Equalizing Inputs, Enduring Gaps: Examining Changes in Levels and Correlates of Gender Gaps in Noncognitive Skills Over Time

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Abstract

I examine changes over time in gender gaps in noncognitive skills by comparing two nationally representative datasets of elementary school students. I determine that girls' advantages in four out five noncognitive measures remain large and unchanged between the 1998-1999 and 2010-2011 national cohorts, ranging from 0.35σ to 0.4σ, substantially larger than cognitive test score gender gaps. Focusing on two groups of three family background and parental input measures examined in previous literature, I investigate the extent to which these measures continue to explain noncognitive gender gaps despite no change in the overall level. I find that their influence as declined, likely due to an equalization of parent reports of educational activities and warmth between boys and girls. Single motherhood and teen motherhood remain predictors of larger gender gaps, though the correlation between kindergarten socioeconomic status and larger gender gaps has decreased.

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1 Introduction

Although the past few decades have seen a widespread increase in math and reading testing in schools, economists and education researchers have become increasingly aware of the importance of other skills not measured by traditional cognitive tests. Although often harder to measure, these noncognitive skills, such as self-control, interpersonal skills, impulsiveness, approaches to learning, internalizing problems and externalizing problems, have been increasingly associated with both difficulties in school and long-term labor market and educational outcomes (Lindqvist and Vestman, 2011; Deming, 2017; Heckman et al., 2006). Additionally, researchers (Jacob, 2002; Goldin et al., 2006; Becker et al., 2010) are increasingly coming to believe that gender gaps in long-term educational outcomes in particular may be mainly explained by gender gaps in these noncognitive skills. Further, economists have identified gender gaps in noncognitive skills as playing a role in more short term outcomes, such as the historical gender gap in grades received in school (Cornwell et al., 2013; Fortin et al., 2015). In other fields, researchers in sociology (DiPrete and Jennings, 2012) and psychology (Duncan et al., 2007; Raver et al., 2007) have conducted studies demonstrating that noncognitive skills affect the accumulation of cognitive skills in the short and medium term, thus affecting long term outcomes both directly and indirectly through the process of cognitive skill formation.

To investigate these gender gaps in noncognitive skills, researchers have taken several different approaches. One branch of research looks at descriptive and correlational evidence from time diaries on how parents spend their time with their children and finds that parents spend more time with children of their own gender, leaving boys without fathers in the home with less parental time investment overall (Baker and Milligan, 2016; Bibler, 2018). Another branch of gender gap research looks outside of specific measures of noncognitive skills and focuses on differential re-

sponses by gender to disadvantaged background characteristics. These papers find evidence that disadvantaged backgrounds, such as impoverished neighborhoods or low family socioeconomic status, seem to have a larger negative effect on boys than girls, suggesting that boys may have a higher responsiveness to disadvantage and human capital inputs more generally (Autor et al., 2019, 2020; Chetty et al., 2016, e.g.).

I follow a third branch of literature, which examines how gender gaps in the development of noncognitive skills correlates with other measures in young students. A prominent example of this literature is Bertrand and Pan (2013), which provides evidence that students from single mother families, low SES families, and teen mother families all experience both larger gender gaps in externalizing behavior, one type of noncognitive skill, and eighth grade suspension rates. They also provide suggestive evidence that, in terms of externalizing behavior, boys are more sensitive than girls to more disadvantaged family backgrounds and lower levels of parental inputs, especially single mother households. I build on this literature by examining changing gender gaps in noncognitive skills over time between elementary school cohorts that entered school 12 years apart. Specifically, I examine how the influence of family background and parental input characteristics on these noncognitive gender gaps has changed over time, and how these changes vary by a broader array of noncognitive skills than externalizing behavior alone.

I find that gender gaps in four out of five noncognitive measures in the ECLS-K datasets remain large and unchanged between the 1998-1999 and 2010-2011 national cohorts. For these four measures, I can rule out any changes in girls' advantages of 0.1σ or greater across all grades. I then combine these measures into a single latent noncognitive skill using factor analysis and dig into how the correlations of family background and parental input measures have changed in relation to this latent measure. An Oaxaca-Blinder decomposition of the gender gap explained by these mea-

sures shows that the overall influence of these measures on the gender gap has decreased by fifth grade, despite no change in the overall gender gap. This change is likely explained by an equalizing of parent reports of educational activities and feelings of warmth between boys and girls between the two cohorts. For family background measures, there are no statistically detectable changes in gender gaps for either single mothers or teen mother families, as both continue to be substantially negative predictors. Socioeconomic status, on the other hand, appears to have a decrease in its role in enlarging gender gaps. Differences in gender gaps have compressed between lower and higher ends of the socioeconomic status distribution in the second half of elementary school when controlling for other family background and parental input measures, suggesting that its influence has waned.

This paper's structure is as follows: Section 2 further describes the relevant literature that inspires and justifies this analysis. Section 3 describes the data and measures I use, section 4 goes over my results, and section 5 concludes.

2 Literature Review

For this section, I focus in on the research that has previously sought to examine differences in parental inputs between genders as well as differential responses to disadvantaged family background. Starting with parental inputs, several researchers have looked at gender differences in parent-reported time and activities spent with children. Baker and Milligan (2016) examine parent-reported time spent with children using datasets on the US, UK, and Canada. They find that, while parents report spending similar amounts of time overall with boys and girls at young ages, they report spending more time in teaching activities with girls starting at very young ages. Bibler (2018)

uses time diaries from the Panel Study of Income Dynamics Child Development Supplement to estimate differences in time parents spend with boys versus girls, but instead estimates a fixed effects model, focusing on families that change from two parent to single mother. He finds that in such cases, boys face a substantially larger decline in parental time than girls, with little evidence of compensating behavior by the single mothers to make up this gap. Collectively, these papers suggest that boys do face somewhat of a disadvantage in parental investment, particularly boys in single mother households.

Turning to the role of disadvantaged family background, multiple researchers have noted that boys seem to respond more negatively to family disadvantage. Chetty et al. (2016) find that, even with family fixed effects and looking only at movers, boys who grow up in disadvantaged neighborhoods have worse long-term employment outcomes than girls. Autor et al. (2019) find that disadvantaged families display boy-girl gaps as early as kindergarten, with these early differences turning into sharp differences in high school graduation rates at age 18. Further, like Bertrand and Pan (2013), they find that these gaps are most manifested in behavioral differences, such as absences and disciplinary issues, and that these behavioral gender gaps are more predictive of high school graduation gender gaps than test scores. Focusing specifically on race, Aucejo and James (2019) find that gender gaps in educational attainment are larger among nonwhite minority groups, and that early behavior accounts for a majority of this gap across racial groups. They also find that black males in particular have the largest response to other forms of family disadvantage, particularly low socioeconomic status. In total, these papers provide strong evidence that boys may have higher responsiveness to family disadvantage than girls, and that these responses often manifest themselves in behavioral or noncognitive manners early on.

3 Data

3.1 Data and Sample

I use two different versions of the Early Childhood Longitudinal Study, Kindergarten Cohort datasets for its analysis: the ECLS-K and the ECLS-K:2011. Both studies are nationally representative samples of children who entered kindergarten in the 1998-1999 and 2010-2011 school years, respectively, referred to for the rest of this paper as the 1998 and 2010 cohorts. Additionally, both studies contain data on over 18,000 children, parents, and teachers interviewed repeatedly in several waves. The ECLS-K conducted interviews in fall of kindergarten, spring of kindergarten, fall of 1st grade, and spring of 1st, 3rd, 5th, and 8th grades. The ECLS-K:2011 conducted interviews in spring and fall of kindergarten, 1st grade, and 2nd grade, as well as spring of 3rd, 4th, and 5th grades. In both of these studies, information was collected about children's cognitive, social, emotional, and physical development by interviewing children, parents, teachers, and administrators. Additional information was collected on the children's home environment, including parental educational activities, the environment at school, and school and teacher practices and qualifications.

To create the final analysis sample, I impose several sample restrictions. First, respondents had to have non-zero fifth grade panel weights in their respective surveys, indicating that they were respondents through all rounds of the survey. Second, respondents had to have information on all control variables. The base control variables to be used throughout the descriptive section of this paper are dummy variables for race and school locale at kindergarten.[1] Third, respondents had to have information on all family background and parental input measures. This includes mother's

[1] Results are robust to including a fuller set of controls more comparable to Bertrand and Pan (2013): race, age and age-squared at first assessment, birthweight, and number of older and younger brothers and sisters

age at first birth, family socioeconomic status (derived from household income, education, and occupations), family structure (i.e. two parents, single mom, or other), parental educational activities (combined into a HOME index), parental warmth (combined into a Warmth index)[2], and parental disciplinary behavior (whether they spank their child). And fourth, respondents, had to have non-missing data on the key outcomes of interest: kindergarten and fifth grade teacher-reported externalizing behavior and approaches to learning. This leaves 6,630 observations for the ECLS-K dataset and 4,930 observations for the ECLS-K:2011 dataset. Weighted descriptive statistics are reported for these two samples in Table 1.[3]

Table 1 shows that, while the two cohorts are largely similar, the 2010 cohort is slightly more advantaged, primarily along the parental education, teen motherhood, and single mother dimensions. There is a 4 percentage point decrease in the number of children born to mothers who were teenagers at their first births and a 6 percentage point increase in those born to mothers over 30 at first birth. There is also a 6 percentage point decrease in families with only a high school education and a 4 percentage point increase in families with a bachelor's degree or greater. Finally, there is a 2 percentage point decrease in children living in single mother households at kindergarten combined with a 4 percentage point increase in children with two biological parents at kindergarten.[4] In sum, the 2010 cohort has more educated parents, more two parent households, and fewer teenage mothers.

[2]Described further in the next subsection.

[3]Results are robust to the use of inverse probability weights to account for item nonresponse in both surveys.

[4]Additionally, in both samples, it appears there is some attrition or item nonresponse from the lowest SES quintile that is not accounted for by panel weight adjustments. SES quintiles are created from a continuous measure for the full population at kindergarten using parent kindergarten weights.

3.2 Key Measures

Following Bertrand and Pan, I have created two indices of parental inputs: a HOME index, which standardizes the sum of eight measures of parental investment activities[5] and a Warmth index, which standardizes the sum of eight measures on parental feelings towards their child[6].[7] These measures are included as measured at kindergarten in order to limit potential endogeneity or reverse causality with child noncognitive abilities that may affect family structure or parental inputs. These two indices, in combination with an indicator for whether the parent reported spanking their child in the last week in kindergarten, are considered as proxies for parental inputs for the duration of this paper.

In addition to data on parent-reported investment and child-rearing activities and attitudes, another important aspect of both ECLS-K datasets is their measures of noncognitive skills, particularly teacher-reported noncognitive skills[8]. Both datasets contain teacher-reported measures on externalizing behaviors, self-control, approaches to learning, interpersonal skills, and internalizing problems. These social skills scales were developed based on teachers' responses to items taken from the Social Skills Rating System. The score on each scale is the mean rating of all items included in the scale. Although the components of these measures are not available due to copyright reasons, the ECLS-K user's manual provides descriptions of each of the noncognitive measures

[5]Measures include whether: read to child $\geq$ 3 times per week, child has $\geq$ 20 books, child reads $\geq$ 3 times per week outside school, have home computer child uses, has visited museum, concert, or library with child, and whether child participated in other outside school activities (dance, sports, music, etc.).

