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MATERNAL EDUCATION, PARENTAL INVESTMENT AND NON-COGNITIVE SKILLS IN RURAL CHINA

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ABSTRACT

The importance of non-cognitive skills in determining long-term human capital and labor market outcomes is widely acknowledged, but relatively little is known about how educational investments by parents may respond to non-cognitive skills early in life. This paper evaluates the parental response to variation in non-cognitive skills among their children in rural Gansu province, China, employing a household fixed effects specification; non-cognitive skills are defined as the inverse of both externalizing challenges (behavioral problems and aggression) and internalizing challenges (anxiety and withdrawal). The results suggest that on average, parents invest no more in terms of educational expenditure in children who have better non-cognitive skills relative to their siblings. However, there is significant heterogeneity with respect to maternal education; less educated mothers appear to reinforce differences in non-cognitive skills between their children, while more educated mothers compensate for these differences. Most importantly, there is evidence that these compensatory investments lead to catch-up in non-cognitive skills over time for children of more educated mothers.

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1 Introduction

In recent years, both research and policy debates have placed increasing emphasis on the importance of non-cognitive skills in determining long-term economic outcomes. Data primarily from industrialized countries has suggested that non-cognitive skills have a large impact on adult economic welfare, measured as earnings and labor productivity (Heckman and Rubinstein, 2001; Heckman, Stixrud and Urzua, 2006; Cunha, Heckman, Lochner and Masterov, 2006; Carneiro, Crawford and Goodman, 2007). There are many causal pathways through which stronger non-cognitive skills may lead to improved educational and economic outcomes: individuals with enhanced skills are more likely to be persistent in achieving strong academic outcomes or building professional expertise, may be more resilient in the face of setbacks, or may be better able to forge useful professional relationships. One particularly important channel, however, is the relationship forged much earlier in life between children and their parents.

Variation in non-cognitive skills may affect parental investments in several ways. First, this variation could alter the weight that a parent places on a child's welfare. Parents could favor a child with stronger non-cognitive skills with whom they forge a stronger relationship, or a child with weaker non-cognitive skills if he seems to require more nurturing. Second, even if the weight parents place on their children's welfare is unchanged, non-cognitive skills will affect children's future income, and may affect the returns to human capital investment in a given child. Depending on whether parents emphasize efficiency or equality, they may then invest more or less in human capital development for children of varying levels of non-cognitive skills.

Ultimately, we may observe compensatory patterns of investment, in which parents invest more in a relatively weaker child, or reinforcing behavior, in which parents invest more in a stronger child; the question of which pattern is dominant is an important question in family economics going back to Becker. Moreover, given that a number of evaluations have found that targeted early intervention can affect children's non-cognitive skills,[1] understanding whether these interventions crowd parental investment in or out may be a useful contribution to the ongoing policy debate.

The objective of this paper is to analyze whether non-cognitive skills measured in childhood and adolescence have a significant impact on the within-household allocation of educational expenditure among households in rural Gansu province, China. We employ a panel dataset that provides a detailed set of outcome measures for a large cohort of children in one of the poorest provinces in China; non-cognitive skills are measured via direct surveys of the sampled children, and defined as the inverse of externalizing challenges (behavioral problems and aggression) and internalizing challenges (withdrawal and anxiety). Focusing on a sample of two-children families, our primary specification examines how parents respond to differences in non-cognitive skills conditional on household fixed effects, and whether this response varies based on the characteristics of the parents.

[1] The results from the Perry preschool study as reported in Schweinhart et al. (2005) are among the best known in this respect.

Our results suggest that while parents are not responsive to differences in non-cognitive skills on average—neither reinforcing nor compensating for these differences—there is significant heterogeneity with respect to characteristics of the parents, and particularly the mother. Households with more educated mothers show evidence of significantly more compensatory investment compared to households with less educated mothers. For a child who exhibits non-cognitive skills one standard deviation lower than his sibling, an increase in maternal education from the 25th to the 75th percentile, or from one to six years of education, would result in an increase in discretionary educational expenditure (comprising all educational expenditure excluding tuition) directed to this child of nearly 35%; there is no comparable effect observed for tuition. In addition, there is very little evidence of comparable heterogeneity with respect to the education of the father.

One potential challenge faced in this analysis is that non-cognitive skills may in fact be partly an outcome of previous parental investment, rather than an endowment; if there is some serial correlation in parental investment, this will generate bias toward the detection of a reinforcing pattern of expenditure. We address this challenge in several ways. First, we demonstrate that bias on the interaction effect including maternal education will only arise specific assumptions that do not seem to be supported by the empirical evidence. Second, we present evidence that the results are robust to several alternate specifications, including the use of earlier measurements of non-cognitive skills and directly controlling for past expenditure.

This observed pattern of heterogeneous response—more compensation in households with a more educated mother—could be consistent with a number of possible channels. More educated mothers may simply be better able to recognize the non-cognitive deficits in their children and to compensate appropriately. Maternal education may be a proxy for income or other household characteristics, and higher-income households may have a preference for intrahousehold compensation. Alternatively, women (or more educated women in particular) may have a preference for compensatory investment, and the ability to impose these preferences within the household.

Further exploration suggests that the first two channels are not particularly salient in this context: there is little evidence consistent with parental learning or higher income leading to a compensatory response by more educated mothers. However, it does seem that more educated mothers may have both a greater preference for compensatory investment and higher bargaining power, enabling them to exert more influence over the allocation of expenditure within a household.

In the final section of the paper, we analyze whether this variation in compensatory vis-a-vis reinforcing behavior results in catch-up in non-cognitive skills over time for children in households with more educated mothers—where struggling children receive greater investment—compared to children in households with less educated mothers. Analyzing longitudinal data observed for the first-born child over time, we find evidence of significantly greater catch-up in non-cognitive skills between ages 9-12 and ages 17-20 for children of more educated mothers. In other words, the correlation between maternal education and non-cognitive skills becomes more pronounced as children

age: in the first wave, the observed cross-household correlation between a dummy for a mother of high maternal education and the percentile measures of non-cognitive skills is essentially zero. In the second wave, the correlation has increased in magnitude to .028, and by the third wave, .151. This result highlights the importance of maternal education on the formation of non-cognitive abilities, and contributes to the literature on the importance of maternal education on child development (Carneiro et al., 2013; Currie, 2009). If the economic returns to non-cognitive skills are significant, this is a channel through which inequality across households can widen over time.

Our paper contributes to several related literatures on intrahousehold allocation and human capital investment. First, there is an extensive literature examining parental responses to differences in children's endowment; Almond and Mazumder (2013) provide a recent review. The evidence has been mixed. Bharadwaj et al. (2013b), Royer (2009), and Almond and Currie (2011) find little or no evidence of either compensatory or reinforcing behavior. Akresh et al. (2012), Rosenzweig and Zhang (2009), Frijters et al. (2013), Almond et al. (2009), Adhvaryu and Nyshadham (2014) and Aizer and Cunha (2012) find parents exhibit reinforcing behavior in Burkina Faso, China, Sweden, Tanzania, and the United States, while Del Bono et al. (2012) find evidence of compensatory behavior in breast-feeding decisions and birth weight and Black et al. (2010) provide some indirect evidence of compensatory behavior in a robustness check. Bharadwaj et al. (2013a) find compensatory investment with respect to initial health comparing across siblings, but comparing across twins, there is no evidence of either compensatory or reinforcing behaviors. Leight (2014) finds evidence of compensatory behavior with respect to height-for-age using the same sample as this paper. This literature, however, focuses primarily on parental responses to children's health endowment and cognitive ability. Our paper is one of the first papers that examines whether parents respond to children's non-cognitive skills in the allocation of human capital investment.[2]

Second, our paper finds that maternal education plays an important role in determining the allocation of parental investment. This is similar to the results reported in Hsin (2012) and Restropo (2016), who conclude that households with less educated mothers generally exhibit reinforcing investment behavior, while households with more educated mothers exhibit compensatory behavior. However, neither of these papers examine the father's education level; instead, they analyze maternal education as a proxy for household socioeconomic status. In light of these findings, a recent review by Almond and Currie (2011) suggests that the observed pattern could be due to credit constraints in low socioeconomic status households, or a high elasticity of substitution between consumption and human capital investment in these households.

In our context, we are able to rule out these two channels given the absence of any evidence of heterogeneity with respect to the father's education and household income. Rather, we present additional results that suggest differential preferences and bargaining power for more educated

[2]The only other relevant paper is Gelber and Isen (2013). While it is not the focus of their work, they report in their appendix that parents respond positively to a child with greater observed non-cognitive abilities, but they do not further investment the heterogeneity by mother's education.

women are the primary channels for the differential compensatory response in households with more educated mothers.

Third, there is growing evidence that early intervention and investment can mitigate initial deficits in children's endowments (Bhalotra and Venkataramani, 2016; Adhvaryu et al., 2015; Bleakley, 2010; Cunha and Heckman, 2007; Cunha et al., 2010; Gould et al., 2011; Almond et al., forthcoming; Kling et al., 2007). However, this literature primarily focuses on evidence of mitigation in children's health and cognitive outcomes. To the best of our knowledge, we are the first to show evidence of catch-up in non-cognitive skills for children as a result of parental investment, especially among more educated mothers.

The remainder of the paper proceeds as follows. Section 2 describes the data. Section 3 describes the empirical strategy and the primary results, and Section 4 presents robustness checks and evidence about the relevant channels. Section 5 examines the longitudinal evidence about persistence of non-cognitive skills over time, and Section 6 concludes.

2 Data

The data set used in this paper is the Gansu Survey of Children and Families (GSCF), a panel study of rural children conducted in Gansu province, China. Gansu, located in northwest China, is one of the poorest and most rural provinces in China. The description of the data here draws substantially on the description in Leight (2014).

The first wave of the GSCF was conducted in 2000, and surveyed a representative sample of 2,000 children aged 9–12 in 20 rural counties, supplementing these surveys with additional surveys of mothers, household heads, teachers, principals, and village leaders. These children are denoted the "index children." All but one of the index children have complete information in the first wave.

The second wave, implemented in 2004, re-surveyed the first sample of children at age 13–16 and also added a survey of their fathers. 1,872 children, or 93.6% of the original sample, were re-interviewed in the second wave. In addition, surveys were added of the eldest younger sibling of the index child. These additional children are denoted "younger siblings." Surveys are conducted directly with the younger siblings, as well as with their homeroom teachers; in addition, mothers and fathers report limited supplementary information about the younger siblings.

In early 2009, a third wave of surveying was conducted, re-interviewing the index children during Spring Festival, a period at which many of them had returned to their natal villages. In cases where the sampled individual was not available, parents were asked to provide information about their child's education and employment status. 1,437 individuals, or 72% of the original sample, were interviewed directly in this wave, and information was collected in parental interviews for an additional 426 sample children.

The household surveys in waves one (2000) and two (2004) included extensive questions about schooling outcomes, household expenditure on education for each child, child time use, time in-

vestments in education by parents and teachers, and child and parental attitudes, as well as more standard socioeconomic variables. The index children also completed a number of achievement and cognitive tests. Younger siblings also completed these tests in wave two.

