-emotional skills and personality traits, using continuous measures of sibling sex composition

	(1)
Panel A: Index of socio-emotional skills	
Percentage of same-sex siblings	0.002**
	(0.001)
Observations	1561
Panel B: Index of socio-emotional skills	
Number of same-sex siblings	0.042**
	(0.020)
Observations	1561
Panel C: Index of personality traits	
Percentage of same-sex siblings	0.002**
	(0.001)
Observations	1570
Panel D: Index of personality traits	
Number of same-sex siblings	0.039**
	(0.020)
Observations	1570

Note: Each model that controls for respondent's age, gender, birth order, number of siblings, and number of siblings squared. Sample includes only those respondents who have at least three siblings. Standard errors in parentheses.

** indicates significance at 5% level.

a large family with at least one sister is beneficial for females' socio-emotional skill development, whereas the point estimates for males are not statistically significant. This finding indicates that the observed effect manifests itself among those females in large families who have at least one sibling of the same sex. Since 92% of women in large families have at least one same-sex sibling and about one-third of the respondents grew up in large families, this effect applies to a relatively large share of the sample.

Finally, Table 5 breaks down the indices of socio-emotional skills and personality traits by their components. The results further confirm that in large families, having same-sex siblings corresponds with the individuals having *higher persistence*, *planning*, and *positive reappraisals* scores.

5.2 | Robustness checks

In Table 6, we present results from several robustness checks. First, we augment model (1) with additional proprietary controls—state identifiers.[2] We also add an indicator variable identifying families on welfare when a respondent was a child, an indicator for mother's labor force participation, and an indicator for parental divorce or separation. Results in Table 6 Panel A reveal that these factors have a negligible effect on the baseline findings, further confirming the exogeneity of the sibling sex configuration.

In the next two panels, we investigate the robustness of the results using a second wave of the survey, MIDUS II[3] (Table 6 Panel B), and the non-imputed sample (Table 6 Panel C). All the estimates provide extra support for the baseline findings. Finally, replacing the continuous number of sibling variables with the dummies (Table 6 Panel D) or including indicators for being the middle child and the youngest child rather than the birth order dummies (Table 6 Panel E) does not alter our conclusions.

TABLE 5 Effect of same-sex siblings on individual measures of noncognitive traits

Dependent variable	(1)
Panel A: Individual socio-emotional skills	
Foresight and anticipation	−0.019
	(0.092)
Insight into past	0.163
	(0.090)
Mastery	0.109
	(0.080)
Persistence	0.182**
	(0.089)
Positive reappraisals	0.187**
	(0.093)
Planning	0.188**
	(0.093)
Self sufficiency	0.076
	(0.089)
Observations	1561
Panel B: Individual personality traits	
Agreeableness	0.142
	(0.083)
Conscientiousness	0.052
	(0.081)
Emotional stability	0.069
	(0.091)
Extroversion	0.075
	(0.100)
Openness to experience	0.169
	(0.087)
Observations	1570

Note: In all models, any same-sex sibling variable is used as a measure of siblings sex composition. Each cell reports the results of a separate model that also controls for respondent's age, gender, birth order, number of siblings, and number of siblings squared. Sample includes only those respondents who have at least three siblings. Standard errors in parentheses.

** indicates significance at 5% level.

5.3 | Potential mechanisms

We now turn our attention to testing whether the observed relationship between socio-economic outcomes and sibling gender composition is due to differences in child-rearing strategies, sibling interactions, or peer influences. As argued, parenting practices might differ, intentionally or unintentionally, depending on the sex composition of the child's siblings; however, it is ambiguous whether parents' behavior is driven by reinforcing or compensatory motive. Differential treatment by parents may lead to rivalry, hostility, and low self-esteem for those children who experience a

TABLE 6 Robustness checks

	(1)
Panel A: *Additional controls*	
Any same-sex sibling	0.231**
	(0.096)
Observations	1562
Panel B: *MIDUS II sample*	
Any same-sex sibling	0.303**
	(0.148)
Observations	854
Panel C: *Non-imputed sample*	
Any same-sex sibling	0.228**
	(0.102)
Observations	1432
Panel D: *Using dummies variables for the number of siblings*	
Any same-sex sibling	0.239**
	(0.095)
Observations	1561
Panel E: *Replacing birth order dummies with the indicators for being the middle child and the youngest child*	
Any same-sex sibling	0.224**
	(0.095)
Observations	1561