[6]Measures include Likert scale on how true parents felt following statements were: have warm or close times together, child likes me, always show child love, express affection, (reversed) being parent harder than expected, (reversed) child does things that bother me, (reversed) sacrifice to meet child's needs, and (reversed) often feel angry with child.

[7]Both were constructed following Bertrand and Pan as closely as possible, though several measures were dropped from the Warmth index due to lack of inclusion in the ECLS-K:2011 data.

[8]Parent-reported ratings of noncognitive skills are also available for early grades. However, I do not include them in this analysis, as I believe that parents are less likely to be objective, unbiased assessors of their children's abilities.

(Tourangeau et al., 2001). Approaches to learning is constructed from "six items that rate the child's attentiveness, task persistence, eagerness to learn, learning independence, flexibility, and organization." Self-control is constructed from "four items that indicate the child's ability to control behavior by respecting the property rights of others, controlling temper, accepting peer ideas for group activities, and responding appropriately to pressure from peers." Interpersonal skills are constructed from items that "rate the child's skill in forming and maintaining friendships, getting along with people who are different, comforting or helping other children, expressing feelings, ideas and opinions in positive ways, and showing sensitivity to the feelings of others." Externalizing problem behaviors are constructed from "Five items on this scale rate the frequency with which a child argues, fights, gets angry, acts impulsively, and disturbs ongoing activities." And finally, internalizing problem behaviors is constructed from four items that ask about "the apparent presence of anxiety, loneliness, low self-esteem, and sadness."

Two of these measures, externalizing behavior and internalizing behavior, have been reordered so that higher scores indicate the child exhibited a "better" score reflecting higher noncognitive skill in each respective category, which means more of each measure's behaviors for positive scales (approaches to learning, self-control, and interpersonal skills) or less of each measure's behaviors for negative scales (externalizing and internalizing problems). Additionally, in order to allow for comparability and reduce arbitrary scaling, all noncognitive measures, including externalizing behavior, are standardized within the estimated population of their respective surveys. Before standardizing, corrections for teachers' reference bias in subjective measures are applied, following Elder and Zhou (2020).[9]

Both the Social Skills Rating System itself and these measures from the ECLS-K based on the

[9] Elder and Zhou (2020) show that teacher-reported measures of noncognitive skills are evaluated to students' other classmates and recommend two possible fixes for this issue. I follow their "Condition 2".

SSRS are also used in numerous other studies involving the ECLS-K. This includes Neidell and Waldfogel (2010) (2010), who state "these scales have high construct validity as assessed by test-retest reliability, internal consistency, inter-rater reliability, and correlations with more advanced behavioral constructs (Elliott et al., 1988) and are considered the most comprehensive social skill assessment that can be widely administered in large surveys such as the ECLS-K (Demaray et al., 1995)." Taken together, these endorsements and descriptions provide evidence for the validity of the measures of noncognitive skills I will be using for the remainder of this paper.

4 Results

4.1 Gender Gaps Remain Wide

The first question to be addressed is whether gender gaps have changed between the two cohorts. To this end, I have recreated weighted measures of gender gaps in all five teacher-reported noncognitive skills in the two ECLS-K datasets and included them in Figure 1.[10] Each data point is the coefficient on a female dummy from a regression of each measure in each grade and each cohort on a female dummy variable. It is worth noting two additional points: (1) Fall-Kindergarten and Spring-Kindergarten survey waves are listed as KF and KS for the remainder of the paper, and (2) the 2010 cohort plots (in orange, dashed lines) have more data points due to conducting surveys at second and fourth grade, unlike for the 1998 cohort.

Figure 1 shows that gender gaps in these noncognitive measures are largely unchanged for all but internalizing problems. While internalizing problems shows a narrowing of the gender gap to the point of no longer having a statistically detectable gender gap for the 2010 cohort, gender gaps

[10]The sixth graph displays the same for the common factor, which will be described further in the next subsection.

in teacher reports of externalizing behavior, self control, interpersonal skills, and approaches to learning remain in the range of $0.35 - 0.6\sigma$. For comparison, similar graphs for gender gaps in math and reading test scores are included in Appendix Figure A1. As Bertrand and Pan note, the gender gaps in noncognitive skills remain much larger in relative magnitude to any gender gaps in test scores, which are in the range of 0.1σ to 0.25σ. This stark difference holds across both ECLS-K cohorts.

Table 2 shows and tests the differences in gender gaps between the two cohorts directly. And, as Table 2 shows, we can reject the null of no changes in any grades for only internalizing problems, confirming the pattern observed in Figure 1. In both Panels A and B of Table 2, each cell in the first five columns is the coefficient on a female and 2010 cohort interaction term for regressions for each respective measure in each respective grade listed in the column title on a dummy for female, a dummy for the 2010 cohort, and a female times 2010 cohort interaction term. The last column shows the p-value of a joint F-test of the null that the gender gap in each measure across all grades is unchanged between the two datasets. In panel A these regressions are run without any controls. In Panel B, the regressions are rerun with controls included for child race, school locale at kindergarten, family background at kindergarten (single motherhood, family socioeconomic quintile, and teen motherhood), and parental inputs at kindergarten (lower HOME index, lower Warmth index, and spanking at kindergarten). The results in Panel B largely confirm those of Panel A, with no statistically detectable changes for any of the measures other than internalizing problems.

Taken together, these findings suggest that gender gaps in noncognitive problems remain a substantial issue 12 years later, despite the changes that have occurred in our schools and society in the interim. However, before fully concluding this, we must address one of the drawbacks

in interpretation of measures based on subjective evaluations: we may not be able to separate changes in how teachers evaluate the same level of skill between genders from actual changes in the underlying skills themselves. To address this concern, I have included estimates of the gender gaps in teachers' subjective Academic Rating Scores[11] in the two cohorts in Appendix Figure A2. If the endurance in subjective reports of gender gaps were solely due to teachers evaluating boys relatively more unfavorably in general, despite a real narrowing of objective skill gaps, we might expect this would result in a shift towards girls in Academic Rating Scores gender gaps. Instead, the change in the female-male gap in Academic Rating Scores between the two cohorts appears to have grown more *favorable* towards boys between the 1998 and 2010 cohorts.[12] In sum, the endurance of gender gaps in subjectively-rated noncognitive skills does not appear to be masking a real narrowing of objective skill, and are thus likely reflecting a real persistence.

4.2 Factor Analysis

In addition to the issue of subjectivity bias, a second issue with interpreting the results in Table 2 is that many of these measured noncognitive skills are highly correlated with each other. Table 3A shows their correlation matrix across all grades and cohorts. The values shown in Table 3A present a problem for interpreting the changes in gender gaps for any individual measure separately, as the skills being measured are also captured to some degree by the other noncognitive measures. Factor analysis presents an ideal solution to this issue by reducing dimensions and creating orthogonal latent factors based on the measures' correlation matrix. To illustrate, let X be a $5xn$ vector of the

[11] These scores are produced by teachers evaluating the academic abilities of students in different subjects before observing the ECLS-K test scores of the students.

[12] While this comparison cannot rule out that teachers' relative evaluations of the skills of boys and girls may be driving the changes in *noncognitive skills specifically*, it does decrease the likelihood of their existence, since any changes that would affect subjective cognitive ratings are ruled out.

five noncognitive skills for each individual i, let Θ be an nxf vector of latent factors, where f is the number of latent factors, let Λ be a $5xf$ factor loading matrix, and let U be a $5xn$ vector of the idiosyncratic error terms, also known as the uniqueness matrix. We then have:

$$X = \Theta\Lambda' + U \tag{1}$$

The goal of factor analysis is to (1) separate out the communally explained variation in $\Theta\Lambda'$ from U and (2) to then create estimates of Θ and Λ, which are unobserved, using eigenvector decomposition of $corr(X) - U$.[13]

Table 3B presents the results of the unrotated principal factor analysis on the five noncognitive measures across all grades and cohorts. This analysis produces one common factor, which I will call "Latent Noncognitive Skill" for the remainder of the paper.[14] The factor loadings column shows estimates of Λ from equation 1 and the uniqueness column shows estimates of U from equation 1. The scores column is calculated from the factor loadings and the correlation matrix, and shows the weights used in creating the Latent Noncognitive Skill variable as a weighted linear combination of the five noncognitive skills.[15]

The estimates in Table 3B show that the Latent Noncognitive Skill factor is comprised of two thirds self control and interpersonal skills, one third externalizing behavior and approaches to learning, and only a small remaining portion coming from internalizing problems. The uniqueness column tells a similar story. This follows directly from the correlation matrix in Table 3A, which

[13]There is no unique solution to step 2, as various orthogonal rotations can produce equally valid solutions once the uniqueness matrix U has been estimated.

[14]Information Criterion instead support the use of two factors for fitting the correlation matrix of noncognitive skills, rather than only one. This two factor orientation is produced by an orthogonal varimax rotation with a Kaiser correction. However, results run with these two factors instead of one are similar to results run with only one, so results are presented using one common factor for simplicity.

[15]The score matrix S is defined as $S = (corr(X))^{-1} * \Lambda$ in orthogonal factor analysis.

shows that internalizing problems is the measure least correlated with the other noncognitive skill and thus has the most unique variance not shared by the latent factor. This means that the estimates of the changes in the Latent Noncognitive Skill variable in the remainder of paper will mostly exclude the decreased gender gap in internalizing problems, reflecting instead the persistent gap of the other four measures. Figure 1 and Table 2 both display analyses for Latent Noncognitive Skill, and the results show that it succeeds in combining the trends of the first four noncognitive skills. As we can see, this latent noncognitive skill continues to display an unchanged gender gap across all grades, confirming the endurance of this issue. The question remains whether any of the underlying correlates of the gender gap has changed. The remaining analyses will show how correlates of this gender gap have evolved between the 1998 and 2010 cohorts to help illustrate what may be leading to its endurance between the two cohorts.

4.3 The Changing Influence of Predictors

While Figure 1 and Table 2 establish that gender gaps across most noncognitive skills have remained, Table 4 investigates how the influence of these gender gaps as explained by the kindergarten family background and kindergarten parental inputs measures examined in Bertrand and Pan (2013) have changed. To this end, fifth grade latent noncognitive skill is regressed on both kindergarten family background and kindergarten parental inputs measures with a full set of cohort and female interaction terms and controls for race and school locale, then predicted values from this regression are generated. These predicted gaps are shown in the first column of Table 4. This first column of predicted gender gaps closely mirrors the findings in Table 2 of persistently large fifth grade gender gaps of 0.55σ across both cohorts. The next two columns, however, do display a change in the role of these predictors.