In addition, each wave of data collection included survey questions posed to the sample children that were designed to measure their non-cognitive skills. In the first and second waves, the survey measured both internalizing and externalizing behavioral challenges: the former refers to intra-personal problems (e.g., withdrawal and anxiety), and the latter to inter-personal problems (destructive behavior, aggression, and hyper-activity). Both measures of non-cognitive skills are constructed by recording the respondent's agreement or disagreement with a series of statements and then applying item response theory (IRT) to generate internalizing and externalizing scores. The measures are identical across waves one and two, and the scores are standardized to have a mean of zero and a standard deviation of one. In the third wave, a Rosenberg self-esteem index and a depressive index were measured. Further detail about the construction of the non-cognitive skills measures can be found in Glewwe, Huang and Park (2013).

Non-cognitive skills of the younger siblings were measured only in wave two. For ease of interpretation, the primary non-cognitive skills measures employed here (the externalizing and internalizing indices) have been inverted; in the original index, a higher value indicates more challenges, but in our index a higher value indicates better non-cognitive skills.

In this paper, we will focus on a subsample of the families in the survey: those with two children in the household where both children have reported measurements for non-cognitive and cognitive skills in the second-wave survey. If the index children and the younger sibling are the only children in the household, then the surveys provide a complete overview of parental allocations and child endowment. Complete data is available for 388 families drawn from 90 localities in 20 counties, and these households constitute the relevant subsample. In our sample, only 6.5% of households have one child. The remaining households are excluded because the index child has two or more siblings, or has one older sibling for whom non-cognitive ability is not reported. In the robustness checks, we will also present results employing a slightly larger sample including households where these two children (the index child and the younger sibling) are part of a larger family.[3] Figure 1 summarizes the structure of the sample, including the years in which data is collected, the children that are observed in each wave, and their age at the point of data collection.

Panel A of Table 1 reports summary statistics for the subsample of two-children families and the overall sample for key demographic indicators of interest, as well as a t-test for equality between the two means; the covariates reported are measured in the second wave of the survey, the wave in primary use here. It is evident that there are no significant differences in income or parental

[3]While China's One-Child Policy was in effect during the period in which these children were born, many rural households could nonetheless have two children legally under various exemptions to the policy (Gu et al., 2007). It is not possible using this dataset to accurately identify for each household whether it was in technical compliance with the policy.

education between the sample and the subsample. However, households in the subsample are slightly younger and have younger children. This primarily reflects the exclusion of larger families or families in which the index child is the younger child; these families are generally headed by older parents. Importantly, there are also no significant differences between the reported non-cognitive and cognitive skills in the second wave for the index children in the full sample and the subsample.

The dependent variable of interest is educational expenditure per child per semester, reported by the head of household in six categories: tuition, educational supplies, food consumed in school, transportation and housing, tutoring, and other fees.[4] Each household separately reports expenditure for each child in each of these categories. Discretionary expenditure is defined as the sum of all expenditures excluding tuition. Summary statistics for average expenditure per child for the subsample of families analyzed can be found in Panel B of Table 1. Total educational expenditure averages around 360 yuan per child per semester; an average of 20% of household income is allocated to educational expenditure in total for both children.

We focus on educational expenditure given that it is the primary form of child-specific expenditure reported in this dataset. The only other type of child-specific expenditure reported is medical expenditure over the past year; only 25% of households report any positive medical expenditure for either child over the past year, and unsurprisingly this expenditure is highly correlated with reported illness (i.e., it is reasonable to assume that very little corresponds to preventive care). Given that we are primarily interested in human capital investments with long-term returns, we do not focus on medical expenditure.

3 Empirical strategy and results

3.1 Empirical strategy

Our empirical strategy entails evaluating whether parental expenditure on education for children is correlated with measures of non-cognitive skills, conditional on household fixed effects.[5] In other words, our primary specification identifies whether parents are more likely to invest in a child who has stronger non-cognitive skills relative to a sibling.

The child's observed non-cognitive skills will be denoted $Ncog_{ihct}$, for child i in household h, living in county c and born in year t: the non-cognitive variables employed will include the externalizing and internalizing index, as well as a summary measure of non-cognitive skills that is the mean of the two indices.

All non-cognitive indices have been standardized to have means equal to zero and standard

[4] In China, textbook fees are mandatory and levied as part of the overall tuition, and here they are likewise reported in the tuition category. Educational supplies is supplies other than textbooks.

[5] Given that our primary interest is examining how parents allocate resources between children with different non-cognitive skills, it is necessary to include family fixed effects since we are examining within household variation. Also, the use of fixed effects addresses the challenge of unobserved household-level heterogeneity.

deviations equal to one, and in order to facilitate interpretation, the indices have been inverted such that a higher value is indicative of stronger non-cognitive skills. The dependent variable, educational expenditure, is denoted Y_{ihct}. The specification includes household fixed effects η_h, year-of-birth fixed effects ν_t, and a vector of child-level covariates X_{ihct}, yielding the following equation. Child-level covariates include gender, the sibling's gender, birth parity (i.e., whether a child is first-born or second-born), height-for-age, reported grades in school, and scores on grade-specific achievement tests administered in math and Chinese. The inclusion of birth parity is particularly important, given the evidence presented by Black et al. (2005a) suggests that birth order is an important determinant of children's outcomes.

This specification is estimated with and without interactions with parental education S_{hct}. Standard errors will be clustered at the county level in all specifications.[6]

$$Y_{ihct} = \beta_1 Ncog_{ihct} + \beta_2 Ncog_{ihct} \times S_{hct} + X_{ihct} + \nu_t + \eta_h + \epsilon_{ihct} \tag{1}$$

The identification assumption for this family of specifications requires that non-cognitive skills are uncorrelated with other unobservable variables that determine parental allocations. This assumption would be violated, for example, if parents invest more in a favored child, who is then observed to have stronger non-cognitive skills.

In order to present some preliminary evidence about the relationship between non-cognitive skills and child characteristics conditional on household fixed effects, the following specifications can be estimated, regressing the internalizing and externalizing indices on child covariates X_{ihct}, conditional on household fixed effects.

$$Ncog_{ihct} = \beta_1 X_{ihct} + \eta_h + \epsilon_{ihct} \tag{2}$$

The results can be found in Table 2: Panel A reports the correlations with sibling parity, age, gender, and grade level, and Panel B reports the correlations with various measures of the child's endowment. Interestingly, in Panel A there is no evidence of any significant correlation between the internalizing index and any child characteristic. However, for the externalizing index we observe that non-cognitive skills are weaker for second-born children, younger children, boys and children enrolled in lower grades in school. There is, of course, a high degree of correlation among these covariates: second-born children are on average younger, enrolled in lower grades, and more likely to be boys.[7] Columns (9) and (10) show the results of a multiple regression including all four covariates; there is some evidence here that the most robust correlations are between gender and grade level and the externalizing index.

Panel B shows that there is little evidence of significant correlations between non-cognitive skills

[6] We regard clustering at the county level as a conservative strategy for inference. Our subsample includes 20 counties and 90 villages; our results are also consistent if we cluster at the village level.

[7] The implications of gender selection for this analysis will be explored in greater detail in Section 4.1.

and other measures of endowment: specifically, height-for-age, and various measures of cognitive skills. This includes the child's grades reported in the last academic year in math and Chinese, and their score on a grade-specific achievement test. The only exception is a significant correlation between the internalizing index and the achievement test score.

In light of these results, the primary specifications all include year-of-birth fixed effects as well as controls for gender, sibling's gender, sibling parity, height-for-age, and all three reported measures of cognitive skills as measured in the second wave, contemporaneously with non-cognitive skills. The inclusion of grade fixed effects is more complex; given that the primary dependent variable of interest is educational expenditure, grade level can plausibly be considered an outcome. However, the primary results will also be robust to the inclusion of grade fixed effects.

Given that the primary specifications are estimated conditional on household and year-of-birth fixed effects, it is also useful to examine how much variation in the child characteristics of interest is observed within a given household and within a given birth year. Table A1 in the Appendix reports the R-squared in a simple regression including only the specified fixed effects as explanatory variables and the specified measure of non-cognitive or cognitive skills as the dependent variable. In general, between 50% and 60% of the variation in non-cognitive skills is explained by household fixed effects, suggesting there is still considerable within-household variation.

3.2 Primary results

Table 3 shows the results of estimating equation (1) without the interaction terms with parental education. The objective is to test whether parental allocations of educational expenditure are responsive, on average, to variation in non-cognitive skills between siblings; the measures of expenditure include total expenditure, discretionary expenditure (the sum of all expenditure excluding tuition), and six individual categories. Enrollment is universal among the subsample of interest, and thus school enrollment is not reported as an outcome. The results show coefficients that are small in magnitude, varying in sign, and generally insignificant. This suggests that parents are neither systematically compensating children with weaker non-cognitive skills, nor systematically reinforcing these differences. A similar pattern is observed if we estimate this regression in the cross-section without household fixed effects.

In light of this pattern, we then examine whether parents who themselves have certain characteristics are more likely to respond to measured differences in the non-cognitive skills of their children. The most obvious relevant characteristic is education, particularly given that recent work from Hsin (2012) and Restropo (2016) suggests that maternal education is an important determinant of parental allocation of expenditure. While the average level of education reported is relatively low—four years for mothers and seven years for fathers—there is considerable variation. Around 75% of mothers report completing at least one year of formal schooling, and 17% report completing junior high school. For fathers, around 90% report completing at least one year of formal schooling,

and 10% report completing senior high school.

Figure 2 shows histograms of the distribution of both maternal and paternal education. The correlation between maternal and paternal education is positive, but low in magnitude (around .3). Unsurprisingly, the education of both parents is also positively correlated with income and other measures of household wealth.

In addition, Figures 3a and 3b show the distribution of intrahousehold (between-sibling) differences in non-cognitive skills and in normalized expenditure residuals for households at different levels of maternal education. We can observe that the mean absolute difference in non-cognitive skills between siblings is around .75 standard deviations, and this is roughly constant across households of different levels of maternal education. Normalized expenditure residuals are calculated by regressing expenditure on child characteristics (gender, birth parity, cognitive skills, and height-for-age), generating the residuals and standardizing them to have mean zero and standard deviation one. The mean absolute difference is around .4 standard deviations, and this seems to be larger at higher levels of maternal education.

To identify whether parents who are more educated respond differentially to differences in non-cognitive skills, we then re-estimate equation (1) including interaction terms between non-cognitive skills and parental education. Again, the specification includes controls for a wide range of child characteristics including gender, sibling parity, and cognitive skills, and household and year-of-birth fixed effects. We also include the interactions of gender, age, sibling parity, height-for-age and the achievement test score with the specified measure of parental education. The results analyzing variation in parental response to children's non-cognitive skills with respect to parental education are reported in Table 4.

We observe a robust pattern in which households in which mothers have low levels of education (roughly speaking, fewer than three years of schooling) provide more expenditure to children with better non-cognitive skills, reinforcing the pre-existing differences, while households with more educated mothers seem to engage in compensatory behavior, providing more expenditure to children with worse skills. This is evident in the negative coefficients on the interaction term between non-cognitive indices and maternal education.[8] The coefficients on the interaction terms for other child characteristics are not reported in Table 4 for concision, but are reported in the on-line appendix for a simple specification using a summary measure of non-cognitive skills.[9] For cognitive skills as captured by a summary achievement test score, β_1 is positive though insignificant, suggestive of a reinforcing allocation of investment, and there is no evidence of heterogeneity with respect to maternal education; more discussion about this pattern is provided in Section 4.2.

In general, there is no compensatory effect observed for tuition, consistent with the intuition that tuition is not easily manipulable by parents; though the coefficients are negative, they are

[8] Aizer and Cunha (2012) find that the degree of parental reinforcing behaviors increases with family size. However, our finding cannot be explained by variation in family size since the sample is restricted to only two-child households.