Note: In all models, the dependent variable is an index of socio-emotional skills. In addition to the controls included in the baseline model (1), regressions in Panel A also account for the family being on welfare, the respondent's state of residence, mother's labor force participation, and parental divorce or separation. Models in Panels B and C control for respondent's age, gender, birth order, number of siblings, and number of siblings squared. In Panel D, we replaced the two continuous variables, number of siblings and number of siblings squared, with the dummies for the number of siblings; all other controls are same as in Table 2. In Panel E, we replaced the dummies for the birth order with the indicators for being the middle and the youngest child; all other controls are same as in Table 2. Standard errors in parentheses.

** indicates significance at 5% level.

deficit of parental attention; by contrast, other children will be more likely to develop positive psychological and behavioral traits.

We start with testing whether child-rearing strategies depend on the sex composition of children by estimating model (1) with one of the nonmonetary parental inputs as a dependent variable. These include *maternal and paternal affection*, *maternal and paternal abuse*, *and maternal and paternal discipline*. It is worth noting in constructing these parental input variables that we were concerned since we use retrospective information that the estimates might suffer from recall bias.

To shed light on this issue, we exploit data reported in both MIDUS I and MIDUS II. We created an indicator identifying individuals giving the same answer to the questions about smoking and drinking alcohol in adolescence in both waves and estimate model (1) using this indicator as a dependent variable (as shown in Table A.9 in Supporting Information S1, all point estimates on the sibling sex composition variable are close to zero in magnitude and statistically insignificant; therefore, it is unlikely that using the retrospective information will bias the results).

From Panel A of Table 7, we do not generally see a link between sibling sex configuration and parenting practices, a result that consistent with previous empirical results on the allocation of parental emotional resources (Frijters et al., 2013).

T A B L E 7   Potential mechanisms

Dependent variable	(1)
Panel A: *Parental inputs*	
Paternal affection	−0.013
	(0.099)
Paternal abuse	−0.135
	(0.101)
Paternal discipline	0.298***
	(0.106)
Maternal affection	−0.021
	(0.103)
Maternal abuse	0.028
	(0.100)
Maternal discipline	0.087
	(0.099)
Panel B: *Sibling interactions*	
Abused by a sibling	−0.634***
	(0.069)
Panel C: *Peer influences*	
Abused by a peer	−0.060
	(0.099)

Note: In all models, any same-sex sibling variable is used as a measure of sibling sex composition. Each cell reports the results of a separate model that also controls for respondent's age, gender, birth order, number of siblings, and number of siblings squared. Sample includes only those respondents who have at least three siblings. Standard errors in parentheses.

*** indicates significance at 1% level.

We do see one exception, however, in the case of *paternal discipline*. A child from a large family is more likely to be disciplined by a father if they have at least one same-sex sibling. This suggests that if fathers impose stricter rules, their children might grow up with more non-cognitive socio-emotional skills (further analysis, not reported here, suggests that in large families, the first-born is more likely to be disciplined by a father than the youngest child).

Next, in Panel B, we assess whether sibling sex composition correlates with the quality of sibling interactions, approximated by a probability of *being abused by a brother or sister*. Estimates in Panel B of Table 7 show that growing up with same-sex siblings significantly reduces the likelihood of being *physically and/or emotionally abused* by a same-sex sibling. Therefore, the direct sibling influences mediate the impact of sibling sex composition on the formation of socio-emotional skills.

Finally, in Panel C, we test whether peer influences are another mechanism of the effect, by estimating the model (1) with the probability of being abused by a peer as a dependent variable. Results displayed in Panel C of Table 7 indicate no relationship between the sibling sex composition and the probability of abuse by a peer.