The second and third columns of Table 4 display Oaxaca-Blinder decompositions for latent noncognitive skill in fifth grade. The Oaxaca-Blinder decomposition breaks down the fifth grade gender gaps into the portions of this gap that are either unexplained or explained by differences in X's, where the covariates included for this analysis are the kindergarten family background, kindergarten parental inputs, racial demographics controls, and kindergarten school locale controls used throughout this paper. This decomposition is shown in equations 2 and 3 below. In equation 2, let y_i be fifth grade noncognitive skill measured for individual i, f_i be an indicator for female, and X_i be a vector of family background, parental inputs, and racial demographics controls. Equation 3 shows how we can decompose the gender gap in fifth grade externalizing behavior using equation 2. I have shown both possible Oaxaca-Blinder specifications in panels A and B.

$$y_i = \beta_0 + \beta_f f_i + \beta_G(f_i \times X_i) + \beta_B((1-f_i) \times X_i) + u_i \tag{2}$$

Let $\overline{X}_G = \overline{f_i \times X_i}$ and let $\overline{X}_B = \overline{(1-f_i) \times X_i}$. Equation 3 shows the specification in panel A, which is derived by adding and subtracting $\beta_G \overline{X}_B$ and factoring out[16].

$$E(y|j=G) - E(y|j=B) = \underbrace{\beta_f + [\beta_G - \beta_B]\overline{X}_B}_{\text{Unexplained}} + \underbrace{\beta_G[\overline{X}_G - \overline{X}_B]}_{\text{Role of X's}} \tag{3}$$

This Oaxaca-Blinder decomposition in Table 4 suggests that the influence of levels of family background and parental inputs has slightly declined. Across both specifications, the difference in the portion of the gaps explained by X's is negative. Further, in panel B, there is a statistically

[16]Panel B is derived by adding and subtracting $\beta_B \overline{X}_G$, which gives us

$$E(y|j=G) - E(y|j=B) = \beta_f + [\beta_G - \beta_B]\overline{X}_G + \beta_B[\overline{X}_G - \overline{X}_B]$$

instead of Equation 3.

significant decrease ($p < 0.05$) in the portion of the gap that is explained by the levels of family background and parental inputs of 0.05σ. This suggests that the influence of these predictors in explaining the large gender gaps in noncognitive skill has decreased, even while the gaps themselves remain unchanged.

4.4 Changes in Levels

This slight decrease in the portion of the gap collectively explained by family background and parental inputs leaves open the question of which of these predictors may have changed. To explore this further, I have broken down the levels of these predictors by gender and cohort, showing results for family background in Table 5 and results for parental inputs in Table 6.

Table 5 looks at different levels of family background characteristics by gender and cohort. Gender is of course randomly assigned at birth, but it is possible that in the presence of higher levels of difficult behavior from boys, family attributes, particularly family structure, may be negatively harmed by the utility penalty imposed from raising a child with more behavioral problems. In Table 5 I show summary stats for all three family background characteristics by cohort and test whether there are detectable differences between genders along these measures. While the results for family structure and teen motherhood are consistent with the principle of random assignment by gender, socioeconomic status is not. Table F-tests of socioeconomics 5 show that the distribution of family socioeconomic status is not equal cross gender in either cohort. In the 19998 cohort, girls were in more socioeconomically advantaged households than boys, while in the 2010 cohort, the situation appears to have reversed. As this change would likely decrease noncognitive gender gaps,[17] it is probable that this reversal is part of the cause of the reduced influence of the predictors

[17] Bertrand and Pan (2013) show that lower kindergarten socioeconomic status is correlated with larger noncognitive

observed in Table 4.

Table 6 shows a breakdown by gender and cohort of each of the three kindergarten parental input measures and proxies: kindergarten HOME index, kindergarten Warmth index, and parent-reported spanking at kindergarten for both genders in both cohorts.[18] Additionally, Table A1 shows the results of Table 6 on top of the components of the two indices. Like Bertrand and Pan (2013) and Baker and Milligan (2016), I find that parents spend more time on educational activities with girls than with boys in both cohorts, though less so for the 2010 cohort. For the 2010 and 1998 cohorts, girls have 0.07σ and 0.16σ higher HOME indices than boys, respectively. This change suggests that parents have relatively moved towards reporting more equal levels of investment between the genders. The gender gap in parental warmth decreased from 0.11σ to 0.00σ indicating a similar decline and now complete absence of any gender gap in reported parental Warmth. Spanking remains similar between the genders, though the levels of spanking for both genders have dropped. Overall, it appears that while girls still enjoy higher levels of parental investment, there was a substantial shift towards greater equality in reported parental inputs.

Together, the reversal of girls' SES advantage and the equalizing of parental inputs provide a reasonable explanation for the decreased influence of the two groups of measures on the noncognitive gender gap. And although the changes in the unexplained portion of the gender gap were collectively statistically undetectable, I will now examine whether any of the coefficients of the individual predictors changed between the cohorts.

gender gaps.

[18] Parental input measures are examined only at kindergarten to avoid issues of reverse causality. If we expect parents to respond endogenously either (1) to a higher psychic cost from parenting a child with externalizing behaviors or (2) with compensating or reinforcing behaviors in response to low observed levels of child noncognitive skill, then observed externalizing behaviors could be driving parental investment, rather than the other way around.

4.5 Changes in Coefficients

To begin examining changes in coefficients, I display the regression results of the first column of Table 4 in Appendix Table A2, holding constant race and kindergarten school locale across gender and cohort. Results are generated by regressing fifth grade latent noncognitive skill on parental inputs and family background characteristics at kindergarten, full interacted with dummies for gender and cohort, and controls for race and school locale. The final column, which shows how gender differences in coefficients have changed between the two cohorts for each measure, shows that most gender differences in coefficients are unchanged, with two exceptions: kindergarten warmth index and socioeconomic status. Both have significant declines in the gender gaps in their coefficients between the two cohorts, with changes of over 0.13σ. For the remainder of this section, I will explore further these two measures.

Starting with kindergarten socioeconomic status, I show the evolution of gender gaps across grades for each cohort and in each of the five quintiles in Figure 2A. Figure 2A calculations are produced by regressing latent noncognitive skill in each grade on indicators for socioeconomic status quintiles interacted with gender and cohort dummies, controlling for parental inputs at kindergarten, the remaining family background measures at kindergarten, race, and school locale at kindergarten. Table 7A tests whether the gender gap for each quintile has changed significantly individually or jointly in fall-kindergarten, grade 3, and grade 5. As we can see from Figure 2A and Table 7A, differences in gender gaps have narrowed for the middle of the distribution in later grades. Gender gaps begin similar across quintiles at the start of kindergarten, but by third and fifth grade, gender gaps begin to decrease for lower quintiles and increase for higher quintiles, with F-test p-values of whether the differences were jointly zero of 0.000 and 0.001 in grades 3 and 5. This suggests that the influence of SES in increasing gender gaps has declined between the

two cohorts, despite continuing to play a role.

Next, for Kindergarten Warmth index, I show the evolution of gender gaps for across grades for each cohort in Figure 2B. Like Figure 2A, Figure 2B calculations are produced by regressing latent noncognitive skill in each grade on indicators for kindergarten warmth index quintiles interacted with gender and cohort dummies, controlling for other parental inputs at kindergarten, family background measures at kindergarten, race, and school locale at kindergarten. Table 7B tests whether the gender gap for each quintile of kindergarten warmth index has changed significantly individually or jointly in fall-kindergarten, grade 3, and grade 5. The story here is similar as for socioeconomic status in Figure 2A and Table 7A: compression of gender gaps across the distribution. The main difference here is that this compression begins in kindergarten, rather than occurring only in later grades.

In summary, it appears there may have been some compression in the influence of socioeconomic status on gender gaps across their distributions, particularly by grade 5. Although this also points in the direction of decreasing gender gaps, like the reversal of girls' socioeconomic status advantage and equalization of reported parental inputs shown in the previous section, this change is not enough to decrease the overall gap by fifth grade, and is instead offset by unexplained factors outside of the six parental inputs and family background measures.

5 Conclusion

Using two cohorts of the nationally representative ECLS-K datasets, I show that gender gaps in noncognitive skills remain substantial and substantially larger than gender gaps in test scores. Combining the five noncognitive measures into one latent noncognitive measure using principal

factor analysis, I then show that, by fifth grade, the influence of two groups of three parental input and family background measures at kindergarten on gender gaps has waned. I then show that this declining influence is likely due to two factors: (1) the distribution of socioeconomic status at kindergarten switching from favoring girls in the 1998 cohort to favoring boys in the 2010 cohort, and (2) a substantial equalizing of parental reports of their inputs between boys and girls. Additionally, looking at the coefficients of kindergarten socioeconomic status and Warmth index measures, I show that their influence, as well as their levels, has changed to be more favorable to boys. In both cases, the correlation of lower ends of the distribution with higher gender gaps has declined and the correlation of higher ends of the distribution with lower gender gaps has decreased, particularly in later grades. However, despite these changes in levels and coefficients, I find that changes in other unexplained factors of the noncognitive gender gap are what are keeping these differences intact.

Although much of this paper has focused on what has changed, it is worth re-emphasizing what has not. Gender gaps in noncognitive skills remain substantially large, and family structure continues to play a prominent role. There may be a decrease in the role of socioeconomic status in these gaps, but it does continue to increase gender gaps. As differing levels of parental input between genders fades away as potential cause, the remaining differential responses to adverse family background conditions becomes more important than ever to study. This study makes clear that gender gaps in noncognitive skills are not going away on their own, and without a further understanding of how family background characteristics play such an important role, policy makers will have difficulty ameliorating their negative influence.

6 References

References

Aucejo, Esteban M and Jonathan James (2019), "Catching up to girls: Understanding the gender imbalance in educational attainment within race." *Journal of Applied Econometrics*, 34, 502–525.

Autor, David, David Figlio, Krzysztof Karbownik, Jeffrey Roth, and Melanie Wasserman (2019), "Family disadvantage and the gender gap in behavioral and educational outcomes." *American Economic Journal: Applied Economics*, 11, 338–81.

Autor, David H, David Figlio, Krzysztof Karbownik, Jeffrey Roth, and Melanie Wasserman (2020), "Males at the tails: How socioeconomic status shapes the gender gap." *NBER Working Paper*.

Baker, Michael and Kevin Milligan (2016), "Boy-girl differences in parental time investments: Evidence from three countries." *Journal of Human Capital*, 10, 399–441.

Becker, Gary S, William HJ Hubbard, and Kevin M Murphy (2010), "The market for college graduates and the worldwide boom in higher education of women." *American Economic Review*, 100, 229–33.

Bertrand, Marianne and Jessica Pan (2013), "The trouble with boys: Social influences and the gender gap in disruptive behavior." *American Economic Journal: Applied Economics*, 5, 32–64.

Bibler, Andrew (2018), "Household composition and gender differences in parental time investments." *Available at SSRN 3192649*.

Chetty, Raj, Nathaniel Hendren, Frina Lin, Jeremy Majerovitz, and Benjamin Scuderi (2016), "Childhood environment and gender gaps in adulthood." *American Economic Review*, 106, 282–88.

Cornwell, Christopher, David B Mustard, and Jessica Van Parys (2013), "Noncognitive skills and the gender disparities in test scores and teacher assessments: Evidence from primary school." *Journal of Human resources*, 48, 236–264.

Demaray, Michelle K, Stacey L Ruffalo, John Carlson, RT Busse, Amy E Olson, Susan M McManus, and Amy Leventhal (1995), "Social skills assessment: A comparative evaluation of six published rating scales." *School Psychology Review*, 24, 648–671.

Deming, David J (2017), "The growing importance of social skills in the labor market." *The Quarterly Journal of Economics*, 132, 1593–1640.

DiPrete, Thomas A and Jennifer L Jennings (2012), "Social and behavioral skills and the gender gap in early educational achievement." *Social Science Research*, 41, 1–15.

Duncan, Greg J, Chantelle J Dowsett, Amy Claessens, Katherine Magnuson, Aletha C Huston, Pamela Klebanov, Linda S Pagani, Leon Feinstein, Mimi Engel, Jeanne Brooks-Gunn, et al. (2007), "School readiness and later achievement." *Developmental psychology*, 43, 1428.

Elder, Todd and Yuqing Zhou (2020), "The black-white gap in non-cognitive skills among elementary school children." *American Economic Journal: Applied Economics (Forthcoming)*.