[9] The on-line appendix can be found on both authors' homepages.

statistically insignificant and small in magnitude.[10] For example, comparing the estimated coefficients for the interaction effect in Columns (2) and (3) in Panel A, we can observe that relative to the mean of the dependent variable, the magnitude of the coefficient on tuition in Column (3) is around 10% of the magnitude of the coefficient on discretionary expenditure in Column (2). A similar pattern is observed in Panel C.

The interaction terms for paternal education, on the other hand, are smaller in magnitude, heterogeneous in sign, and generally not statistically significant. Panels B and D report p-values testing the equality of the estimated coefficients on the interaction terms for maternal and paternal education for the internalizing and externalizing indices, respectively; this test is implemented by estimating the two specifications simultaneously in a seemingly unrelated regression framework. These coefficients are denoted β_2^m and β_2^f, where β_2^m refers to the coefficient on the interaction term for maternal education, and β_2^f refers to the analogous coefficient for paternal education. While the imprecision in the coefficients on the paternal education interaction term does not allow us to reject equality in all cases, we can reject the hypothesis that the coefficient on the maternal and the parental education interaction terms is equal in both specifications employing total and discretionary expenditure as the dependent variable, as well as in several additional specifications. We also report results in both panels from a joint test of the hypotheses $\beta_1^m = \beta_1^f$ and $\beta_2^m = \beta_2^f$, and find generally parallel results.

The magnitudes of the implied effects are also substantial. For example, consider a child who exhibits non-cognitive skills as measured by the internalizing index that are one standard deviation lower than his sibling. The coefficient on the interaction term suggests that an increase in maternal education from the 25th to the 75th percentile, or from one to six years, would result in an increase in discretionary educational expenditure for this child compared to his sibling of 35%. The magnitudes are similar for the coefficients estimated for the externalizing index in Panel C.

4 Robustness checks and channels

4.1 Robustness checks

Alternate specifications First, we verify the primary results are robust to a number of additional specifications. For concision, in the robustness checks we employ an average non-cognitive index that is the mean of the internalizing and externalizing indices. The observed pattern is consistent if grade fixed effects are included, if the non-cognitive variables are reformulated as percentile rank variables, and if log expenditure variables are employed as the dependent variables.[11] Importantly, the results are also consistent in sign and magnitude if estimated unconditional on

[10] Approximately 12% of students attend schools that are are private or publicly assisted private institutions; accordingly, it is possible that there is some variation in tuition, and some potential for parents to select a higher-tuition school for their children.

[11] These results are reported in the on-line appendix.

cognitive skills and other endowment measures. There may be some concern that contemporaneous measures of cognitive skills are endogenous relative to parental investments, but there is no evidence that including these cognitive measures as controls generates systematic bias; the results from estimating a more parsimonious specification are reported in Panel A of Table A2.

We also re-estimate the results using two alternate samples. First, we employ the full sample of all households where the number of children is greater than or equal to two, rather than restricting to households in which the index child and his or her younger sibling are the only children.[12] (Less than 10% of the sample of interest are households with only one child.) The estimation results can be found in Panel B of Table A2, and the interaction terms on maternal education are again negative and and of roughly equal magnitude, suggesting that the observed pattern of compensation in households with more educated mothers is not limited to households of a particular size. (Households in which the index child has an older sibling and no younger siblings are still not observed in this sample due to the absence of data on the older sibling. However, the evidence presented in Table 1 suggests that there is no significant difference in household characteristics or the non-cognitive or cognitive skills of the index child when comparing index children observed in the subsample to the full sample.)[13]

Second, it should be noted that gender cannot be considered to be exogenous in this sample; nearly 70% of second-born children are boys. However, consistent with existing anthropological evidence, there is little evidence of sex selection prior to the first birth (Gu et al., 2007). The gender ratio for first-born children is not significantly different from .5, and the gender ratio for second-born children who follow the birth of a son is also not significantly different from .5. Thus, sex selection is a phenomenon primarily observed after the birth of a first-born girl. Accordingly, if we restrict the sample to households reporting a first-born son, the distribution of gender in these households can plausibly be considered quasi-exogenous. Re-estimating the primary specification for this smaller sample generates the same pattern of results, reported in Panel C of Table A2.

Serial correlation in parental investment Parents may use various strategies to determine investment between children: they may seek to maximize the returns on their educational investments, or they may allocate based on other criteria. Regardless of the allocation strategy, if there is some serial correlation in investment, this may be a source of bias in our results.

Consider the following simple specification as an example, where the dependent variable is

[12] We preferentially employ the restricted sample in the primary results given that failing to observe the endowment of the third sibling may lead to attenuation bias in the primary results if parents are compensating the unobserved sibling.

[13] We also explore whether there is evidence of a correlation between birth spacing (between the first- and second-born child) and maternal education that could be an alternate channel for the detected pattern. There is no evidence of any correlation between birth spacing and maternal or paternal education, and no evidence that parents respond differentially to non-cognitive skills in households with different spacing between the two siblings.

educational expenditure and $Y_{i,t-1}$ denotes previous parental investment.

$$Y_{it} = \beta_1 Noncog_{it} + \beta_2 Y_{i,t-1} \tag{3}$$

If we assume that prior investment is unobserved and is positively correlated with expenditure today, then $Cov(Noncog_{it}, Y_{i,t-1}) > 0$ will generate upward bias on the coefficient β_1. If β_1 is positive (i.e., investment is higher for children with higher non-cognitive skills), then we will over-estimate β_1 and over-estimate the degree of reinforcing investment. If β_1 is negative (i.e., investment is higher for children with lower non-cognitive skills), then the coefficient will be biased toward zero, and we will under-estimate the degree of compensatory investment. The bias in the coefficient can be captured by the familiar bias term for omitted variables, $\frac{\beta_2 \ Cov(Y_{i,t-1}, Noncog_{it})}{Var(Noncog_{it})}$. β_2 captures the degree of serial correlation in investment.

The question of primary interest for our specification is whether there will be bias in the interaction term between non-cognitive skills and maternal education – and, if the bias does exist, why do we observe this pattern only for maternal education, but not paternal education?[14] If we estimated equation (3) separately for low-education and high-education mothers and then calculated the difference in the estimated correlations β_1 as a proxy for the interaction term, the bias would cancel unless $\frac{\beta_2 \ Cov(Y_{i,t-1}, Noncog_{it})}{Var(Noncog_{it})}$ is different for the two samples. This could arise if either the variance in non-cognitive skills or the degree of serial correlation in investment is different for more and less educated mothers (i.e., β_2 is not the same), or if the relationship between past investment and current non-cognitive skills is different for more and less educated mothers (i.e., the returns to investment are not the same).

We can present some evidence on these points using data reported on non-cognitive skills and expenditure for the first-born child over time. In general, there is positive serial correlation in investment that seems to be significantly larger in families with more educated mothers.[15] However, there is no evidence that the dependence of current non-cognitive skills on past investment differs significantly in households with more or less educated mothers, and there is also no evidence that $Var(Noncog_{it})$ ais statistically different between the two groups. Thus if anything, the upward bias on β_1 would be larger in the sample of more educated mothers, generating upward bias on the interaction term of interest in the main specification; this is, of course, in the opposite direction of the observed effect.

We can also perform an additional test to evaluate the potential for bias in the primary specifications due to serial correlation in investment. We presume that there is limited scope for parental investment (via educational expenditure or other, correlated measures) to affect non-cognitive skills prior to primary school. Accordingly, we construct a new variable $Ncog_{ihct}^{prim}$ that is defined as non-

[14] We will also present results in Section 4.2 that there is no evidence of comparable heterogeneity with respect to household income.

[15] More specifically, the correlation between $Y_{i,t-1}$ and Y_{it} is 0.22 for children with mothers above the median level of education, and 0.11 for children with mothers below the median level of education.

cognitive skills at primary school age, as observed in wave one for the older sibling or wave two for the younger. We similarly define expenditure at primary school age Y_{ihct}^{prim}. We then estimate a specification parallel to the specification of interest, though rather than using year-of-birth fixed effects, we employ fixed effects for the age of the child in the survey year, ν_{age}.

$$Y_{ihct}^{prim} = \beta_1 Ncog_{ihct}^{prim} + \beta_2 Ncog_{ihct}^{prim} \times S_{hct} + \beta_3 X_{ihct} + \nu_{age} + \eta_h + \epsilon_{ihct} \quad (4)$$

The results from estimating equation (4) are reported in Panels A and B of Table A3. We observe a similar pattern to the primary results: evidence of greater compensation in households with more educated mothers, and no systematic variation with respect to paternal education. While the coefficients are smaller in magnitude, the mean levels of expenditure are also lower when we examine only children at primary school age. The estimated coefficients suggest that a one standard deviation increase in maternal education leads to an increase in discretionary expenditure directed to a child with one standard deviation lower non-cognitive skills of around 27%, compared to an effect size of 35% using the original specification. This result is consistent with the hypothesis that the observed pattern does not solely reflect bias introduced by differential prior investment.

It is also possible to re-estimate our primary specification controlling directly for lagged expenditure; this is analogous to attempting to solve the omitted variable bias challenge captured in equation (3) by directly including the omitted variable. The primary results, reported in Panel C Table A3, are all consistent in both magnitude and significance when re-estimated including lagged measures of expenditure.

Parental favoritism Parental favoritism may interact with non-cognitive skills in two ways. First, if a child with better non-cognitive skills is more likely to be the parental favorite and thus receives more parental investment, favoritism could be interpreted as a channel through which non-cognitive skills affect educational investment. Second, if parents choose a favorite child early in life, invest more in this favored child, and he is then observed to have better non-cognitive skills, then parental favoritism could be the underlying reason for a pattern of serial correlation — and if parental favoritism and the associated persistence in investment is more prevalent in certain households, this could be a source of bias in our main specification.

We implement two tests to evaluate whether favoritism is relevant in this analysis. First, we exploit questions in the survey of mothers in which she reports the identity of the children who will provide more emotional and economic support in the future. We designate a child as a favorite if he is identified as the primary source of both emotional and economic support, and examine whether more educated mothers are more likely to provide more expenditure to their favorite children, conditional on non-cognitive skills and the full set of child characteristic controls already reported. Importantly, there is no significant correlation between non-cognitive skills and the identity of the favorite child, nor is there any heterogeneity in this correlation with respect to maternal education,

suggesting that it is not the case that children with stronger non-cognitive skills are more likely to build relationships with parents and be identified as the favorite.

Second, we evaluate whether parents invest more in a favored child, and if this pattern is different in households with more educated mothers. The specification of interest is as follows, where F_{ihct} denotes a dummy for favorite.

$$Y_{ihct} = \beta_1 Ncog_{ihct} + \beta_2 Ncog_{ihct} \times S_{hct} + \beta_3 F_{ihct} + \beta_4 F_{hct} \times S_{hct} + \beta_5 X_{ihct} + \nu_t + \eta_h + \epsilon_{ihct} \quad (5)$$

The results are reported in Table A4. In general, there is no systematic preference in expenditure for the favored child; there is some evidence of greater preference for the favored child among more educated mothers, but the difference is not significant.[16] These results suggest that favoritism is unlikely to be an important channel for the observed pattern of compensation.