5.4 | Propensity score matching

While it is generally accepted that sex composition of siblings is exogenous, arguably family size may be endogenous. A remaining concern is whether correlation of sibling sex composition with family size could lead to biased inferences. The sibling sex composition and the family size will be correlated if parents prefer to have at least one child of each

gender. To the extent this is the case, the correlation between these two variables may result in selection bias. As a result, one risks attributing the effect of the type of sibship only to siblings, while it could be due to factors correlated with the family size.

To mitigate this concern, we carried out the analysis separately for small families, those with one or two siblings, and large families, those with at least three siblings, consistent with the strategy used in previous research as mentioned. In dealing with endogeneity, an Instrumental Variable technique would of course have been preferable, but to our knowledge none of the previous papers that look at sibling sex composition has found an adequate instrument.

To ensure that our classification approach addresses the possible endogeneity of family size, as well as to investigate potential selection bias that might affect our results, we use a propensity score matching method that helps reduce the effects of confounding factors (Austin, 2011). We perform the propensity score matching analysis by matching the respondents with at least *one same-sex sibling* (our *treated* group) to those *with no same-sex siblings* (our *control* group) on a broad set of observable socioeconomic and demographic covariates.

The technique allows us to compare for a *treated* group (respondents with *same-sex siblings*) the extent to which they are inherently different or similar with family in a *control* group (respondents with no *same-sex siblings*), controlling for key socioeconomic and demographic characteristics that are related to family size. If the two sets of respondents in the *treated* group and the *control* group are different in ways that we do not account for, then our results might reflect the interference of confounding variables, instead of our independent variable of interest—the impact of the *same-sex siblings*.

(The *balancing test* results are presented in the Table A.10 in Supporting Information S1). For the choice of covariates, we omit the number of siblings variable and the birth-order dummies from the set of characteristics because our goal is to match individuals with similar demographic and socio-economic characteristics, independently of family size and birth order. The results show that for each strata of respondents that has the same propensity score, there are no systematic differences in the distribution of baseline covariates between *treated* and *control* groups after we perform the propensity score matching. The results of the balancing test suggest that our propensity score is correctly specified. As can be seen again in Table A.10 in Supporting Information S1 after matching, the difference in means between the *treated* and *control* groups is statistically insignificant in all panels, confirming that the matching process was successful.

In the full sample (1+ siblings) in Panel A, before matching, the *treated* individuals (those with at least one *same sex siblings*) have lower educational attainments and are more likely to grow up in a divorced family or family with a lower socio-economic status than the control group. In Panel B, which focuses on the respondents with at least two siblings, before matching the *treated* and *control* groups differ on two characteristics at the 5% significance level, the education of the father and whether they grew up in poverty. OLS would not be appropriate in the case of small families because of possible confounding socioeconomic variables impacting both family size and sibling sex composition.

In Panel C, which examines the respondents from large families (3+ siblings), before matching the *treated* individuals are more likely to be female but are the same as the controls in terms of demographic characteristics, educational attainment, and socio-economic status in childhood. As such, because in large families, sibling sex composition does not correlate with the observed key characteristics of one's family, we rule out the selection bias concerns and suggest that the OLS technique produced unbiased estimates.

Using the matched sample and the extended set of controls listed in Table A.10 in Supporting Information S1, we re-estimate Equation (1) with the *index of socio-emotional skills* as a dependent variable and report the results in Table A.11 in Supporting Information S1. While the effect of sibling sex composition is small and statistically insignificant in the full sample in Column 1, the respondents from large families benefit from having at least one sibling of the same sex in the third Column.[4] In sum, the propensity score estimates in Table A.11 in Supporting Information S1 are in line with the findings from the main OLS regressions presented in Table 2.

6 | CONCLUSIONS

We investigate the impact of having at least one same-gender sibling on long-run noncognitive skills and personality traits. We use OLS based on our key assumption that the gender of siblings is exogenous, conditional on family size and birth order. In small families we find no effect while in large families with same-sex siblings we find improved long-run skills and traits. The latter result is driven entirely by the presence of female siblings. We examine potential mechanisms by exploring the links between having a same-sex sibling and parental investment and sibling interactions.