Elliott, Stephen N, Frank M Gresham, Terry Freeman, and George McCloskey (1988), "Teacher and observer ratings of children's social skills: Validation of the social skills rating scales." *Journal of psychoeducational Assessment*, 6, 152–161.

Fortin, Nicole M, Philip Oreopoulos, and Shelley Phipps (2015), "Leaving boys behind gender disparities in high academic achievement." *Journal of Human Resources*, 50, 549–579.

Goldin, Claudia, Lawrence F Katz, and Ilyana Kuziemko (2006), "The homecoming of american college women: The reversal of the college gender gap." *Journal of Economic perspectives*, 20, 133–156.

Heckman, James J, Jora Stixrud, and Sergio Urzua (2006), "The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior." *Journal of Labor economics*, 24, 411–482.

Jacob, Brian A (2002), "Where the boys aren't: Non-cognitive skills, returns to school and the gender gap in higher education." *Economics of Education review*, 21, 589–598.

Lindqvist, Erik and Roine Vestman (2011), "The labor market returns to cognitive and noncognitive ability: Evidence from the swedish enlistment." *American Economic Journal: Applied Economics*, 3, 101–28.

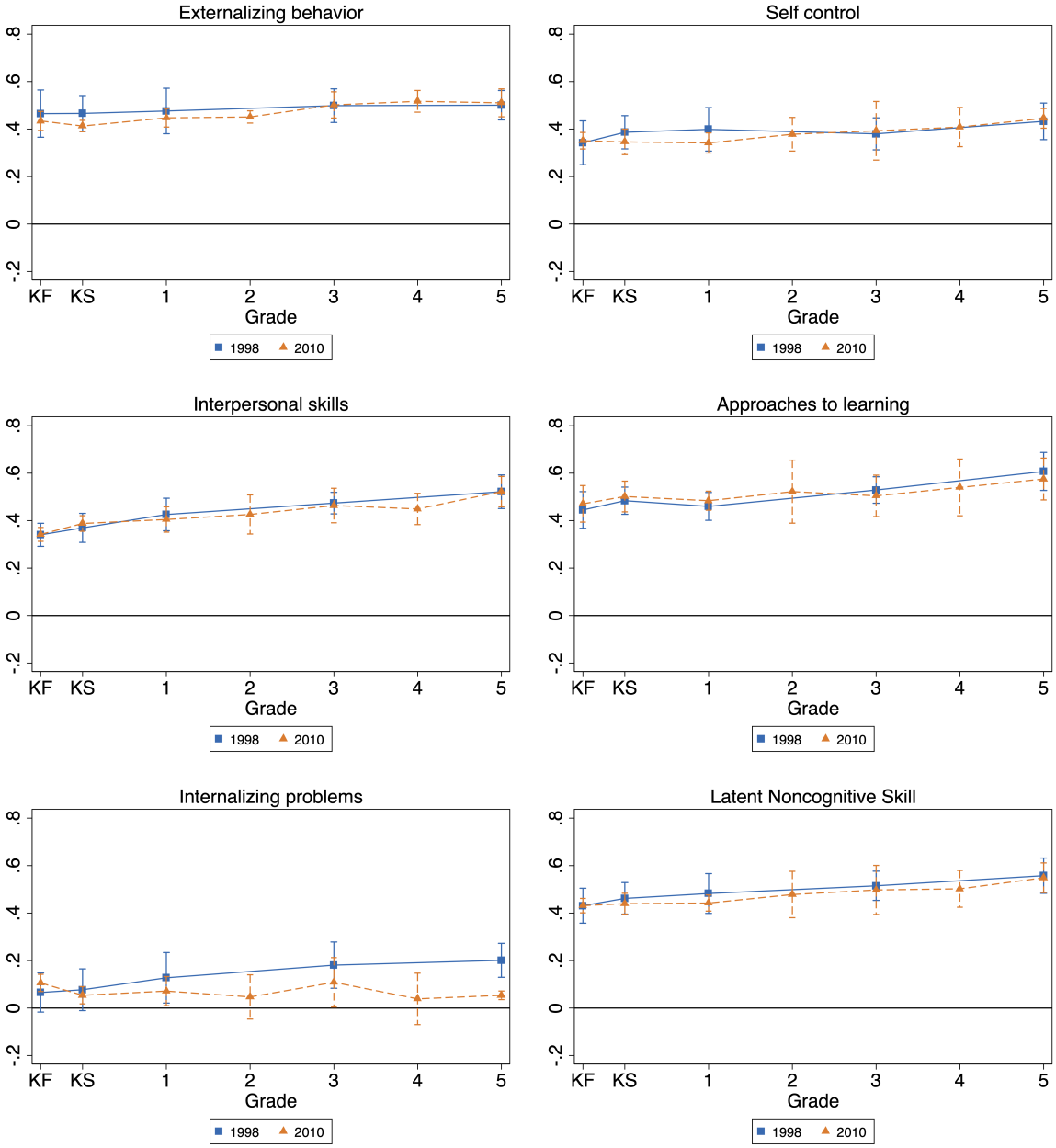
Neidell, Matthew and Jane Waldfogel (2010), "Cognitive and noncognitive peer effects in early education." *The Review of Economics and Statistics*, 92, 562–576.

Raver, CC, Pamela W Garner, and Radiah Smith-Donald (2007), "The roles of emotion regulation and emotion knowledge for children's academic readiness: Are the links causal?" In *School readiness and the transition to kindergarten in the era of accountability*, 121–147, Paul H Brookes Publishing.

Tourangeau, Karen, John Burke, Thanh Le, Siu Wan, Margaret Weant, Eugene Brown, Nancy Vaden-Kiernan, Elizabeth Rinker, Richard Dulaney, Kirsten Ellingsen, Brandon Barrett, Ismael Flores-Cervantes, Nicholas Zill, Judith Pollack, Donald Rock, Sally Atkins-Burnett, and Samuel Meisels (2001), *ECLS-K Base Year Public-Use Data Files and Electronic Codebook*. U.S. Department of Education, Washington, DC: National Center for Education Statistics. (NCES 2001-029).