Alternate measures of non-cognitive skills Our primary measure of non-cognitive skills is based on children's self-reported status. This may raise questions about noise in the data, especially given that some children in the sample are relatively young. In particular, it is possible that children from some households are better able to understand and respond to the questions designed to elicit measures of their non-cognitive skills; this could result, for example, in a pattern in which there is greater measurement error in non-cognitive skills in households with less educated mothers.

The other measure of non-cognitive skills available in this data is drawn from surveys of the children's teachers, who are asked to report whether a child possesses a series of eight characteristics, both positive and negative.[17] Given the limited variation in this teacher-reported measure, which has only eight unique values, we construct a dummy variable equal to one if the teacher's reports of the child's characteristics places him or her in the top half of all children, denoted $Tcog^D_{ihct}$. We then estimate a specification parallel to our primary specification of interest, employing this dummy variable as a measure of non-cognitive skills.

$$Y_{ihct} = \beta_1 Tcog^D_{ihct} + \beta_2 Tcog^D_{ihct} \times S_{hct} + \beta_3 X_{ihct} + \nu_t + \eta_h + \epsilon_{ihct} \quad (6)$$

The results are reported in Table A5 and show the same pattern of greater compensation in households with more educated mothers. The magnitude observed is similar to the magnitude in a parallel specification using a dummy variable constructed from the original self-reported non-cognitive skills measure.

This evidence suggests that the observed pattern of differential compensation for adverse non-cognitive skills in households with more educated mothers is not an artifact of the non-cognitive

[16] It is also useful to note that the favorite child is significantly more likely to be a boy, though there is no significant variation in this relationship with respect to maternal education.

[17] This series includes whether the child is smart, conscientious, reasonable/well-mannered, clean, enjoys work, is lively/imaginative, gets along with others, likes to cry, or lacks confidence.

self-reports. However, we preferentially use the measures of non-cognitive skills derived from self-reports given that these measures have greater variation, and only self-reported measures can be employed in the longitudinal analysis discussed in Section 5. Teacher reports are, clearly, no longer available for the index children once they have completed secondary school.

4.2 Channels

There are several channels that would be consistent with the observed pattern of compensation only in high maternal education households. First, more educated mothers may simply be better able to learn about variation in non-cognitive skills among their children, while less educated mothers do not acquire this information. (By contrast, more educated fathers are no better able to recognize differences in non-cognitive skills compared to less educated fathers.) Second, maternal education may be a proxy for income or socioeconomic status, and higher-income households may have a preference for compensatory investment.

Third, more educated women may have a greater preference for compensatory investment relative to less educated women; alternatively, all women may have a greater preference for compensatory investment, while only educated women are able to impose this preference within the household. A gender difference in preferences would be consistent with the finding from the experimental literature that women are in general more inequality-averse (Andreoni and Vesterlund, 2001; Dickinson and Tiefenthaler, 2002; Selten and Ockenfels, 1998; Dufwenberg and Muren, 2006), with the caveat that we cannot rule out that compensatory investment in this context is a returns-maximizing strategy if returns to investment are higher for children with lower non-cognitive skills.[18] In addition, a large literature has presented evidence that women exhibit a preference for greater investment in health and education for children, (Bobonis, 2009; Duflo, 2003; Fafchamps and Quisumbing, 2002; Quisumbing and Maluccio, 2003); women or more educated women may also have a stronger preference for compensatory investment. We will explore each channel in turn.

Parental learning about child characteristics The first postulated channel is that more educated mothers are better able to recognize deficits in non-cognitive skills among their children and respond appropriately, while less educated mothers do not recognize deficits in non-cognitive skills. It is also possible that more educated mothers acquire information about the returns to investing in children with weak non-cognitive skills that less educated mothers do not acquire. In either case, it is also necessary to assume there is no correlation between paternal education and the relevant information acquisition process.

If this channel is important, then ceteris paribus we would expect more compensation among parents who spend more time with their children, and thus have the opportunity to learn more

[18] For example, Andreoni and Vesterlund (2001) find that women are more concerned about equalizing earnings during experiments, while men are more focused on maximizing efficiency.

about their child's characteristics and/or how these characteristics affect the returns to investment on that child. In this survey, parents report the time spent in a typical week either playing with or talking to children; about 65% of both mothers and fathers report that in a typical week they spend any time on either of these activities, and the mean time spent is around three hours, only slightly higher for mothers than fathers. (Importantly, they do not report the division of this time between children, and thus we cannot analyze the time spent with each child as a dependent variable.) Also, similar to the evidence presented in Guryan et al. (2008), we find a positive, albeit relatively weak, correlation between parental education and time spent with children.

In order to test whether the observed pattern in fact reflects a process in which educated mothers spend more time with their children and thus learn more about their characteristics, we estimate the following specification including the original interaction term between non-cognitive skills and parental education, and adding an interaction term between non-cognitive skills and average hours spent per week with children $Time_{hct}$ for both the mother and the father. (In order to enable comparison of the coefficients on the two variables, in each specification the time variable is re-scaled to have the same mean as the parental education variable.) The same control variables included in the primary specification are included.

$$\begin{aligned} Y_{ihct} &= \beta_1 Ncog_{ihct} + \beta_2 Noncog_{ihct} \times S_{hct} + \beta_3 Noncog_{ihct} \times Time_{hct} + \beta_4 X_{ihct} \\ &+ \nu_t + \eta_h + \epsilon_{ihct} \end{aligned} \tag{7}$$

The results can be found in Panels A and B of Table 5 for maternal and paternal education respectively. We can observe that the coefficients β_2 remain significant and negative for the mother. While the estimated coefficients β_3 are negative, indicating there is some evidence that mothers who spend more time with their children do compensate more, they are small in magnitude and generally insignificant. However, it is also important to note that if the most important information educated mothers acquire is information about variation in the returns to investment with respect to child characteristics, rather than child characteristics themselves, this process may be orthogonal to time spent with the child. In that case, the test implemented here would have limited power.

Maternal education as a proxy for income The second postulated channel that could be consistent with the observed pattern of differential compensation is that maternal education is a proxy for household income, and higher-income parents prefer compensatory investment whereas lower-income households prefer reinforcing investment. As suggested by Almond and Currie (2011) and Conley (2008), low socioeconomic status households could focus on better endowed children due to credit constraints; alternatively, the elasticity of substitution between consumption and human capital investment could be higher for low SES households. These hypotheses are somewhat less plausible in our context given that there are no parallel effects for paternal education, and in the sample of interest there is no evidence that maternal education is more closely correlated with

household income when compared to paternal education.

However, a simple test of this hypothesis can be implemented by adding an interaction term between household income and non-cognitive skills to the primary specification. This yields the following equations, where I_{hct} denotes household income; income and maternal education are re-scaled to have the same mean in order to allow for comparison of the coefficient magnitudes.

$$Y_{ihct} = \beta_1 Ncog_{ihct} + \beta_2 Ncog_{ihct} \times S_{hct} + \beta_3 In_{ihct} \times I_{hct} + \beta_4 X_{ihct} + \nu_t + \eta_h + \epsilon_{ihct} \quad (8)$$

The results of estimating equation (8) employing the education of the mother as the measure of parental education can be found in Table 6. It is evident that the coefficients β_3 on the income interaction terms are small in magnitude, inconsistent in sign, and generally insignificant. The coefficients on the maternal education interaction terms, by contrast, remain consistently negative and significant. We also re-estimate this specification employing indices of productive assets and durable household goods owned by the household, rather than income. We observe some evidence of greater compensation among higher-asset households; importantly, however, the coefficient β_2 remains negative, significant, and of consistent magnitude. This suggests it is unlikely the primary results reflect shifts in parental preferences in higher-income households.

Maternal education and preferences for compensatory investment Finally, we seek to evaluate whether there is evidence consistent with the hypothesis that maternal education is correlated with a greater preference for compensatory investment, or a greater ability to impose a certain preference within the household (i.e., greater bargaining power). We do not have any data that would enable us to identify variation in preferences for compensatory investment between more and less educated mothers, or for mothers compared to fathers. However, we do have data on who makes certain decisions within the household (as reported by mothers), and we employ this data to construct two measures of household decision-making power. The first is a general decision-making index ranging from zero to seven, corresponding to the number of decision-making categories in which the mother reports involvement.[19] The second is an index capturing whether the mother makes decisions related to parenting and children's education, ranging from zero to two.

We then regress these decision-making measures on both the mother's education and the difference in education in two simple specifications, including household control variables (net income, per-capita income, and age of both parents) and county fixed effects. The decision-making variables are denoted Dec_{hct}.

$$Dec_{hct} = \beta_1 S^m_{hct} + \kappa_c + X_{hct} + \epsilon_{hct} \quad (9)$$

$$Dec_{hct} = \beta_1 S^{dif}_{hct} + \kappa_c + X_{hct} + \epsilon_{hct} \quad (10)$$

[19]These include decisions about children's schooling, purchase of durable goods, choice of crops, purchase of livestock, managing family finances, parenting methods, and household management.

The results are reported in Panel A of Table 7, and suggest that there is generally a positive correlation between maternal education and the mother's reported decision-making power.[20] We then test whether greater bargaining power is correlated with greater compensation by re-estimating the primary specification, adding an interaction term between the non-cognitive index and a dummy variable capturing the mother's reported decision-making power around parenting decisions; the dummy variable is defined equal to one if she reports any decision-making power. The specification of interest can thus be written as follows, where Dec^D_{hct} denotes the decision-making dummy.

$$\begin{aligned} Y_{ihct} &= \beta_1 Noncog_{ihct} + \beta_2 Noncog_{ihct} \times S_{hct} + \beta_3 Noncog_{ihct} \times Dec^D_{hct} + \beta_4 X_{ihct} \\ &+ \nu_t + \eta_h + \epsilon_{ihct} \end{aligned} \tag{11}$$

The results are reported in Panel B of Table 7. While the coefficients β_2 on maternal schooling remain significant and similar in magnitude compared to the coefficients reported in Table 4, the interpretation is somewhat different. For example, the results in Table 4 suggest we would observe compensatory behavior in a household where the mother has five years of education. Here, the results suggest if the mother has five years of education but no decision-making power (the decision-making dummy equals zero), we would observe a reinforcing allocation of expenditure. In contrast, if the mother is educated and has some decision-making power, the allocation of educational expenditure would reverse, favoring the child with weaker non-cognitive skills. This example illustrates the importance of the mother's bargaining power in conjunction with her education level in determining the intrahousehold allocation of investment.

Since the coefficients on maternal education remain relatively unchanged, this also suggests that maternal education may affect investment through a channel other than bargaining power. We interpret this as evidence that different preferences among more educated women are also important. A differential preference for compensation may reflect a belief among more educated women that they have the knowledge to utilize expenditure to address non-cognitive deficits among their children, while low-educated women may not believe they have this knowledge. This difference is in addition to the implied difference in average preferences between mothers and fathers; the latter may reflect a lack of interest by fathers in compensation, or perhaps a belief that some other compensatory strategy is more appropriate.