Recent evidence underscores the importance of noncognitive skills for both short- and long-run outcomes. Noncognitive skills have important implications for a host of life-time outcomes. For example, there is convincing

evidence that the Big Five personality traits affect labor market outcomes, health, and educational attainment (Nyhus & Pons, 2012). More conscientious individuals exhibit higher productivity (Cubel et al., 2016), extroversion correlates positively with earnings (Fletcher, 2013), and emotional stability correlates negatively with the duration of unemployment (Uysal & Pohlmeier, 2011).

Lack of persistence and social skills leads to lower earnings and a higher likelihood of being unemployed (Almlund et al., 2011; Lindqvist & Vestman, 2011). People with well-developed self-efficacy and future orientation tend to make better health-related choices (Chiteji, 2010), and those with higher self-esteem in adolescence end up with better health outcomes in adulthood (Kaestner & Callison, 2011). We calculated what our estimates could imply in terms of individual income based on previous research findings.

Fletcher (2013) found that one standard deviation increase in *extroversion* raises earnings by 5.3% and one standard deviation in *openness to experience* by 2.6%. If we relate the findings in this paper to Fletcher's, although statistically insignificant for these specific traits in our paper, the results imply that growing up in a large family with at least one same-sex sibling increases earnings through the improvement in *extroversion* by 5.3*0.075 = 0.40% and through the improvement in the *openness to experience* by 2.6*0.169 = 0.44%.

Given the fact that noncognitive skills are so meaningful for real outcomes with potential benefits for society and upward mobility of people, it makes sense to understand the determinants or formation process of these traits. To date, much less is known about the formation of these skills in the economics literature. The current paper contributes to the literature by looking at some previously unexplored features of the household to identify sources of noncognitive formation and development.

We use the MIDUS dataset, which includes a rich set of family inputs, including information on parental affection, discipline, and abuse by siblings. That data included a key information on the gender constellation of siblings and some indicators of the quality of sibling interactions, including support and conflict. Still, these concepts remain hard to measure and quantify. Our study, therefore, represents only an important first step. The analysis in this paper suggests the importance of further research to investigate whether our results are affected by unobserved heterogeneity. Future research based on data with more specific measures of parental interventions, family socialization patterns, and relationships between family members may be necessary to understand better the link between sibling sex composition, parenting, and the development of noncognitive traits.

Even so, a few important conclusions can be drawn from the findings. One key result is that there is a significant effect of same-sex siblings for individual members of larger families; for them, growing up with same-sex siblings has a beneficial impact on noncognitive traits. This result is robust to several additional tests and specifications. In those families, childhood exposure to at least one same-sex sibling has a beneficial impact on specific traits, namely *persistence*, *planning*, and *positive reappraisals*. Additional analyses suggest gender heterogeneity in the *same-sex siblings* effects—the results hold for females, but are not significant for males.

We test whether the observed relationship between socio-economic traits outcomes and sibling gender composition is mediated through or due to differences in child-rearing parenting strategies, sibling interactions, or peer influences. Generally, we find no link between sibling sex configuration and parenting factors such as affection or abuse. One exception relates to discipline by fathers. We find that a (first) child from a large family with a same-sex sibling is more likely to be disciplined by a father. Simply stated, this result signals that if fathers of large families (all girls) impose stricter rules, the children might grow up with healthier socio-emotional skills.

Finally, we find evidence of the mediating effect of sibling interactions in large families. Growing up with same-sex siblings significantly reduces the likelihood of being physically and/or emotionally abused by a sibling. Hence, the quality of sibling interactions matters in the formation of socio-emotional skills.

Arguably, the results could possibly speak to public actions, efforts, or initiatives that seek to enhance child development though intermediation or guidance over sibling relationship. This might mean that such programs should also be mindful of supporting the socioemotional health of children and mitigating conditions in families that might create isolation or be emotionally abusive on children, assuming that parents are not able to stop siblings' abusive behavior. This might mean an affordable teenage counseling program that also includes parental inputs with all the siblings involved.

The impact of the presence of fathers in families imposing high-quality discipline that shapes the characters of daughters appears to be a one factor explaining the formation of good socio-emotional skills. One important step, not fully explored here, is to investigate the role played by the full socioeconomic and demographic characteristics of households, beyond family size, in which fathers may have more difficulties in exercising effective discipline on their daughters. The father's presence and ability to exercise effective discipline could possibly be associated with factors like

poverty or low educational attainment. Our propensity score results using an untreated sample hints at the possibility that these conditions could potentially be sources of concern in small families.