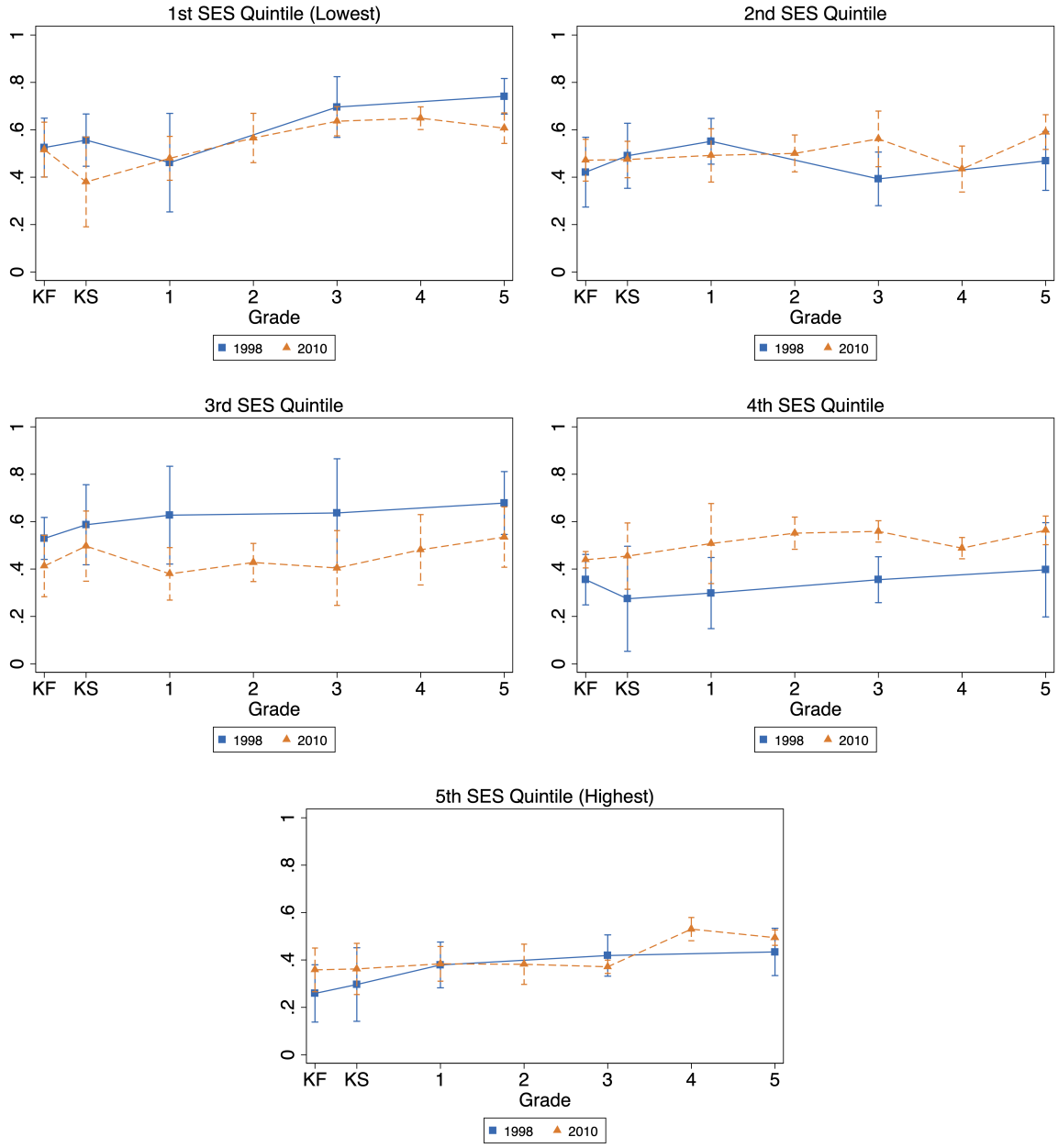
7 Figures

Figure 1: Female-Male Gaps in Teacher Ratings of Noncognitive Skills



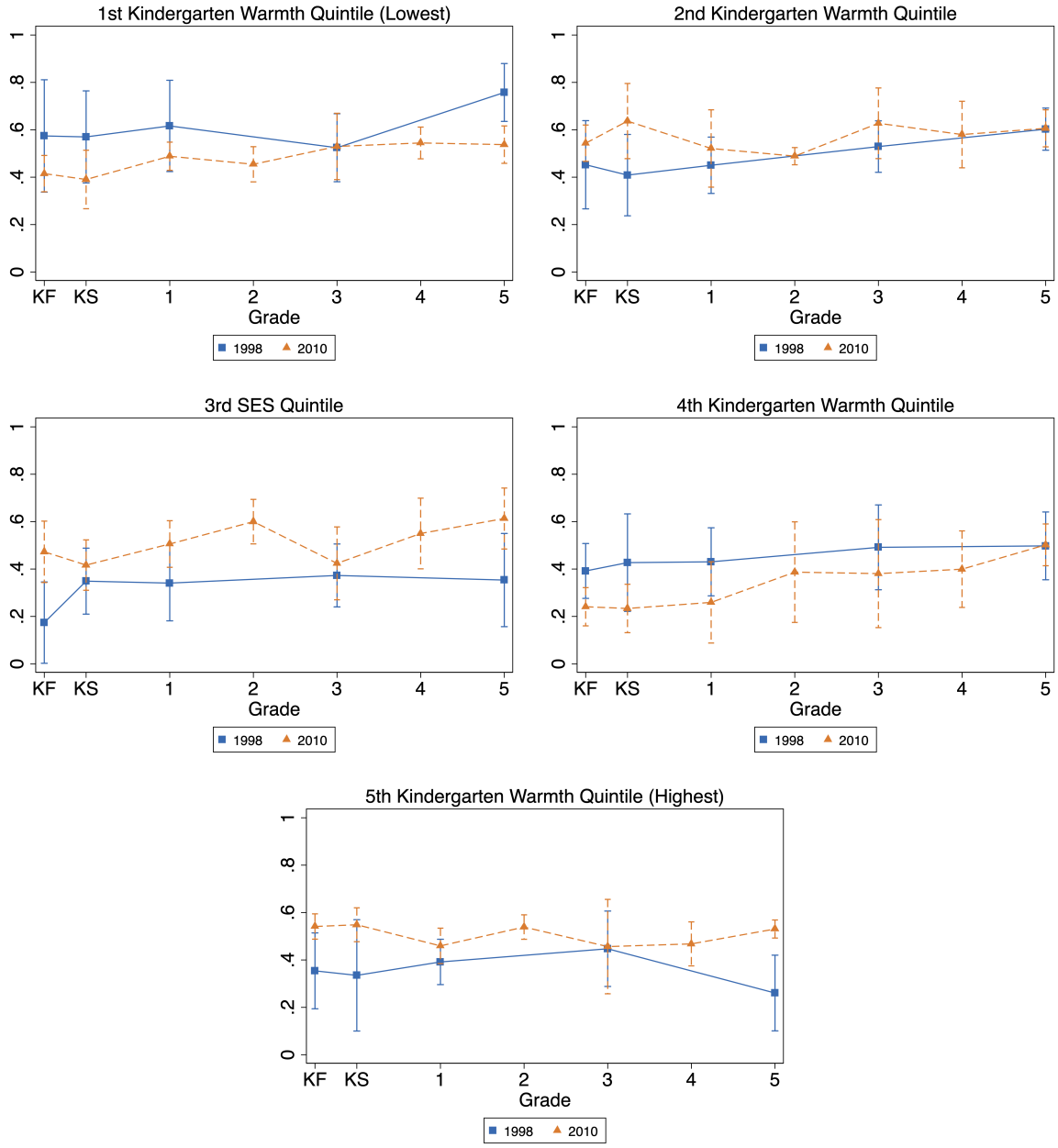
Notes: Each graph shows the coefficient on a female dummy from a regression of each respective teacher-reported noncognitive skill in each respective grade on a female dummy variable. KF refers to the fall of kindergarten, KS, refers to spring of kindergarten. Teacher ratings are standardized to have a mean of zero and standard deviation one in the population based on weighting after imposing the sample restrictions. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

Figure 2A: Female-Male Gaps in Latent Noncognitive Skill, By SES at Kindergarten



Notes: Each graph shows the sum of the coefficients on a female dummy, a female by 2010 cohort interaction term, a female by SES quintile interaction term, and a female by 2010 cohort by SES quintile interaction term (for the 2010 estimates) as well sum of the coefficients on a female dummy and a female by SES quintile interaction term (for the 1998 estimates) from a regression of latent noncognitive skill in each respective grade on a set of indicators for four quintiles of socioeconomic status in kindergarten interacted with female and cohort dummies. Controls for family structure at kindergarten, teen motherhood, HOME index at kindergarten, Warmth index at kindergarten, spanking at kindergarten, child race, and school locale at kindergarten are included. KF refers to the fall of kindergarten, KS, refers to spring of kindergarten. Teacher ratings are standardized to have a mean of zero and standard deviation one in the population based on weighting after imposing the sample restrictions. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

Figure 2B: Female-Male Gaps in Latent Noncognitive Skill, By Kindergarten Warmth Index



Notes: Each graph shows the sum of the coefficients on a female dummy, a female by 2010 cohort interaction term, a female by Warmth index quintile interaction term, and a female by 2010 cohort by Warmth index quintile interaction term (for the 2010 estimates) as well sum of the coefficients on a female dummy and a female by Warmth index quintile interaction term (for the 1998 estimates) from a regression of latent noncognitive skill in each respective grade on a set of indicators for four quintiles of Warmth index in kindergarten interacted with female and cohort dummies. Controls for family structure at kindergarten, teen motherhood, socioeconomic status at kindergarten, HOME index at kindergarten, spanking at kindergarten, child race, and school locale at kindergarten are included. KF refers to the fall of kindergarten, KS, refers to spring of kindergarten. Teacher ratings are standardized to have a mean of zero and standard deviation one in the population based on weighting after imposing the sample restrictions. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

8 Tables

Table 1: Sample Summary Statistics

Variable	2010 Cohort Mean	1998 Cohort Mean
White	0.58	0.61
Black	0.12	0.14
Hispanic	0.22	0.18
Asian	0.03	0.03
Other race/ethnicity	0.06	0.05
Female	0.49	0.49
School locale: City	0.30	0.36
School locale: Suburbs	0.35	0.42
School locale: Town or Rural	0.35	0.22
1st SES quintile (lowest)	0.14	0.17
2nd SES quintile	0.20	0.21
3rd SES quintile	0.23	0.20
4th SES quintile	0.21	0.21
5th SES quintile (highest)	0.21	0.21
Parents' Highest Education: Less than HS	0.10	0.09
Parents' Highest Education: High School	0.21	0.27
Parents' Highest Education: Some college	0.34	0.33
Parents' Highest Education: College or greater	0.35	0.31
Age first birth < 20	0.21	0.25
Age first birth ≥ 20 and < 30	0.56	0.59
Age first birth ≥ 30	0.22	0.16
Single mom	0.18	0.20
Both biological parents	0.73	0.69
Other family structure	0.09	0.11

Notes: Each cell shows the weighted mean of each variable in each respective dataset. Column 2 shows the means for the 2010 cohort, in the ECLS-K:2011 data, and column 3 shows the means for the 1998 cohort, in the ECLS-K data dataset. Sample restrictions are imposed as described in text. Fifth grade parent panel weights are used for each calculation.

Table 2: Changes in Female-Male Gaps in Teacher Ratings of Noncognitive Skills

Variable	Fall-K	Spring-K	Grade 1	Grade 3	Grade 5	Joint test *p*-value
Panel A: Unadjusted						
Externalizing behavior	-0.037	-0.068+	-0.038	-0.002	0.003	0.181
	[0.050]	[0.037]	[0.049]	[0.051]	[0.035]	
Self control	-0.006	-0.054	-0.073	0.007	0.002	0.215
	[0.044]	[0.041]	[0.049]	[0.069]	[0.039]	
Interpersonal skills	-0.011	0.006	-0.031	-0.014	-0.011	0.937
	[0.026]	[0.034]	[0.043]	[0.043]	[0.042]	
Approaches to learning	0.017	0.007	0.009	-0.028	-0.038	0.734
	[0.050]	[0.039]	[0.038]	[0.052]	[0.059]	
Internalizing problems	0.038	-0.031	-0.064	-0.081	-0.150**	0.000
	[0.044]	[0.041]	[0.058]	[0.070]	[0.033]	
Latent Noncognitive Skill	-0.014	-0.037	-0.054	-0.023	-0.019	0.531
	[0.035]	[0.038]	[0.045]	[0.061]	[0.043]	
Panel B: Adjusted						
Externalizing behavior	-0.022	-0.047	-0.023	0.025	0.030	0.400
	[0.052]	[0.039]	[0.048]	[0.044]	[0.032]	
Self control	0.008	-0.032	-0.053	0.036	0.031	0.345
	[0.041]	[0.045]	[0.045]	[0.058]	[0.036]	
Interpersonal skills	0.011	0.030	-0.006	0.013	0.018	0.926
	[0.024]	[0.030]	[0.042]	[0.031]	[0.035]	
Approaches to learning	0.039	0.035	0.037	0.002	-0.006	0.473
	[0.044]	[0.038]	[0.036]	[0.040]	[0.057]	
Internalizing problems	0.046	-0.016	-0.046	-0.065	-0.131**	0.000
	[0.043]	[0.044]	[0.058]	[0.061]	[0.030]	
Latent Noncognitive Skill	0.010	-0.010	-0.030	0.007	0.014	0.856
	[0.030]	[0.039]	[0.041]	[0.047]	[0.039]	

Standard errors in brackets
** p<0.01, * p<0.05, + p<0.1

Notes: Each cell shows the coefficient on an interaction term for female and 2010 data with each row measure in each column grade as the left hand side variable. The last column displays the p-value from a joint F-test of the null that the differences across all grades for each measure are zero. Teacher ratings and test scores are standardized to have a mean of zero and standard deviation one in the population based on weighting and sampling methodology correction after imposing the sample restrictions, with additional correction for reference bias. Regressions in panel B include controls for race, school locale, family background, and parental inputs as reported at kindergarten. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

Table 3A: Noncognitive Skills Correlation Matrix

	Externalizing	Self control	Interpersonal skills	Approaches to learn	Internalizing
Externalizing behavior	1.000	0.726	0.621	0.587	0.295
Self control	0.726	1.000	0.803	0.687	0.305
Interpersonal skills	0.621	0.803	1.000	0.715	0.345
Approaches to learning	0.587	0.687	0.715	1.000	0.371
Internalizing problems	0.295	0.305	0.345	0.371	1.000

Notes: Results are shown from a weighted correlation matrix of all five standardized noncognitive skills across all grades and cohorts. Fifth grade parent panel weights are used for this calculation.

Table 3B: Factor Loadings, Scores, and Uniqueness

	Eigenvalue	Proportion Explained	
	2.879	1.064	
Noncog Variables	Factor Loadings	Factor Scores	Uniqueness
Externalizing behavior	0.754	0.161	0.422
Self control	0.888	0.380	0.197
Interpersonal skills	0.863	0.296	0.255
Approaches to learning	0.787	0.199	0.368
Internalizing problems	0.397	0.058	0.811

Notes: Results are shown from an unrotated principal factor analysis of all five standardized noncognitive skills across all grades and cohorts. Fifth grade parent panel weights are used for this calculation. Results for further factors are not displayed due to low eigenvalues.

Table 4: Oaxaca-Blinder Decomposition of Fifth Grade Gender Gaps: Latent Noncognitive Skill

Cohort	Predicted Gender Gap (girls − boys)	Unexplained	Due to X's
Panel A: Boys' X's, Girls' Betas			
2010	0.549**	0.553**	-0.005
	[0.035]	[0.032]	[0.010]
1998	0.558**	0.542**	0.015
	[0.042]	[0.039]	[0.016]
Difference	-0.009	0.011	-0.020
	[0.055]	[0.050]	[0.019]
Panel B: Girls' X's, Boys' Betas			
2010	0.549**	0.555**	-0.006
	[0.034]	[0.033]	[0.015]
1998	0.558**	0.512**	0.045*
	[0.044]	[0.038]	[0.020]
Difference	-0.009	0.043	-0.052*
	[0.055]	[0.051]	[0.025]

Bootstrapped standard errors in brackets
** p<0.01, * p<0.05, + p<0.1

Notes: The Oaxaca-Blinder decompositions shown here are performed as described in text. Gender gaps as reported in the first column are the predicted gender gap from a regression of each measure on family background, parental input, racial demographics, and school locale measures as reported at kindergarten interacted separately by cohort and gender. Standard errors are bootstrapped with 100 replications, with each rows' estimates produced jointly in each bootstrapping procedure. Sample restrictions are imposed as described in text. Fifth grade parent panel weights are used for these estimates.