These results also raise the question of whether it is solely the level of maternal education that affects observed decisions about child investment, or the difference between maternal and paternal education. If we re-estimate the primary results restricting the sample to households where parents are relatively close in education (i.e., excluding households falling in the top and bottom 25% of the distribution of the within-household educational gap), we observe that more

[20] Interestingly, the comparable correlation between paternal education and paternal bargaining power is insignificant.

educated women still report greater decision-making power, and households with more educated women still show evidence of greater compensation. In other words, high-education women married to high-education men exhibit more compensatory behavior than low-education women married to low-education men. This suggests that the level of education is important, perhaps because it is correlated with different maternal preferences.[21]

However, we can also re-estimate our primary specification by replacing the interaction of maternal education and non-cognitive skills with the interaction of the difference in education (maternal minus paternal) and non-cognitive skills, and we also observe greater compensation in households where the difference in education is more positive. In other words, low-education women married to low-education men show more compensatory behavior than low-education women married to high-education men, presumably because they can exert greater bargaining power within the household. This evidence, in conjunction with the results presented in Panel A of Table 7, suggests that the difference in education (relative bargaining power) is also relevant.[22]

Both the difference in education and the level of education seem important in determining parents' joint decisions. This is consistent with higher education for mothers leading to a greater preference for compensation and more bargaining power among educated women.

It may also be useful at this point to briefly return to the evidence for the parental response to cognitive skills. The results, though noisy, suggested that there was uniform reinforcement with respect to cognitive skills, regardless of the level of maternal education.[23] One hypothesis that would be consistent with this pattern is that, as argued above, fathers generally have a preference for reinforcing expenditure with respect to all dimensions of human capital for their children, and mothers are primarily responsive to non-cognitive skills (and do not respond to cognitive skills). Accordingly, we observe a pattern of reinforcing expenditure except with respect to non-cognitive skills in households with more educated mothers, who have a stronger preference for compensatory investment in this dimension, and/or the bargaining power to impose this preference. However, given the imprecision in the estimated response to cognitive skills, this hypothesis must be regarded as merely speculative.

[21] These results, as well as the results referred to below, are reported in the on-line appendix.

[22] The fact that the difference in education is also correlated with greater compensation also suggests that it is unlikely that greater compensation in higher maternal-education households reflects a pattern of assortative mating in which high-education women choose spouses whose preferences match their own. Even comparing across households where the woman is relatively uneducated, and thus presumably commands less power in the marriage market, we observe that a woman who is relatively more educated within her household is able to exert a preference for greater compensation.

[23] If we estimate the parental response to a summary human capital variable including cognitive, non-cognitive skills and height-for-age, a proxy for overall health, the results are generally noisy, and show no uniform pattern of compensation or reinforcement.

5 Catch-up in non-cognitive skills over time

Given the evidence about compensatory investment in households with educated mothers, it is plausible to hypothesize that over time, children of educated mothers with worse non-cognitive skills should begin to catch up relative to their peers (assuming, of course, that there are in fact positive returns to educational expenditure). In other words, the persistence over time of non-cognitive challenges should be weaker for children of highly educated mothers.

In this data, the younger sibling is only observed once (in the second wave of the survey employed here), while the older sibling is observed in all three survey waves. Accordingly, to test whether catch-up in non-cognitive skills is more evident in more educated households, we examine whether the longitudinal correlation in child characteristics for the older child is weaker in households with a more educated mother.[24] More specifically, we regress various measures of non-cognitive skills observed in 2009 and 2004 on earlier measures of non-cognitive skills for the same child. In 2009, the psychometric measures include a Rosenberg index of self-esteem, and an index of depression.[25] In 2004, internalizing and externalizing indices are reported as already noted; in 2000, the internalizing and externalizing indices are reported, as well as a self-esteem measure.

In the psychology literature, it is also common to use rank-order measures for personality traits (Shiner and Caspi, 2003; Roberts and DelVecchio, 2000). This is particularly relevant when employing longitudinal data in which subjects are observed at very different ages. Accordingly, for this analysis we convert all the non-cognitive measures into percentile measures ranking the child with respect to children of the same gender and the same age group; the child with the strongest non-cognitive skills is assigned the highest percentile of 1.[26]

These measures of non-cognitive skills will be denoted $Psych_{ihct}$ for child i in household h in county c born in year t, and the superscript will indicate the year in which the data was observed. Thus the primary equations of interest can be written as follows, regressing non-cognitive outcomes on outcomes from the previous wave and the interaction of the previous outcome with a household-level input that can lead to catch up in non-cognitive skills, I_{hct}. I_{hct} can be a dummy variable for the mother or father having a high level of education (above the median), or reported discretionary educational expenditure on the child in the previous wave. The specifications of interest are written as follows.

[24] Another test that could be implemented is to examine whether the absolute difference in human capital characteristics between the first-born and second-born children is narrower in wave two in households with more educated mothers. This would be consistent with compensatory investment already successfully leading to "catch-up" by the weaker sibling. This test shows no significant differences in the absolute difference comparing across households with more or less educated mothers. Results are reported in the on-line appendix.

[25] We invert the depression index, such that a higher depression index is indicative of a lower level of depression.

[26] The primary results are similar when estimated employing the original variables, though more noisily estimated.

$$
\begin{aligned}
Ncog_{ihct}^{2009} &= \beta_1 Ncog_{ihct}^{2004} + \beta_2 Ncog_{ihct}^{2004} \times I_{hct} \qquad (12)\\
&+ \beta_4 X_{hct} + \nu_t + \kappa_c + \epsilon_{ihct}\\
Ncog_{ihct}^{2004} &= \beta_1 Ncog_{ihct}^{2000} + \beta_2 Ncog_{ihct}^{2000} \times I_{hct} \qquad (13)\\
&+ \beta_4 X_{hct} + \nu_t + \kappa_c + \epsilon_{ihct}
\end{aligned}
$$

X_{ihct} denotes a vector of child- and household-level controls, and standard errors are clustered at the county level. The control variables of interest are drawn from the same set of covariates employed in the earlier analysis: cognitive test scores as measured in 2000 and 2004, math and Chinese test scores as measured in 2004, height-for-age as measured in 2004, household net income, fixed capital and assets as measured in 2004, paternal and maternal education dummies, the number of siblings in the family, gender, gender of the younger sibling, sibling gender interacted with the number of siblings, and county and year-of-birth fixed effects. We also include an interaction term with household net income as measured in 2004. In the specifications including an expenditure interaction effect, additional controls include linear and quadratic terms for total and discretionary educational expenditure, and a dummy for discretionary expenditure above the median.

The results of estimating equations (12) and (13) for maternal and paternal education dummies and educational expenditure are reported in Table 8. Note a positive coefficient β_1 can be interpreted as evidence of persistence of non-cognitive skills over time, and a negative coefficient β_2 can be interpreted as catch-up in households with higher levels of parental education or more educational expenditure. The interaction terms with maternal and paternal education are included in the same specification.

First, it is useful to note that non-cognitive skills at ages 9–12 (as measured in 2000) do not seem to be particularly strongly correlated with non-cognitive skills at ages 13–16 (as measured in 2004); β_1 is positive, but not always statistically significant. There appears to be greater evidence of persistence between ages 13–16 and young adulthood, or between 2004 and 2009.

Second, and more importantly, there is also evidence of catch-up in non-cognitive skills for children of more educated mothers (as reported in Columns 1, 3, 5, and 7), and for children who receive more educational expenditure (as reported in Columns 2, 4, 6, and 8). This is observed both between 2000 and 2004 and between 2004 and 2009, and is consistent with compensatory investment by mothers facilitating catch-up by children with weaker non-cognitive skills.[27] This pattern is consistent with the existing literature suggesting non-cognitive skills are more malleable for a longer period into adolescence and young adulthood than cognitive skills (Borghans et al., 2008). (It is, however, important to be cautious in interpreting these results as evidence of returns

[27]There is no evidence of comparable catch-up in cognitive skills. This is unsurprising, given that we did not observe a compensatory response among households with more educated mothers in response to variation in children's cognitive skills.

to the specific investments observed: more educated mothers may also make additional, unobserved investments targeting children with weaker non-cognitive skills that leads to catch-up.)

The interaction terms with paternal education, by contrast, are generally positive and insignificant. Given that there was little evidence that more educated fathers compensated children of lower non-cognitive skills with additional investment, this is consistent with our prior results.

An alternate test that captures the same fundamental empirical pattern examines the cross-household correlation between non-cognitive skills and a dummy variable for the household being characterized by high maternal education, conditional on the same set of control variables. This correlation is increasing in magnitude in each wave: in the first wave, the observed cross-household correlation between a dummy for a mother of high maternal education and the percentile measures of non-cognitive skills is essentially zero. In the second wave, the correlation has increased in magnitude to .028, and by the third wave, .151. The difference between the first- and third-wave coefficients is statistically significant at the five percent level.[28] There is no evidence of a comparable pattern for paternal education.

Given this pattern, it is also useful to briefly reconsider our primary results of heterogeneous response to variation in non-cognitive skills with respect to parental education. The longitudinal evidence suggests that in households with more educated mothers, compensatory investments may already have succeeded in generating some catch-up in non-cognitive skills among first-born children with weaker non-cognitive skills prior to wave two. However, we have already presented evidence in section 4.1 (Table A3) that the primary results are robust to employing the initial, wave-one measure of non-cognitive skills for the older child. In addition, any catch-up prior to wave two would lead to a narrowing of the gap in non-cognitive skills between children of an educated mother, and thus lead us to underestimate the compensatory behavior engaged in by these mothers. There is no obvious source of bias that would lead us to erroneously conclude that educated mothers are compensating when in fact they are reinforcing.

Considering the long-term effect of the observed patterns, we can again compare a child with a mother below the median level of education to a child with a mother above the median level of education. For the former child, a one standard deviation decrease in the non-cognitive percentile rank in adolescence leads to a .23 decrease in the Rosenberg percentile rank in young adulthood (i.e., the child has lower self-esteem).[29] For the latter child, however, the same decrease in the non-cognitive index in adolescence does not lead to any statistically significant change in self-esteem in adulthood. If there are positive returns in the labor market to non-cognitive skills such as self-esteem, this pattern may have meaningful economic implications.

In addition, these results may raise the question of why parents appear to utilize educational

[28] The difference between the coefficients for the first and second wave is not significant, and the difference between the coefficients for the second and third wave is narrowly insignificant at the ten percent level.

[29] We assume the father is also above the median level of education, and thus the relevant coefficient is the sum of .110 and .118 as reported in Column (5) of Table 8.

expenditure as a tool to address deficits in non-cognitive skills as opposed to some other form of expenditure more explicitly targeted at developing these skills. We should note that we cannot rule out that parents are simultaneously making other, targeted investments, in expenditure or in time, to develop non-cognitive skills, and that the observed pattern represents primarily returns to these unobserved investments. As previously highlighted, educational expenditure is the only type of child-specific investment reported in this survey other than medical care. However, given that these are relatively resource-constrained households, forms of expenditure that might be considered appropriate for developing non-cognitive skills in a developed county (e.g., therapeutic interventions, additional attention from teachers, or intense supervision by parents) may be unavailable. In fact, both parents report spending only around four hours total per week with their children playing, talking, or assisting with homework, and this includes time spent with both children.

If we examine the evidence about categories of expenditure that respond to non-cognitive skills, referring back to Table 3, we observe the largest effects for food at school, transportation to school, and tutoring. Tutoring for children after school hours may be a viable strategy to ensure that they engage in constructive activities when the parents are unavailable for supervision. Expenditure on food at school and transportation to school may correspond to a decision to allow the child to spend more time at school or attend a school that is farther away from home, enhancing exposure to peers and teachers and potentially enhancing non-cognitive skills. Needless to say, we also cannot rule out that these investments lead to simultaneous enhanced development of cognitive skills.

6 Conclusion

The decisions parents make about how to allocate educational investments among children have major implications for policies targeting human capital accumulation. As greater emphasis is placed on the development of non-cognitive skills as well as cognitive skills as a strategy for increasing long-term welfare, it is even more important to understand how parents may respond to observed differences in non-cognitive skills, and whether they seek to address any detectable deficits.