The result that sex differences interact with noncognitive skill formation to define potential outcomes, especially for women, also suggests that policy efforts should be developed to redress or preempt gender asymmetric outcomes. Although it is important to note that while our findings find mediating effects though same-sex siblings, it is possible that as gender roles are changing for the current generation, alternative mechanisms related to expectations and comparisons may no longer be in play in the future. This remains to be seen.

Finally, at the time of writing, the ongoing Covid-19 pandemic heightens the importance of mental health for the overall well-being of individuals. The social impacts of the pandemic put additional pressure and stress on youth everywhere. In schools, educators, parents, and administrators have cited social and emotional well-being as major challenges facing students with experts predicting that mental-health challenges will likely have a knock-on effect on academics going forward (McKinsey & Company, 2021).

In response to pandemic disruptions, three federal stimulus bills passed in 2020 and 2021 have directed unprecedented funding to support recovery for students and youth. The passage of the Consolidated Appropriations Act (CAA) in December 2020, the Coronavirus Aid, Relief, and Economic Security (CARES) Act of March 2020, and the American Rescue Plan Act (ARPA) of March 2021, appropriated more than $190 billion to the Elementary and Secondary School Emergency Relief (ESSER) fund (created under the CARES Act), which allocates money to states for direct aid to public school districts and independent charter schools. Plans submitted by state education agencies on how to use the money shows that programs to address mental health are among the top priorities moving forward (Newberger & Toussaint-Comeau, 2022).

To the extent that family circumstances and sibling interactions might be a source of stress, especially in confined environments for large families during a pandemic, our results (though not for this recent timeframe) still might be relevant for policymakers seeking to develop programs or initiatives that address mental and noncognitive health of youth. The results suggest that these interventions should also look into the within-family context of interactions and particular circumstances.

ENDNOTES

[1] We test our data to see if there is a correlation between gender composition and education and other outcomes, as in previous research. The Appendix TableA.1 in Supporting Information S1 confirms a relationship based on reduced-form regressions, consistent with a more recent previous study that uses the same data set as in this paper (Bhai, 2016).

[2] The data on geographic identifiers are restricted, and we use it with permission from the Institute on Aging at the University of Wisconsin-Madison.

[3] MIDUS II does not include the seven socio-emotional skill variables present in MIDUS I. Therefore, the *index of socio-emotional skills*, used as a dependent variable in panel B of Table 6, is based only on 21 survey questions, as opposed to 28 questions in MIDUS I.

[4] Notice that the propensity score estimates in Column 2 of Table A.11 in Supporting Information S1 are not comparable with the OLS estimates in Column 2 of Table 2, which is based on respondents with only 1 or 2 siblings, because of matching using the socio-economic characteristics of the family rather than family size. For this reason, the subsample in Column 2 of Table A.11 in Supporting Information S1 consists of the respondents with at least two siblings.

REFERENCES

Ajwad, M.I.S.H., Abdulloev, I., Audy, R., de Laat, J., Kataoka, S., Larrison, J., et al. (2014) *The skills road: skills for employability in Tajikistan*. Washington, DC: World Bank.

Akerlof, G. (1997) Social distance and social decisions. *Econometrica*, 65(5), 1005–1027. Available from: https://doi.org/10.2307/2171877

Almlund, M., Duckworth, A.L., Heckman, J. & Kautz, T. (2011) Personality psychology and economics. In: *Handbook of the economics of education*, vol. 4, pp. 1–181.