Table 5: Kindergarten Family Background Characteristics, By Gender and Cohort

	2010 Cohort			1998 Cohort			Diff-in-Diff
Variable	Girls	Boys	Difference	Girls	Boys	Difference	
1st SES quintile (lowest)	0.144	0.141	0.002	0.151	0.172	-0.022	0.024
	[0.021]	[0.024]	[0.007]	[0.007]	[0.024]	[0.021]	[0.022]
2nd SES quintile	0.213	0.193	0.020**	0.203	0.219	-0.016	0.036**
	[0.013]	[0.008]	[0.007]	[0.013]	[0.011]	[0.011]	[0.013]
3rd SES quintile	0.223	0.237	-0.013+	0.199	0.209	-0.010	-0.003
	[0.009]	[0.005]	[0.007]	[0.008]	[0.022]	[0.027]	[0.028]
4th SES quintile	0.204	0.218	-0.013**	0.227	0.190	0.036**	-0.050**
	[0.016]	[0.014]	[0.005]	[0.009]	[0.008]	[0.013]	[0.014]
5th SES quintile (highest)	0.215	0.212	0.004	0.221	0.210	0.011	-0.007
	[0.009]	[0.014]	[0.008]	[0.013]	[0.011]	[0.012]	[0.014]
F-test jointly zero *p*-value			0.000			0.008	0.000
Age first birth < 20	0.219	0.210	0.009	0.239	0.253	-0.014	0.023
	[0.018]	[0.012]	[0.009]	[0.020]	[0.012]	[0.017]	[0.019]
More than 20 years old	0.781	0.790	-0.009	0.761	0.747	0.014	-0.023
	[0.018]	[0.012]	[0.009]	[0.020]	[0.012]	[0.017]	[0.019]
F-test jointly zero *p*-value			0.308			0.429	0.241
Single mom	0.181	0.187	-0.005	0.193	0.200	-0.007	0.001
	[0.005]	[0.013]	[0.009]	[0.011]	[0.009]	[0.008]	[0.012]
Both biological parents	0.728	0.729	-0.001	0.697	0.689	0.007	-0.008
	[0.005]	[0.016]	[0.018]	[0.011]	[0.012]	[0.012]	[0.021]
Other family structure	0.090	0.084	0.006	0.110	0.111	-0.001	0.007
	[0.007]	[0.006]	[0.010]	[0.007]	[0.011]	[0.008]	[0.013]
F-test jointly zero *p*-value			0.201			0.704	0.854

Standard errors in brackets

** p<0.01, * p<0.05, + p<0.1

Notes: Columns 1-2 and 4-5 show the means of each row measure for each gender in the 2010 and 1998 cohort, respectively. Columns 3 and 6 show the difference between coefficients in columns 1-2 and 4-5, respectively. Column 7 shows the difference between columns 3 and 6. Significance stars are only included in columns 3, 6, and 7. Estimates are calculated by regressing each grouping of measures simultaneously (using SUR) on a female dummy, a 2010 cohort dummy, and a female by 2010 cohort dummy. The final rows of each section shows the p-value from a joint F-test of the null that the coefficients from a regression on a female dummy in each cohort on all listed measures are jointly zero. Sample is restricted as reported in the text. Observations are weighted using fifth grade parent panel weights for the 1998 cohort and fifth grade panel weights for the 2010 cohort. Standard errors are heteroskedasticity robust and clustered at the primary sampling unit level.

Table 6: Kindergarten Parental Inputs, By Gender and Cohort

	2010 Cohort			1998 Cohort			Diff-in-Diff
Variable	Girls	Boys	Difference	Girls	Boys	Difference	
Kindergarten HOME index	0.034	-0.033	0.067+	0.082	-0.082	0.163**	-0.096+
	[0.026]	[0.025]	[0.036]	[0.030]	[0.031]	[0.043]	[0.056]
Kindergarten Warmth index	-0.002	0.002	-0.004	0.058	-0.058	0.116**	-0.120*
	[0.025]	[0.024]	[0.035]	[0.027]	[0.035]	[0.044]	[0.056]
Spanked child last week, kindergarten	0.149	0.169	-0.020	0.260	0.276	-0.015	-0.004
	[0.009]	[0.009]	[0.013]	[0.013]	[0.014]	[0.019]	[0.023]

Standard errors in brackets
** p<0.01, * p<0.05, + p<0.1

Notes: Columns 1-2 and 4-5 show the means of each row measure for each gender in the 2010 and 1998 cohort, respectively. Columns 3 and 6 show the difference between coefficients in columns 1-2 and 4-5, respectively. Column 7 shows the difference between columns 3 and 6. Significance stars are only included in columns 3, 6, and 7. Estimates are calculated by regressing each row measure on a female dummy, a 2010 cohort dummy, and a female by 2010 cohort dummy. The final rows of each section shows the p-value from a joint F-test of the null that the coefficients from a regression on a female dummy in each cohort on all listed measures are jointly zero. Sample is restricted as reported in the text. Observations are weighted using fifth grade parent panel weights for the 1998 cohort and fifth grade panel weights for the 2010 cohort. Standard errors are heteroskedasticity robust and clustered at the primary sampling unit level.

Table 7A: Changes in Gender Gaps Between Cohorts
The Role of Socioeconomic Status at Kindergarten

Latent Noncognitive Skill In:	Fall-K	Grade 3	Grade 5
1st SES quintile (lowest)	-0.009	-0.060	-0.135**
	[0.086]	[0.074]	[0.049]
2nd SES quintile	0.050	0.169*	0.122+
	[0.088]	[0.081]	[0.073]
3rd SES quintile	-0.116	-0.232+	-0.144
	[0.079]	[0.139]	[0.094]
4th SES quintile	0.084	0.204**	0.166
	[0.056]	[0.053]	[0.105]
5th SES quintile (highest)	0.099	-0.048	0.060
	[0.077]	[0.046]	[0.054]
Joint F-test of no change *p*-value	0.253	0.000	0.001

Standard errors in brackets

** p<0.01, * p<0.05, + p<0.1

Notes: Each estimate shows the coefficients on a female by 2010 cohort by SES quintile interaction term from a regression of latent noncognitive skill in each respective grade on a set of indicators for four quintiles of socioeconomic status in kindergarten interacted with female and cohort dummies. Controls for family structure at kindergarten, teen motherhood, HOME index at kindergarten, Warmth index at kindergarten, spanking at kindergarten, child race, and school locale at kindergarten are included. Teacher ratings are standardized to have a mean of zero and standard deviation one in the population based on weighting after imposing the sample restrictions. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

Table 7B: Changes in Gender Gaps Between Cohorts
The Role of Kindergarten Warmth Index

Latent Noncognitive Skill In:	Fall-K	Grade 3	Grade 5
1st Kindergarten Warmth quintile (lowest)	-0.182	-0.012	-0.232**
	[0.130]	[0.101]	[0.077]
2nd Kindergarten Warmth quintile	0.084	0.092	-0.001
	[0.105]	[0.095]	[0.059]
3rd Kindergarten Warmth quintile	0.285*	0.042	0.254*
	[0.113]	[0.106]	[0.119]
4th Kindergarten Warmth quintile	-0.158*	-0.120	-0.000
	[0.071]	[0.150]	[0.086]
5th Kindergarten Warmth quintile (highest)	0.178*	0.003	0.265**
	[0.086]	[0.125]	[0.085]
Joint F-test of no change *p*-value	0.001	0.835	0.000

Standard errors in brackets

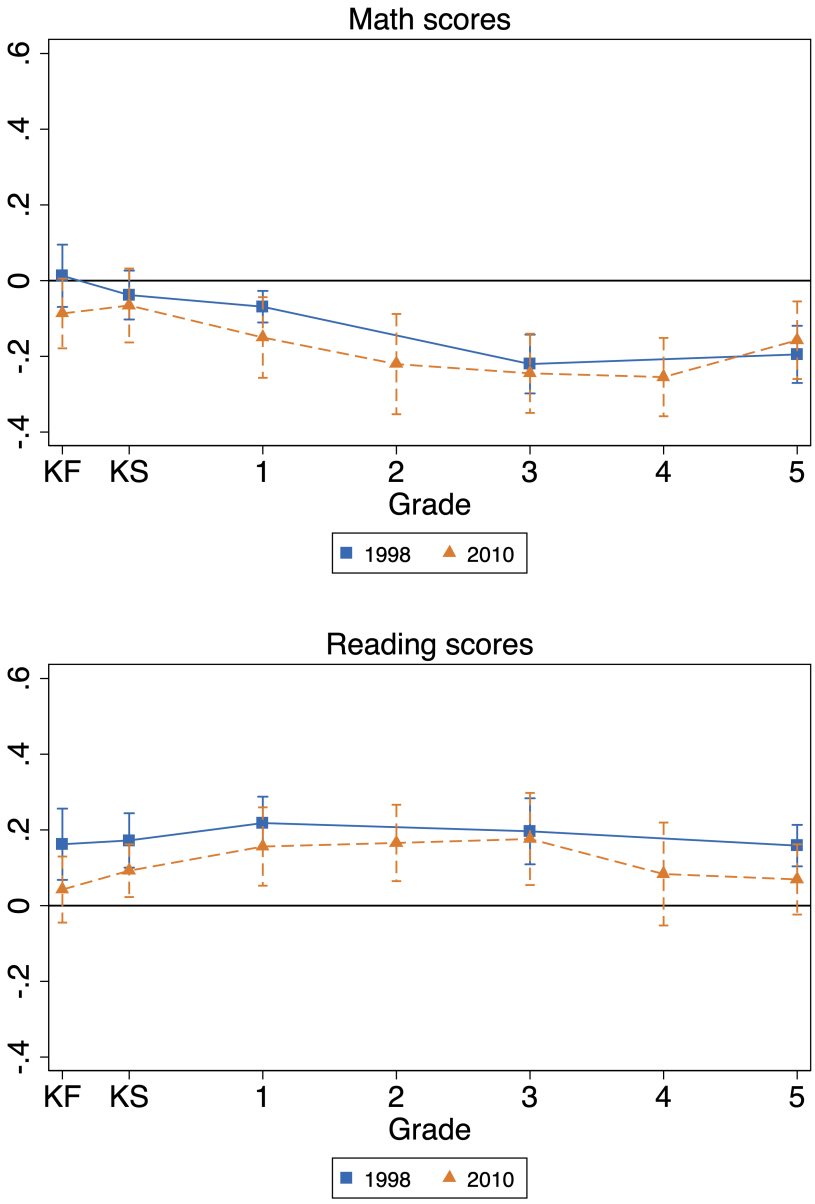
** p<0.01, * p<0.05, + p<0.1

Notes: Each estimate shows the coefficients on a female by 2010 cohort by kindergarten Warmth index quintile interaction term from a regression of latent noncognitive skill in each respective grade on a set of indicators for four quintiles of socioeconomic status in kindergarten interacted with female and cohort dummies. Controls for family structure at kindergarten, teen motherhood, SES at kindergarten, HOME index at kindergarten, spanking at kindergarten, child race, and school locale at kindergarten are included. Teacher ratings are standardized to have a mean of zero and standard deviation one in the population based on weighting after imposing the sample restrictions. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