The evidence in this paper suggests that in a rural developing country context, households with more educated mothers may engage in more compensatory behavior, targeting expenditure to children with weak non-cognitive skills, when compared to households with less educated mothers. While the observed pattern would be consistent with many channels and we must be cautious in interpreting our findings, the evidence presented here suggests that both greater bargaining power for more educated mothers and a differential preference for compensation among more educated mothers are relevant. Over time, this leads to greater persistence in non-cognitive challenges in households with less educated mothers, while children in households with more educated mothers show evidence of catch-up.

One implication is that maternal education plays a significant role in child development. There is an extensive literature that find the intergenerational transmission of the mother's education and

one's education achievement(Black et al., 2005b).[30] Our finding suggests part of the intergenerational transmission of education may work through the impact of maternal education on children's non-cognitive abilities, which in terms affect the child's education outcome.

Given that Gansu is one of the poorest regions of China—our sample is characterized by per capita income of only around $200—our results suggest that compensatory behavior by parents can be found even in resource-constrained settings. This pattern also may have implications for interventions targeted to strengthen non-cognitive skills. If more educated mothers respond to such interventions by redirecting expenditure away from the child whose skills have been strengthened, this may be a mechanism that decreases the long-term benefits for the targeted child. There may, however, be positive spillovers for other siblings.

It is important to note that our sample is relatively small and drawn from only one province in China, and we cannot conclude that the observed phenomenon is a general one. However, our results suggest that the question of whether differential household responses to child variation in non-cognitive skills widen cross-household inequality in human capital over time may merit further analysis.

[30] See Björklund et al. (2011) for a review of this literature.

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7 Figures and Tables

Figure 1: Data structure

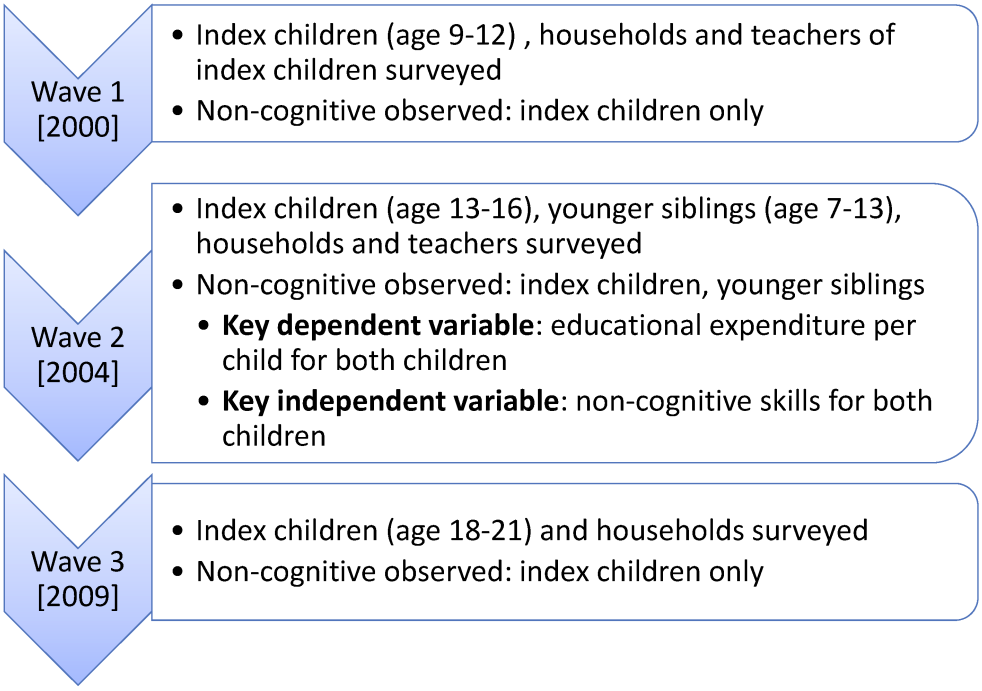
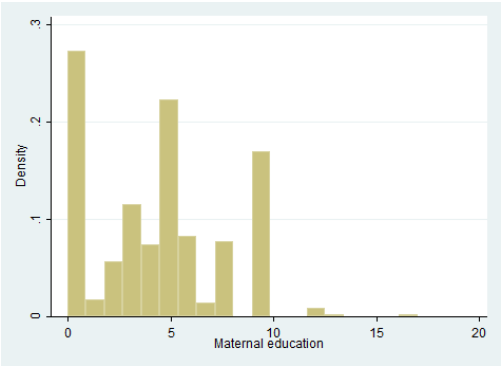


Figure 2: Parental education

(a) Maternal education



(b) Paternal education

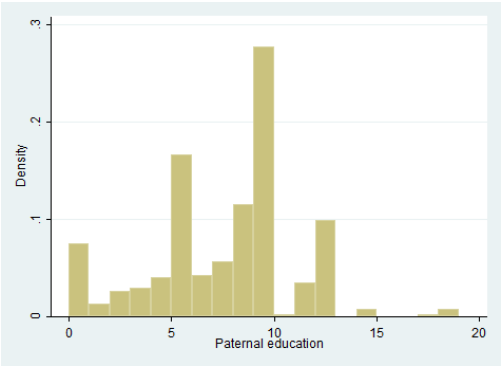
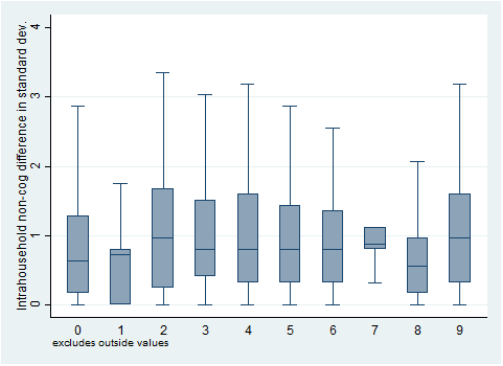
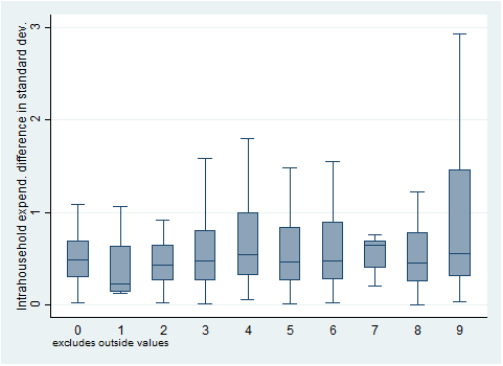


Figure 3: Intra-household differences in non-cognitive skills and expenditure, by mother's education

(a) Non-cognitive skills



(b) Expenditure



Notes: For each level of mother's education in years, the bottom bar corresponds to the minimum value of between-sibling absolute differences in non-cognitive skills (Figure 3a) or between-sibling absolute differences in normalized educational expenditure residuals (Figure 3b), while the top bar corresponds to the maximum value. The rectangle corresponds to the interquartile range, with the median value represented by the bold line bisecting the rectangle. Normalized expenditure residuals are calculated by regressing expenditure on child characteristics (gender, birth parity, cognitive skills, and height-for-age), generating the residuals and standardizing them to have mean zero and standard deviation one.

Table 1: Summary statistics

Panel A: Demographic data				**Panel B: Educational expenditure per child**			
	Sample	Subsample	p-value		Mean	Std. Dev.	Max.
Net income	6848.56	6728.28	.863	Total	361.52	343.1	2900
Income per capita	1717.76	1631.04	.581	Discretionary	149.03	215.65	1660
Mother education	4.31	4.35	.805	Tuition	212.49	185.47	2000
Father education	7.12	7.16	.837	Supplies	47.07	43.55	300
Mother age	39.19	36.97	.000	Transportation	19.67	50.99	500
Father age	42.57	38.89	.072	Food	59.12	139.08	1200
Index child age	15.09	14.96	.013	Tutoring	9.66	21.42	110
Internalizing index	-.01	.01	.634	Other fees	13.50	36.41	360
Externalizing index	.03	-.01	.280				
Achievement index	0	.06	.183				
Obs.	1918	388					

Notes: The sample encompasses the full sample of households that report income data; this is 1914 out of the full sample of 2000 households in the survey. The subsample is households with two-children families in which both children report data on non-cognitive skills as well as height-for-age. There are 388 households in the subsample of interest, and 776 children. Income is reported in yuan; educational expenditure is reported in yuan per semester. Internalizing, externalizing and achievement indices have been standardized to have means equal to zero and standard deviations equal to one. A higher internalizing or externalizing index is indicative of higher non-cognitive skills. Column (3) reports the p-value for a test of equality of means across the sample and subsample.

Table 2: Non-cognitive skills and child characteristics

	Internal (1)	External (2)	Internal (3)	External (4)	Internal (5)	External (6)	Internal (7)	External (8)	Internal (9)	External (10)
Panel A: Child characteristics										
Sibling parity	.003	-.118**							.143	.131
	(.058)	(.059)							(.140)	(.119)
Age			.008	.039**					.007	-.076*
			(.017)	(.018)					(.051)	(.044)
Female					-.006	.315***			-.007	.289***
					(.077)	(.083)			(.080)	(.074)
Grade level							.015	.068***	.046	.159***
							(.019)	(.020)	(.045)	(.054)
Panel B: Cognitive skills and health										
Height-for-age	.013	.042							.019	.045
	(.030)	(.039)							(.029)	(.038)
Math score			-.0007	.002					-.0005	-.0009
			(.003)	(.005)					(.005)	(.006)
Chinese score					.0009	.005			.004	.007
					(.005)	(.005)			(.007)	(.007)
Achievement score							-.006**	-.005	-.006**	-.005*
							(.003)	(.003)	(.003)	(.003)
Obs.	776	776	776	776	776	776	776	776	776	776

Notes: The dependent variables are the internalizing and externalizing indices. A higher internalizing or externalizing index is indicative of higher non-cognitive skills. The independent variable is the specified child characteristic, all measured in the second wave; all specifications include household fixed effects and standard errors clustered at the county level. Asterisks indicate significant at the 10, 5 and 1 percent levels.

Table 3: Parental allocations and non-cognitive skills

	Total (1)	Discretionary (2)	Tuition (3)	Supplies (4)	Transportation (5)	Food (6)	Tutoring (7)	Other (8)
Panel A: Internalizing index								
Index	-8.010	-10.019	2.009	.591	-.617	-10.713*	-1.056	1.776
	(10.770)	(8.021)	(4.065)	(1.635)	(1.247)	(5.873)	(.712)	(1.437)
Panel B: Externalizing index								
Index	.028	-2.772	2.800	2.366*	.252	-6.048	-.284	.941
	(11.850)	(7.854)	(5.576)	(1.405)	(1.348)	(5.799)	(.730)	(.912)
Obs.	776	776	776	776	776	776	776	776
Mean (dep. var.)	276.748	104.052	172.696	38.164	12.011	37.679	6.218	9.98
St. dev. (dep. var.)	286.515	174.218	161.381	38.785	40.065	109.107	17.357	28.532

Notes: The dependent variables are educational expenditure per semester per child in the specified category; total expenditure is the sum of all categories, and discretionary expenditure is the sum of all categories excluding tuition. The independent variable is the specified index of internalizing or externalizing behavior. A higher internalizing or externalizing index is indicative of higher non-cognitive skills. All specifications include controls for sibling parity, gender, sibling gender, height-for-age and cognitive skills measured contemporaneously with non-cognitive skills, year-of-birth and household fixed effects, and standard errors clustered at the county level. Asterisks indicate significance at the 10, 5 and 1 percent levels.