Altonji, J., Cattan, S. & Ware, I. (2017) Identifying sibling influence on teenage substance use. *Journal of Human Resources*, 52(1), 1–47. Available from: https://doi.org/10.3368/jhr.52.1.0714-6474r1

Amin, V. (2009) Sibling sex composition and educational outcomes: a review of theory and evidence for the U.K. *Labour*, 23(1), 67–96. Available from: https://doi.org/10.1111/j.1467-9914.2008.00443.x

Austin, P.C. (2011) An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research*, 46(3), 399–424. Available from: https://doi.org/10.1080/00273171.2011.568786

Averett, S., Argys, L. & Rees, D. (2011) Older siblings and adolescent risky behavior: does parenting play a role? *Journal of Population Economics*, 24(3), 957–978. Available from: https://doi.org/10.1007/s00148-009-0276-1

Bart, H.H., Golsteyn, C. & Magnee, A.J. (2020) Does sibling gender affect personality traits? *Economics of Education Review*, 77, 102016. Available from: https://doi.org/10.1016/j.econedurev.2020.102016

Berndt, T. (1992) Friendship and friends' influence in adolescence. *Current Directions in Psychological Science*, 1(5), 158–159. Available from: https://doi.org/10.1111/1467-8721.ep11510326

Bernheim, B.D. (1994) A theory of conformity. *Journal of Political Economy*, 102(5), 841–877. Available from: https://doi.org/10.1086/261957

Bhai, M. (2016) Double take: the effect of sibling sex composition on women's schooling, earnings, and labor supply. *Economics Letters*, 146, 42–46. Available from: https://doi.org/10.1016/j.econlet.2016.06.030

Butcher, K.F. & Case, A. (1994) The effect of sibling sex composition on women's education and earnings. *Quarterly Journal of Economics*, 109(3), 531–563. Available from: https://doi.org/10.2307/2118413

Chiteji, N. (2010) Time preference, noncognitive skills, and well-being across the life course: do noncognitive skills encourage healthy behavior? *The American Economic Review*, 100(2), 200–204. Available from: https://doi.org/10.1257/aer.100.2.200

Conley, D. (2000) The sibship sex composition effects on educational attainment. *Social Science Research*, 29(3), 441–457. Available from: https://doi.org/10.1006/ssre.2000.0678

Cubel, M., Nuevo-Chiquero, A., Sanchez-Pages, S. & Vidal-Fernandez, M. (2016) Do personality traits affect productivity? Evidence from the laboratory. *Economic Journal*, 126(592), 654–681. Available from: https://doi.org/10.1111/ecoj.12373

Cunha, F. & Heckman, J.J. (2007) The technology of skill formation. *The American Economic Review*, 97(2), 31–47. Available from: https://doi.org/10.1257/aer.97.2.31

Cyron, L., Schwerdt, G. & Viarengo, M. (2017) The effect of opposite sex siblings on cognitive and noncognitive skills in early childhood. *Applied Economics Letters*, 24(19), 1369–1373. Available from: https://doi.org/10.1080/13504851.2017.1279263

Dahl, G. & Moretti, E. (2008) The demand for sons. *The Review of Economic Studies*, 75(4), 1085–1120. Available from: https://doi.org/10.1111/j.1467-937x.2008.00514.x

Downey, D.B. & Condron, D.J. (2004) Playing well with others in kindergarten: the benefit of siblings at home. *Journal of Marriage and Family*, 66(2), 333–350. Available from: https://doi.org/10.1111/j.1741-3737.2004.00024.x

Falk, A. & Knell, M. (2004) Choosing the Joneses: endogenous goals and reference standards. *Journal of Economics*, 106(3), 417–435. Available at: https://www.iza.org/de/publications/dp/1152

Fehr, E. & Schmidt, K.M. (1999) A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics*, 114(3), 817–868. Available from: https://doi.org/10.1162/003355399556151

Fiorini, M. & Keane, M. (2014) How the allocation of children's time affects cognitive and noncognitive development. *Journal of Labor Economics*, 32(4), 787–836. Available from: https://doi.org/10.1086/677232

Fletcher, J. (2013) The effects of personality traits on adult labor market outcomes: evidence from siblings. *Journal of Economic Behavior and Organization*, 89, 122–135. Available from: https://doi.org/10.1016/j.jebo.2013.02.004

Foley, K., Gallipoli, G. & Green, D.A. (2014) Ability, parental valuation of education, and the high school dropout decision. *Journal of Human Resources*, 49(4), 906–944. Available from: https://doi.org/10.1353/jhr.2014.0027

Frijters, P., Johnston, D., Shah, M. & Shields, M. (2013) Intrahousehold resource allocation: do parents reduce or reinforce child ability gaps? *Demography*, 50(6), 2187–2208. Available from: https://doi.org/10.1007/s13524-013-0224-2

Furman, W. & Buhrmester, D. (1992) Age and sex differences in perceptions of networks of personal relationships. *Child Development*, 63(1), 103. Available from: https://doi.org/10.2307/1130905

Gill, A. & Kleinjans, K. (2020) The effect of the fall of the Berlin Wall on children's noncognitive skills: evidence from the German Reunification. *Applied Economics*, 52(51), 5595–5612.