9 Online Appendix

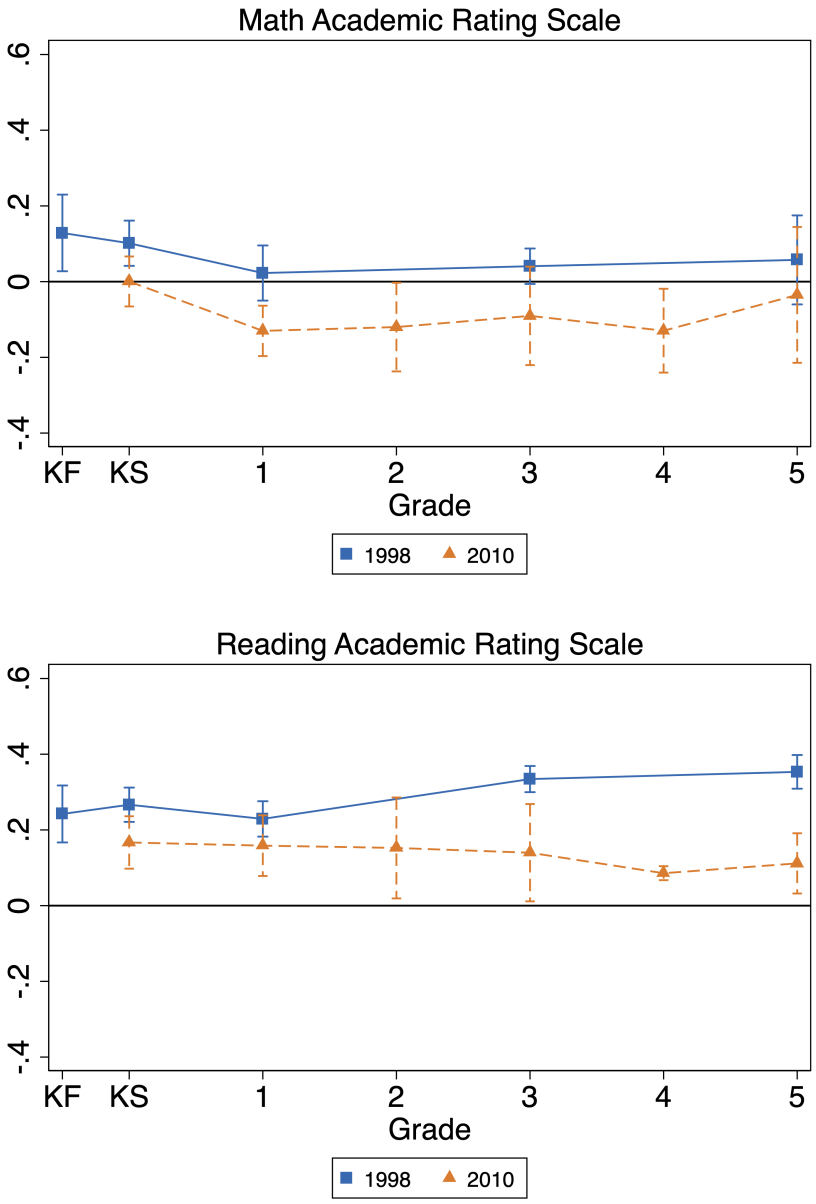
9.1 Appendix Figures

Figure A1: Female-Male Gaps in Test Scores



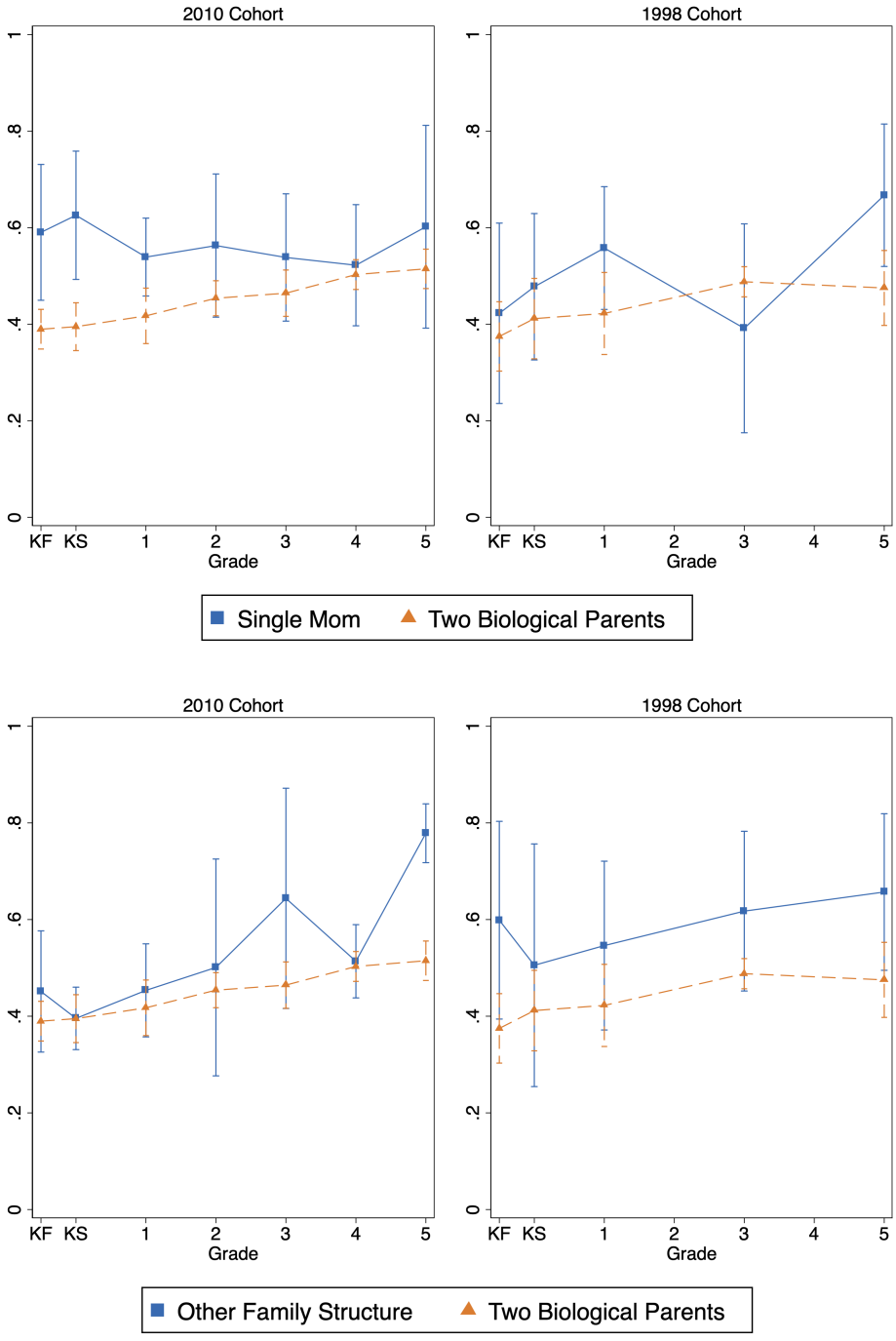
Notes: Each graph shows the coefficient on a female dummy from a regression of each test score in each respective grade on a female dummy variable. KF refers to the fall of kindergarten, KS, refers to spring of kindergarten. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

Figure A2: Female-Male Gaps in Teacher Cognitive Evalutions



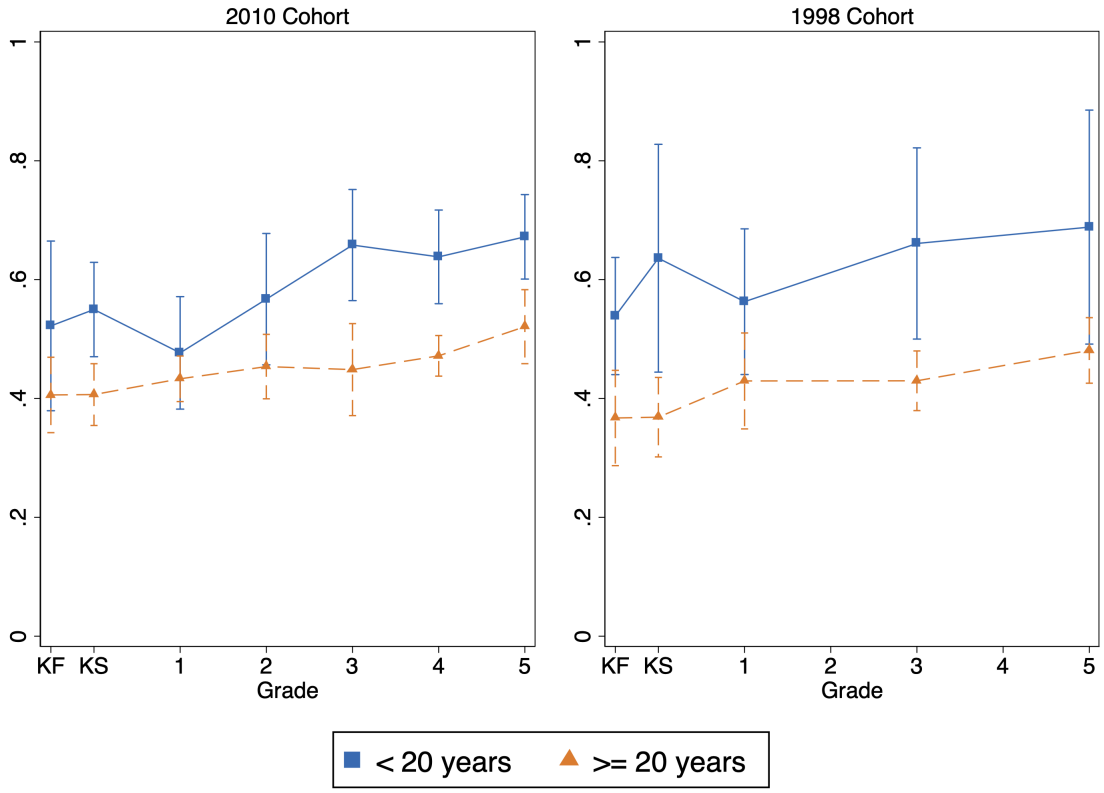
Notes: Each graph shows the coefficient on a female dummy from a regression of each respective teacher-reported rating of cogntive ability in each respective grade on a female dummy variable. Academic Rating Scores were not reported for the 2010 Cohort Fall-Kindergarten survey wave. KF refers to the fall of kindergarten, KS, refers to spring of kindergarten. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

Figure A3A: Female-Male Gaps in Latent Noncognitive Skill, By Kindergarten Family Structure



Notes: Estimates for each grade in all four graphs come from one regression of latent noncognitive skill in each grade with controls for teen motherhood, SES at kindergarten, HOME index at kindergarten, Warmth index at kindergarten, spanking at kindergarten, child race, and school locale at kindergarten. Separate estimates of gender gaps for each cohort and subgroup are produced using interaction terms for gender and cohort. Two biological parent estimates are the same in both rows. KF refers to the fall of kindergarten, KS, refers to spring of kindergarten. Teacher ratings are standardized to have a mean of zero and standard deviation one in the population based on weighting after imposing the sample restrictions and reference bias corrections are imposed. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

Figure A3B: Female-Male Gaps in Latent Noncognitive Skill, By Mother's Age at First Birth