Table 4: Heterogeneous effects with respect to parental education

	Total (1)	Discretionary (2)	Tuition (3)	Supplies (4)	Transportation (5)	Food (6)	Tutoring (7)	Other (8)
Panel A: Internalizing index and maternal education								
Index	27.973	20.386	7.588	.392	4.365*	10.157	1.253	4.219**
	(17.338)	(14.144)	(7.585)	(1.600)	(2.504)	(11.232)	(.829)	(2.080)
Index x mother educ.	-8.595**	-7.262**	-1.333	.048	-1.190**	-4.985*	-.551**	-.583
	(4.186)	(3.617)	(1.686)	(.426)	(.606)	(2.652)	(.231)	(.442)
Panel B: Internalizing index and paternal education								
Index	-11.252	-17.317	6.066	-2.838	5.045*	-9.825	-2.712	-6.987***
	(20.718)	(16.862)	(8.148)	(1.905)	(2.664)	(14.485)	(1.725)	(2.676)
Index x father educ.	.286	.949	-.663	.488	-.775**	-.131	.204	1.163**
	(2.329)	(1.580)	(1.414)	(.314)	(.340)	(1.355)	(.170)	(.472)
Test $\beta_2^m = \beta_2^f$	.072	.023	.847	.430	.589	.070	.017	.013
Joint test	.184	.073	.857	.484	.084	.180	.052	.034
Panel C: Externalizing index and maternal education								
Index	36.951**	22.555*	14.396*	-.033	5.606**	13.883	1.764**	1.335
	(15.425)	(11.563)	(8.706)	(1.281)	(2.391)	(8.492)	(.813)	(1.227)
Index x mother educ	-9.971**	-6.840*	-3.131	.648	-1.446**	-5.382**	-.553*	-.106
	(4.740)	(3.531)	(2.495)	(.403)	(.644)	(2.531)	(.309)	(.325)
Panel D: Externalizing index and paternal education								
Index	-18.195	-23.448	5.253	-.946	1.977	-18.834	-2.200	-3.444*
	(26.820)	(19.075)	(11.498)	(2.617)	(2.666)	(15.555)	(1.857)	(2.008)
Index x father educ	2.644	2.855	-.211	.408	-.197	1.758	.243	.643*
	(2.725)	(1.983)	(1.287)	(.325)	(.362)	(1.570)	(.203)	(.347)
Test $\beta_2^m = \beta_2^f$	.027	.020	.344	.601	.064	.028	.051	.347
Joint test	.085	.058	.453	.168	.099	.089	.144	.473
Obs.	766	766	766	766	766	766	766	766
Mean (dep. var.)	276.748	104.052	172.696	38.164	12.011	37.679	6.218	9.98
St. dev. (dep. var.)	286.515	174.218	161.381	38.785	40.065	109.107	17.357	28.532

Notes: The dependent variables are educational expenditure per semester per child in the specified category; total expenditure is the sum of all categories, and discretionary expenditure is the sum of all categories excluding tuition. The independent variable is the specified index of internalizing or externalizing behavior, as well as the index interacted with the specified measure of parental education in years. A higher internalizing or externalizing index is indicative of higher non-cognitive skills. All specifications include controls for sibling parity, gender, sibling gender, height-for-age and cognitive skills measured contemporaneously with non-cognitive skills, sibling parity, gender, height-for-age and achievement scores interacted with maternal education, year-of-birth and household fixed effects, and standard errors clustered at the county level. Panels B and D report tests of equality of the interaction term β_2 across parallel specifications employing maternal and paternal education, as well as joint tests of the equalities $\beta_1^m = \beta_1^f$ and $\beta_2^m = \beta_2^f$. Asterisks indicate significance at the 10, 5 and 1 percent levels.

Table 5: Non-cognitive skills and parental learning

	Total	Discretionary	Tuition	Supplies	Transp.	Food	Tutoring	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Non-cognitive index and maternal time investment								
Index	56.650***	39.536***	17.114*	2.472	6.391**	23.109**	2.845**	4.718**
	(17.674)	(14.165)	(9.529)	(1.943)	(2.554)	(10.783)	(1.365)	(2.170)
Index x mother educ.	-11.198**	-8.597**	-2.601	.447	-1.645**	-6.325**	-.677**	-.396
	(5.085)	(4.292)	(2.088)	(.453)	(.702)	(3.138)	(.301)	(.433)
Index x time	-3.765	-2.925	-.840	-.524	-.035	-1.836	-.218	-.312**
	(2.716)	(2.401)	(.658)	(.353)	(.289)	(2.112)	(.159)	(.155)
Panel B: Non-cognitive index and paternal time investment								
Index	-21.437	-26.774	5.337	-1.285	2.899	-20.299	-3.369	-4.721**
	(32.034)	(23.348)	(12.583)	(3.316)	(2.563)	(19.510)	(2.354)	(2.054)
Index x father educ.	1.678	2.183	-.504	.511	-.575	.914	.269	1.065**
	(2.772)	(1.856)	(1.496)	(.356)	(.356)	(1.612)	(.214)	(.431)
Index x time	.487	.333	.154	-.097	.146	.398	.048	-.161
	(.828)	(.511)	(.466)	(.231)	(.118)	(.405)	(.086)	(.108)
Obs.	766	766	766	766	766	766	766	766
Mean (dep. var.)	276.748	104.052	172.696	38.164	12.011	37.679	6.218	9.98
St. dev. (dep. var.)	286.515	174.218	161.381	38.785	40.065	109.107	17.357	28.532

Notes: The dependent variables in Panels A and B are educational expenditure per semester per child in the specified category; total expenditure is the sum of all categories, and discretionary expenditure is the sum of all categories excluding tuition. The independent variables are the specified index of internalizing or externalizing behavior, the index interacted with the specified measure of parental education in years, and the index interacted with the amount of time the parent reports spending with children playing, talking or assisting with homework in a typical week. A higher non-cognitive index is indicative of higher non-cognitive skills. Time invested by the mother (father) is re-scaled to have the same mean as education of the mother (father). All specifications include controls for sibling parity, gender, sibling gender, height-for-age and cognitive skills measured contemporaneously with non-cognitive skills, sibling parity, gender, age, height-for-age and achievement scores interacted with maternal education, year-of-birth and household fixed effects, and standard errors clustered at the county level. Standard errors are clustered at the level of the county. Asterisks indicate significance at the 10, 5 and 1 percent levels.

Table 6: Heterogeneous effects with respect to maternal education and income

	Total (1)	Discretionary (2)	Tuition (3)	Supplies (4)	Transportation (5)	Food (6)	Tutoring (7)	Other (8)
Index	42.020**	29.815*	12.204	.520	6.639**	16.680	2.264**	3.712**
	(19.792)	(15.645)	(8.968)	(1.473)	(3.053)	(11.959)	(.891)	(1.841)
Index x educ.	-11.308**	-8.161**	-3.146	.458	-1.524**	-6.156**	-.599*	-.340
	(4.879)	(4.124)	(2.185)	(.522)	(.616)	(3.030)	(.307)	(.465)
Index x income	-.571	-1.243	.672	-.120	-.192	-.621	-.162*	-.148
	(1.401)	(.896)	(.678)	(.149)	(.198)	(.563)	(.087)	(.111)
Obs.	776	776	776	776	776	776	776	776
Mean (dep. var.)	276.748	104.052	172.696	38.164	12.011	37.679	6.218	9.98
St. dev. (dep. var.)	286.515	174.218	161.381	38.785	40.065	109.107	17.357	28.532

Notes: The dependent variables are educational expenditure per semester per child in the specified category; total expenditure is the sum of all categories, and discretionary expenditure is the sum of all categories excluding tuition. The independent variable is the specified index of internalizing or externalizing behavior, the index interacted with the specified measure of parental education in years, and the index interacted with household net income. A higher non-cognitive index is indicative of higher non-cognitive skills. Net income is re-scaled to have the same mean as maternal education. All specifications include controls for sibling parity, gender, sibling gender, height-for-age and cognitive skills measured contemporaneously with non-cognitive skills, sibling parity, gender, age, height-for-age and achievement scores interacted with maternal education, year-of-birth and household fixed effects, and standard errors clustered at the county level. Asterisks indicate significance at the 10, 5 and 1 percent levels.

Table 7: Maternal education and bargaining power

Panel A: Reported household decision-making by mother

	All decisions		Parenting decisions	
	(1)	(2)	(3)	(4)
Dif educ.	.036*		.004	
	(.019)		(.006)	
Mother educ.		.051**		.017**
		(.025)		(.008)
Mean	2.952	2.952	.857	.857
Obs.	383	388	383	388

Panel B: Non-cognitive index and maternal decision-making

	Total	Discretionary	Tuition	Supplies	Transportation	Food	Tutoring	Other
Index	76.364***	62.670***	13.694	.845	14.829**	38.894**	6.160***	1.942
	(23.839)	(19.364)	(14.853)	(2.838)	(5.984)	(15.355)	(2.038)	(2.032)
Index x mother educ.	-11.429**	-8.721**	-2.708	.384	-1.589**	-6.394**	-.675**	-.446
	(5.175)	(4.316)	(2.086)	(.465)	(.703)	(3.129)	(.313)	(.452)
Index x decision-making	-40.159*	-40.040***	-.119	-.647	-9.707*	-26.561**	-4.782***	1.657
	(23.719)	(15.173)	(15.661)	(2.857)	(5.891)	(13.077)	(1.708)	(2.047)
Obs.	776	776	776	776	776	776	776	776
Mean (dep. var.)	276.748	104.052	172.696	38.164	12.011	37.679	6.218	9.98
St. dev. (dep. var.)	286.515	174.218	161.381	38.785	40.065	109.107	17.357	28.532

Notes: The dependent variable in Panel A, Columns (1) and (3) is an index indicating the number of decisions made by the mother, as reported by the mother (ranges from 0 to 7); the dependent variable in Columns (4) and (6) is an index indicating the number of decisions made by the father, as reported by the father (ranges from 0 to 7). The independent variables in Panel A are the difference between maternal education and paternal education in years, maternal education in years or paternal education in years, as specified, and controls included are household net income, per-capita income, maternal and paternal age, and county fixed effects.
In Panel B, the dependent variables are educational expenditure as defined in Table 3, and the independent variables are the non-cognitive index, the index interacted with a dummy variable equal to one if the mother reports any decision-making power around parenting, and the index interacted with maternal education. A higher non-cognitive index is indicative of higher non-cognitive skills. Specifications in Panel B include controls for sibling parity, gender, sibling gender, height-for-age and cognitive skills measured contemporaneously with non-cognitive skills, sibling parity, gender, age, height-for-age and achievement scores interacted with maternal education, year-of-birth and household fixed effects, and standard errors clustered at the county level. Asterisks indicate significance at the 10, 5 and 1 percent levels.