Hill, M.S., Yeung, W.-J.J. & Duncan, G.J. (2001) Childhood family structure and young adult behavior. *Journal of Population Economics*, 14(2), 271–299. Available from: https://doi.org/10.1007/s001480000039

Hsin, A. & Felfe, C. (2014) When does time matter? Maternal employment, children's time with parents, and child development. *Demography*, 51(5), 1867–1894. Available from: https://doi.org/10.1007/s13524-014-0334-5

Juhn, C., Rubinstein, Y. & Zuppann, A. (2015) *The quantity-quality trade-off and the formation of cognitive and noncognitive skills.* NBER Working Paper No. 21824.

Kaestner, R. & Callison, K. (2011) Adolescent cognitive and noncognitive correlates of adult health. *Journal of Human Capital*, 5(1), 29–69. Available from: https://doi.org/10.1086/660082

Kemper, D.K. (2016) Some applications of status-power and reference group theory. In: *Chapter in elementary forms of social relations.* London: Routledge.

Lindqvist, E. & Vestman, R. (2011) The Labor market returns to cognitive and noncognitive ability: evidence from the Swedish Enlistment. *American Economic Journal: Applied Economics*, 3(1), 101–128. Available from: https://doi.org/10.1257/app.3.1.101

Lundberg, S. & Rose, E. (2002) The effects of sons and daughters on men's labor supply and wages. *The Review of Economics and Statistics*, 84(2), 251–268. Available from: https://doi.org/10.1162/003465302317411514

McHale, S., Crouter, A. & Tucker, C. (1999) Family context and gender role socialization in middle childhood: comparing girls to boys and sisters to brothers. *Child Development*, 70(4), 990–1004. Available from: https://doi.org/10.1111/1467-8624.00072

McKinsey & Company (2021) *COVID-19 and education: an emerging K-shaped recovery.* Available at: https://www.mckinsey.com/industries/education/our-insights/covid-19-and-education-an-emerging-k-shaped-recovery

Newberger, R. & Toussaint-Comeau, M. (2022) *Engaging the conversation for thriving youth: moving forward with an equitable recovery.* Federal Reserve Bank of Chicago, Community Development and Policy Studies Vlog.

Nyhus, E. & Pons, E. (2012) Personality and the gender wage gap. *Applied Economics*, 44(1), 105–118. Available from: https://doi.org/10.1080/00036846.2010.500272

Rubin, D. (1996) Multiple imputation after 18+ years. *Journal of the American Statistical Association*, 91(434), 473–489. Available from: https://doi.org/10.1080/01621459.1996.10476908

Shahbazian, R. (2021) Under the influence of our older brother and sister: the association between sibling gender configuration and STEM degrees. *Social Science Research*, 97, 102558. Available from: https://doi.org/10.1016/j.ssresearch.2021.102558

van Ijzendoorn, M.H., Moran, G., Belsky, J., Pederson, D., Bakermans-Kranenburg, M.J. & Kneppers, K. (2000) The similarity of siblings' attachments to their mother. *Child Development*, 71(4), 1086–1098. Available from: https://doi.org/10.1111/1467-8624.00211

Updegraff, K.A., McHale, S.M. & Crouter, A.C. (2000) Adolescents' sex-typed friendship experiences: does having a sister versus a brother matter? *Child Development*, 71(6), 1597–1610. Available from: https://doi.org/10.1111/1467-8624.00251

Uysal, S.D. & Pohlmeier, W. (2011) Unemployment duration and personality. *Journal of Economic Psychology*, 32(6), 980–992. Available from: https://doi.org/10.1016/j.joep.2011.03.008

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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