Notes: Estimates for each grade in both graphs come from one regression of latent noncognitive skill in each grade with controls for family structure at kindergarten, SES at kindergarten, HOME index at kindergarten, Warmth index at kindergarten, spanking at kindergarten, child race, and school locale at kindergarten. Separate estimates of gender gaps for each cohort and subgroup are produced using interaction terms for gender and cohort. KF refers to the fall of kindergarten, KS, refers to spring of kindergarten. Teacher ratings are standardized to have a mean of zero and standard deviation one in the population based on weighting after imposing the sample restrictions and reference bias corrections are imposed. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

9.2 Appendix Tables

Table A1: Kindergarten Parental Inputs, By Gender

	2010 Cohort			1998 Cohort			
Variable	Girls	Boys	Difference	Girls	Boys	Difference	
Kindergarten HOME index	0.034	-0.033	0.067+	0.082	-0.082	0.163**	-0.096+
	[0.026]	[0.025]	[0.036]	[0.030]	[0.031]	[0.043]	[0.056]
Read book to child 3+ times per week	0.883	0.868	0.015	0.837	0.794	0.043*	-0.028
	[0.008]	[0.008]	[0.012]	[0.011]	[0.013]	[0.017]	[0.021]
Child has $\geq$20 books around house	0.874	0.866	0.008	0.887	0.857	0.030*	-0.023
	[0.009]	[0.008]	[0.012]	[0.009]	[0.011]	[0.015]	[0.019]
Visited the library	0.618	0.571	0.047**	0.572	0.550	0.021	0.026
	[0.012]	[0.012]	[0.017]	[0.015]	[0.015]	[0.021]	[0.027]
Gone to a play/concert/show	0.426	0.410	0.016	0.422	0.346	0.076**	-0.060*
	[0.012]	[0.012]	[0.017]	[0.015]	[0.014]	[0.021]	[0.027]
Visited art/musuem/historical site	0.338	0.344	-0.006	0.308	0.297	0.011	-0.017
	[0.012]	[0.011]	[0.016]	[0.014]	[0.014]	[0.020]	[0.025]
Child reads outside school 3+ times per week	0.249	0.009	0.241**	0.139	-0.309	0.448**	-0.207**
	[0.021]	[0.024]	[0.032]	[0.026]	[0.034]	[0.042]	[0.053]
Have home computer child uses	0.761	0.764	-0.003	0.602	0.563	0.038+	-0.041
	[0.011]	[0.011]	[0.015]	[0.015]	[0.015]	[0.021]	[0.026]
Child engages in other outside school activity	0.753	0.740	0.012	0.683	0.629	0.054*	-0.041
	[0.011]	[0.011]	[0.016]	[0.014]	[0.015]	[0.021]	[0.026]
Kindergarten Warmth index	-0.002	0.002	-0.004	0.058	-0.058	0.116**	-0.120*
	[0.025]	[0.024]	[0.035]	[0.027]	[0.035]	[0.044]	[0.056]
Warm, close times together	0.962	0.950	0.012+	0.956	0.947	0.009	0.002
	[0.005]	[0.005]	[0.007]	[0.007]	[0.008]	[0.011]	[0.013]
Child likes me	0.981	0.970	0.011*	0.979	0.968	0.012	-0.001
	[0.003]	[0.004]	[0.005]	[0.004]	[0.007]	[0.008]	[0.009]
Always show child love	0.931	0.934	-0.004	0.870	0.862	0.008	-0.011
	[0.006]	[0.006]	[0.008]	[0.010]	[0.010]	[0.015]	[0.017]
Express affection	0.992	0.985	0.007+	0.986	0.976	0.010*	-0.004
	[0.002]	[0.003]	[0.004]	[0.002]	[0.004]	[0.005]	[0.006]
Being parent harder than I thought (reverse)	0.413	0.420	-0.007	0.522	0.513	0.009	-0.015
	[0.012]	[0.012]	[0.017]	[0.015]	[0.015]	[0.021]	[0.027]
Child does things that bother me (reverse)	0.916	0.902	0.014	0.912	0.882	0.030*	-0.016
	[0.006]	[0.007]	[0.010]	[0.008]	[0.011]	[0.014]	[0.017]
Sacrifice to meet child's needs (reverse)	0.715	0.751	-0.036*	0.767	0.754	0.013	-0.050*
	[0.012]	[0.010]	[0.016]	[0.013]	[0.013]	[0.018]	[0.024]
Often feel angry with child (reverse)	0.988	0.985	0.003	0.984	0.985	-0.002	0.004
	[0.002]	[0.003]	[0.004]	[0.004]	[0.004]	[0.005]	[0.007]
Spanked child last week, kindergarten	0.149	0.169	-0.020	0.260	0.276	-0.015	-0.004
	[0.009]	[0.009]	[0.013]	[0.013]	[0.014]	[0.019]	[0.023]

Standard errors in brackets
** p<0.01, * p<0.05, + p<0.1

Notes: Columns 1-2 and 4-5 show the means of each row measure for each gender in the 2010 and 1998 cohort, respectively. Columns 3 and 6 show the difference between coefficients in columns 1-2 and 4-5, respectively. Column 7 shows the difference between columns 3 and 6. Significance stars are only included in columns 3, 6, and 7. Estimates are calculated by regressing each row measure on a female dummy, a 2010 cohort dummy, and a female by 2010 cohort dummy. The final rows of each section shows the p-value from a joint F-test of the null that the coefficients from a regression on a female dummy in each cohort on all listed measures are jointly zero. Sample is restricted as reported in the text. Observations are weighted using fifth grade parent panel weights for the 1998 cohort and fifth grade panel weights for the 2010 cohort. Standard errors are heteroskedasticity robust and clustered at the primary sampling unit level.

Table A2: Fifth Grade Joint Returns, by Gender and Cohort

Latent Noncognitive Skill in Fifth Grade	2010 Cohort			1998 Cohort			Diff-in-Diff
	Girls	Boys	Difference	Girls	Boys	Difference	
Lower kindergarten HOME index	0.039*	0.016	0.023	0.038+	0.023*	0.014	0.009
	[0.015]	[0.011]	[0.021]	[0.023]	[0.011]	[0.029]	[0.036]
Lower kindergarten Warmth index	-0.040+	-0.048	0.008	-0.022*	-0.166**	0.145**	-0.137**
	[0.022]	[0.034]	[0.014]	[0.011]	[0.030]	[0.029]	[0.032]
Spanked child last week, kindergarten	-0.178**	-0.192**	0.014	-0.083	-0.154**	0.072	-0.057
	[0.035]	[0.011]	[0.039]	[0.056]	[0.046]	[0.051]	[0.064]
Single mom	-0.279**	-0.343**	0.064	-0.156**	-0.286**	0.130	-0.066
	[0.103]	[0.030]	[0.112]	[0.035]	[0.068]	[0.081]	[0.136]
Other family structure	-0.314**	-0.547**	0.233**	-0.320**	-0.428**	0.108	0.125
	[0.057]	[0.047]	[0.039]	[0.062]	[0.083]	[0.083]	[0.092]
Age first birth < 20	0.002	-0.110*	0.112	-0.214*	-0.353**	0.138	-0.027
	[0.039]	[0.044]	[0.080]	[0.095]	[0.048]	[0.123]	[0.147]
1st SES quintile (lowest)	-0.397**	-0.402**	0.005	-0.262*	-0.400**	0.138	-0.134
	[0.065]	[0.063]	[0.041]	[0.127]	[0.046]	[0.122]	[0.127]
2nd SES quintile	-0.330**	-0.333**	0.003	-0.325**	-0.269**	-0.056	0.059
	[0.055]	[0.068]	[0.064]	[0.094]	[0.047]	[0.096]	[0.113]
3rd SES quintile	-0.261**	-0.255**	-0.005	-0.090+	-0.278**	0.188**	-0.193*
	[0.086]	[0.059]	[0.059]	[0.048]	[0.031]	[0.051]	[0.079]
4th SES quintile	-0.099**	-0.147*	0.047	-0.129+	-0.074	-0.054	0.102
	[0.020]	[0.056]	[0.043]	[0.066]	[0.046]	[0.092]	[0.102]
SES F-test of jointly zero, *p*-value			0.345			0.000	0.000

Standard errors in brackets
** p<0.01, * p<0.05, + p<0.1

Notes: Estimates are produced from one regression of latent noncognitive skill in fifth grade on both sets of three parental inputs and family background measures at kindergarten interacted fully with a set of dummy variables for female and 2010 cohort. Kindergarten HOME and Warmth indices used in this regression are multiplied by negative one to match the direction of the other measures in the table. The first two rows, the only continuous measures, report differing slopes between the subgroups. The remaining columns and rows report estimates as follows.1998 boys: coefficient on row variable. 1998 girls: sum of coefficients on row variable and row variable by female interaction term. 1998 difference: coefficient on row variable by female interaction term. 2010 boys: sum of coefficients on row variable and row variable by 2010 cohort interaction term. 2010 girls: sum of coefficients on row variable, row variable by 2010 cohort interaction term, row variable by female interaction term, and row variable by female by 2010 cohort interaction term. 2010 difference: sum of coefficients on row variable by female interaction term, and row variable by female by 2010 cohort interaction term. Diff-in-diff: coefficient on row variable by female by 2010 cohort interaction term. Controls for child race and school locale at kindergarten are included. Teacher ratings are standardized to have a mean of zero and standard deviation one in the population based on weighting after imposing the sample restrictions. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

Table A3A: Changes in Gender Gaps Between Cohorts
The Role of Family Structure at Kindergarten

Category	Fall-K	Grade 3	Grade 5
Single mom	0.168	0.147	-0.065
	[0.115]	[0.127]	[0.128]
Both biological parents	0.015	-0.024	0.040
	[0.043]	[0.027]	[0.045]
Other family structure	-0.147	0.026	0.122
	[0.118]	[0.138]	[0.087]
Joint F-test of no change *p*-value	0.265	0.366	0.441

Standard errors in brackets

** p<0.01, * p<0.05, + p<0.1

Notes: Each estimate shows the coefficients on a female by 2010 cohort by family structure category interaction term from a regression of latent noncognitive skill in each respective grade on a set of indicators for single motherhood and other family structure at kindergarten interacted with female and cohort dummies. Controls for socioeconomic status at kindergarten, teen motherhood, HOME index at kindergarten, Warmth index at kindergarten, spanking at kindergarten, child race, and school locale at kindergarten are included. Teacher ratings are standardized to have a mean of zero and standard deviation one in the population based on weighting after imposing the sample restrictions. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.

Table A3B: Changes in Gender Gaps Between Cohorts
The Role of Mother's Age at First Birth

Category	Fall-K	Grade 3	Grade 5
Less than 20 years old	-0.017	-0.003	-0.016
	[0.087]	[0.093]	[0.106]
More than 20 years old	0.039	0.019	0.040
	[0.052]	[0.045]	[0.042]
Joint F-test of no change *p*-value	0.649	0.842	0.636

Standard errors in brackets

** p<0.01, * p<0.05, + p<0.1

Notes: Each estimate shows the coefficients on a female by 2010 cohort by teen motherhood interaction term from a regression of latent noncognitive skill in each respective grade on an indicator for teen motherhood with female and cohort dummies. Controls for socioeconomic status at kindergarten, family structure at kindergarten, HOME index at kindergarten, Warmth index at kindergarten, spanking at kindergarten, child race, and school locale at kindergarten are included. Teacher ratings are standardized to have a mean of zero and standard deviation one in the population based on weighting after imposing the sample restrictions. Please refer to the text for sample restrictions. Observations are weighted using fifth grade parent panel weights, with robust standard errors and clustering at the primary sampling unit level.