Table 8: Persistence of non-cognitive skills in percentile and parental education

	Internal 2004		External 2004		Rosenberg 2009		Depression 2009	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Psychometric index 2000	.001	.067	-.005	.046				
	(.093)	(.078)	(.059)	(.054)				
Mother educ. 2000 int.	-.143**		-.083					
	(.059)		(.070)					
Father educ. 2000 int.	.159		.127					
	(.121)		(.106)					
Exp. 2000 int.		-.002***		-.0009**				
		(.0005)		(.0004)				
Psychometric index 2004					.110	.093	.131**	.164***
					(.096)	(.070)	(.063)	(.048)
Mother educ. 2004 int.					-.181*		-.004	
					(.107)		(.099)	
Father educ. 2004 int.					.118		-.025	
					(.116)		(.106)	
Exp. 2004 int.						-.00002		-.0004**
						(.0003)		(.0002)
Obs.	550	550	550	550	408	408	410	410

Notes: The dependent variables are the specified measure of non-cognitive skills from waves two and three, calculated in percentile terms. A higher index in internalizing or externalizing behavior is indicative of higher non-cognitive skills. A higher percentile in the Rosenberg index is associated with higher self-esteem. The depression index is inverted, and thus a higher percentile in the depression index is indicative of a lower level of depression. The independent variables include the psychometric index, the mean of internalizing and externalizing indices from waves one and two, calculated in percentile terms. The psychometric index is also interacted with dummy variables for the mother's (father's) education being above the median, and discretionary educational expenditure. All specifications include controls for cognitive skills measured in waves one and two, grades in math and Chinese, height-for-age, the parental education dummy variables, net income, assets, and fixed capital in the household, the number of siblings, sibling gender, and sibling gender interacted with the number of siblings, and county and year-of-birth fixed effects; the specifications including an interaction effect with expenditure also include linear and quadratic terms for total and discretionary educational expenditure, and a dummy for discretionary expenditure above the median. Standard errors are clustered at the level of the county. Asterisks indicate significance at the 10, 5 and 1 percent levels.

Appendix

Table A1: Within-household and cross-household variation

	Internal		External		Height-for-age		Achievement score		Grades	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Fixed effects	Household	Year	Household	Year	Household	Year	Household	Year	Household	Year
Obs.	776	776	776	776	776	776	776	776	776	776
R-squared	.600	.021	.620	.016	.828	.067	.864	.054	.676	.034

Notes: Each column reports the R-squared for the regression of the specified child characteristic on the specified set of fixed effects.

Table A2: Parental allocations and non-cognitive skills: Alternate specifications

	Total	Discretionary	Tuition	Supplies	Transportation	Food	Tutoring	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Results unconditional on child characteristics								
Index	38.182**	24.918*	13.265	.520	5.902**	13.422	1.465**	3.609
	(15.827)	(13.257)	(8.286)	(1.443)	(2.552)	(10.643)	(.720)	(2.584)
Index x mother educ.	-11.467**	-8.740**	-2.727	.129	-1.534***	-6.293**	-.525*	-.516
	(4.752)	(3.939)	(2.169)	(.528)	(.552)	(2.829)	(.284)	(.519)
Obs.	776	776	776	776	776	776	776	776
Panel B: Households including two or more children								
Index	29.733**	18.451*	11.282**	.786	4.462*	9.526	1.042	2.635**
	(12.185)	(9.588)	(5.406)	(.965)	(2.334)	(7.144)	(.965)	(1.119)
Index x mother educ.	-8.238**	-5.680**	-2.558	.269	-.864	-3.756*	-.999	-.330
	(3.554)	(2.896)	(1.576)	(.335)	(.540)	(1.973)	(.668)	(.275)
Obs.	1132	1132	1132	1132	1132	1132	1132	1132
Panel C: Households including a first-born son								
Index	48.862*	39.267**	9.595	1.790	6.373	27.235**	2.954**	.915
	(25.905)	(18.256)	(11.187)	(1.876)	(3.928)	(13.106)	(1.444)	(1.593)
Index x mother educ.	-13.411*	-11.645**	-1.766	-.184	-1.674	-8.777**	-1.022**	.012
	(7.697)	(5.729)	(2.911)	(.520)	(1.077)	(4.148)	(.437)	(.669)
Obs.	390	390	390	390	390	390	390	390
Mean (dep. var.)	261.867	94.244	167.622	36.22	10.658	31.111	7.025	9.23
St. dev. (dep. var.)	273.416	168.236	148.407	37.226	37.467	102.985	33.987	30.367

Notes: The dependent variables are educational expenditure per semester per child in the specified category; total expenditure is the sum of all categories, and discretionary expenditure is the sum of all categories excluding tuition. The independent variable is a mean index of non-cognitive skills and the interaction of this index with maternal education. A higher internalizing or externalizing index is indicative of higher non-cognitive skills. In Panel A, the specifications include year-of-birth and household fixed effects, and standard errors clustered at the county level; the sample is households with two children. In Panel B, all specifications include controls for sibling parity, gender, sibling gender, height-for-age and cognitive skills, sibling parity, gender, age, height-for-age and achievement scores interacted with maternal education, year-of-birth and household fixed effects, and standard errors clustered at the county level; the sample is households with two or more children. Asterisks indicate significance at the 10, 5 and 1 percent levels.

Table A3: Heterogeneous effects: Addressing bias due to serial correlation in expenditure

	Total	Discretionary	Tuition	Supplies	Transp. and food	Tutoring	Other fees	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Maternal education and non-cognitive index								
Index	9.480*	6.518*	2.962	1.455	1.611	.317	.069	
	(5.508)	(3.862)	(3.558)	(1.904)	(1.090)	(.286)	(1.448)	
Index x mother educ.	-3.820**	-2.643**	-1.177	-.897**	-1.045*	-.115	-.054	
	(1.829)	(1.208)	(1.061)	(.420)	(.582)	(.082)	(.464)	
Obs.	756	756	756	756	756	756	756	
Panel B: Paternal education and non-cognitive index								
Index	-17.016	3.775	-20.791	1.076	-2.584	-.781**	2.551	
	(18.593)	(7.605)	(15.264)	(2.487)	(2.235)	(.379)	(2.340)	
Index x father educ.	1.762	-1.017	2.779	-.423	.048	.096*	-.445	
	(2.450)	(.770)	(2.122)	(.311)	(.236)	(.056)	(.346)	
Mean (dep. var.)	159.95	49.19	110.76	25.06	5.42	1.52	9.75	
St. dev. (dep. var.)	133.65	78.21	89.91	24.35	32.7	7.9	25.11	
Obs.	756	756	756	756	756	756	756	
Panel C: Maternal education including controls for past expenditure								
	Total	Discretionary	Tuition	Supplies	Transportation	Food	Tutoring	Other
Index	40.791**	27.190*	13.601	.267	6.230**	15.364	1.927**	3.402*
	(18.974)	(15.689)	(8.923)	(1.399)	(2.987)	(12.149)	(.955)	(1.822)
Index x mother educ.	-11.692**	-8.987**	-2.705	.378	-1.653**	-6.569**	-.706**	-.437
	(5.004)	(4.238)	(2.105)	(.463)	(.707)	(3.095)	(.312)	(.433)
Mean (dep. var.)	276.748	104.052	172.696	38.164	12.011	37.679	6.218	9.98
St. dev. (dep. var.)	286.515	174.218	161.381	38.785	40.065	109.107	17.357	28.532
Obs.	776	776	776	776	776	776	776	776

Notes: In Panel A and Panel B, the dependent variables are educational expenditure per semester per child in the specified category at primary school age (as observed in wave one for the first-born child and in wave two for the second-born child); total expenditure is the sum of all categories, and discretionary expenditure is the sum of all categories excluding tuition. The independent variables in Panels A and B include a non-cognitive index as measured at primary school age, as well as the index interacted with the specified measure of parental education. A higher internalizing or externalizing index is indicative of higher non-cognitive skills. All specifications include controls for sibling parity, gender, sibling gender, height-for-age and cognitive skills measured contemporaneously with non-cognitive skills, sibling parity, gender, age, height-for-age and achievement scores interacted with maternal education, year-of-birth and household fixed effects, and standard errors clustered at the county level. Specifications in Panel C are similar to those in Table 4 and include an additional control for lagged educational expenditure (as reported in wave one). Asterisks indicate significance at the 10, 5 and 1 percent levels.

Table A4: Heterogeneous effects with respect to maternal favorite

	Total	Discretionary	Tuition	Supplies	Transportation	Food	Tutoring	Other
Index	40.644**	27.199*	13.445	.283	6.230**	15.348	1.902**	3.435*
	(18.599)	(15.198)	(8.873)	(1.370)	(2.845)	(11.894)	(.926)	(1.846)
Index x mother educ.	-11.693**	-9.023**	-2.670	.366	-1.653**	-6.587**	-.701**	-.447
	(5.181)	(4.352)	(2.111)	(.460)	(.702)	(3.163)	(.320)	(.448)
Favorite	11.545	-1.244	12.789	-1.940	.535	.839	2.113	-2.790
	(24.908)	(19.064)	(9.275)	(6.472)	(4.874)	(13.812)	(2.238)	(1.912)
Favorite x mother educ.	6.370	7.054	-.684	1.222	.723	4.281	.293	.535
	(8.962)	(5.643)	(4.555)	(1.476)	(1.375)	(4.232)	(.490)	(.520)
Obs.	776	776	776	776	776	776	776	776
Mean (dep. var.)	276.748	104.052	172.696	38.164	12.011	37.679	6.218	9.98
St. dev. (dep. var.)	286.515	174.218	161.381	38.785	40.065	109.107	17.357	28.532

Notes: The dependent variable is educational expenditure in the specified category, and the independent variables are the non-cognitive index and a dummy for the child being reported as the maternal favorite, and both variables interacted with maternal education. A higher internalizing or externalizing index is indicative of higher non-cognitive skills. All specifications include controls for sibling parity, gender, sibling gender, height-for-age and cognitive skills measured contemporaneously with non-cognitive skills, sibling parity, gender, age, height-for-age and achievement scores interacted with maternal education, year-of-birth and household fixed effects, and standard errors clustered at the county level. Standard errors are clustered at the level of the county.

Table A5: Alternate measures of non-cognitive skills: teacher reports

	Total (1)	Discretionary (2)	Tuition (3)	Supplies (4)	Transportation (5)	Food (6)	Tutoring (7)	Other (8)
Teacher index	34.132	28.784*	5.348	8.086	4.973	13.544	.136	2.045
	(25.439)	(16.150)	(12.351)	(5.030)	(4.655)	(8.644)	(2.061)	(2.044)
Index x mother educ.	-14.294**	-13.210***	-1.085	-1.586**	-2.785**	-8.496***	-.282	-.061
	(5.642)	(4.078)	(2.626)	(.764)	(1.121)	(2.551)	(.592)	(.272)
Obs.	774	774	774	774	774	774	774	774
Mean (dep. var.)	276.748	104.052	172.696	38.164	12.011	37.679	6.218	9.98
St. dev. (dep. var.)	286.515	174.218	161.381	38.785	40.065	109.107	17.357	28.532

Notes: The dependent variables are educational expenditure per semester per child in the specified category; total expenditure is the sum of all categories, and discretionary expenditure is the sum of all categories excluding tuition. The independent variables are a dummy variable equal to one if an index of non-cognitive skills based on teacher reports of the child's behavior is above the mean, and the interaction of this dummy variable with maternal education. All specifications include controls for sibling parity, gender, sibling gender, height-for-age and cognitive skills measured contemporaneously with non-cognitive skills, sibling parity, gender, age, height-for-age and achievement scores interacted with maternal education, year-of-birth and household fixed effects, and standard errors clustered at the county level. Asterisks indicate significance at the 10, 5 and 1 percent levels.