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The Role of Maternal Cognitive Ability on Child Health

by

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Abstract[1]

The literature on child health suggests mother's schooling is a key determinant of child health. Little is known of how other sources of maternal human capital contribute to her children's health. This paper investigates the differential returns on child health of three sources of maternal human capital: schooling, cognitive ability and childhood background. Conditional on schooling and mother's height, we first analyze the effect of maternal cognitive ability on her children's health. Next, we relax the assumption of mother's schooling and reasoning ability as predetermined variables and study the extent to which both returns reflect observed mother's childhood endowments. We conclude by investigating the importance of mother's schooling and cognitive ability in enhancing her offspring's health during first-time motherhood. Results show maternal cognitive ability is an important factor in improving her children's health. We find these returns robust to the inclusion of mother's observed childhood endowments. However, estimates of mother's schooling drop by 30 percent when we control for these variables. This suggests that unlike mother's schooling, maternal returns to cognitive ability on child health are less likely to reflect mother's childhood background. Finally, we find maternal reasoning ability to be an important factor in improving her children's health in first-time motherhood. Our analysis is based on information gathered in the Mexican Family Life Survey (MxFLS-1), which administered Raven's Colored Progressive Matrices, and collected anthropometric outcomes. Our results focus on child height-for-age (0-17 years) z-scores as long-run health outcomes.

JEL Classification: I12, J13
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1. Introduction

It is generally agreed that investments in human resources play an important role in economic growth. There is a vast literature showing that education is a key determinant of improved performance in the labor market, in one's business, on the farm and even in the home in the sense of its influence on the outcomes of one's children. Like schooling, health is a form of human capital, and it is also correlated with improved functionality and productivity (Strauss and Thomas, 1995). But health is a good for which there is no market, and it is therefore produced within the household. Given household endowments and child-rearing technology, the way parents allocate family resources has a direct impact on child health. These decisions, in turn, not only affect the productivity of the children at school and at their jobs when they are older, but also influence their life expectancy. For example, malnutrition in early stages of life has been shown to be correlated with child mortality and child morbidity. Likewise, incipient child health problems have been shown to be related with a decline in cognitive ability and mental development (Beaton et al., 1993; Bleichrodt and Born, 1994; and Wachs, 1995).

The literature on child health and nutrition in a socioeconomic context has been analyzed by several authors. Shultz (1984) reviews the impact of household economic and community variables on child mortality; Wolfe and Behrman (1982) and Thomas, Strauss and Henriques (1990a) investigate the interdependence of child height and nutritional status with child survival; Barrera (1990) studies the role of maternal schooling and its interaction with public health programs in child health production; and Thomas (1990, 1994) investigates how household differences in resource allocation on child health reflect both technological differences in child rearing and differences in the preferences of the parents.

This literature suggests that mothers play a central role in household and child-rearing activities. As a result, mother's education has been commonly described as a key determinant of child health. At least four ways in which maternal education enhances the child health have been suggested: a) it improves the productivity of health inputs due to better knowledge and access to new information; b) it makes allocation of resources more efficient; c) it increases the economic resources available to the family via the mother's participation in economic activities, and d) as proxy of individual permanent income, it grants the mother important bargaining power in household decision making, shifting household preferences towards child human capital investments.

Several attempts have been made to separate the differential mechanisms through which mother's human capital impacts health outcomes. Behrman and Wolf (1987) have analyzed the correlation of schooling returns to unobserved mother's childhood background, and intra-generation transmission of knowledge; while Thomas, Strauss, and Henriques (1990) have analyzed the effect of maternal capacity on processing information on child health. Nevertheless, little is known regarding the importance of the mother's cognitive ability in procuring her children's health.

This paper bridges the gap and investigates the role of maternal cognitive ability in enhancing child health as measured by the child's height. To do so, we first assess the magnitude of the returns to schooling relative to those of maternal cognitive ability. Second, we relax the assumption of maternal cognitive ability as a predetermined variable and investigate the mechanism through which it improves the health of her children. By doing so, we hope to contribute to the cognitive ability literature, where most of the studies investigating the returns of reasoning ability on individual labor productivity and on cognitive achievement have treated it as predetermined. (See for example, Alderman, Behrman, Ross, and Sabot, 1996; and Glewwe and Jacoby 1994).

In particular, we explore how the effect of maternal cognitive ability reflects her childhood background experience in the form of a) parental intra-generation transmission of knowledge and b) mother's childhood environmental factors such as community characteristics and school quality proxies. We also investigate whether the mechanism through which maternal cognitive ability relates to the health of her children operates through contemporaneous child health determinants, such as maternal child-rearing experience and household economic resources. Finally, we test whether returns to maternal reasoning ability on child's health are correlated to mother's unobserved characteristics other than childhood endowments by use of 2SLS methods.

Our results show that maternal cognitive ability is an important factor in improving her children's height, even after controlling for child's age and gender, parental age, mother's and father's years of schooling and mother's height. We find that maternal cognitive ability estimates are robust to the inclusion of the mother's parents' years of schooling, whether she lived in an urban community during her primary years, and whether she attended a public elementary school as opposed to a private institution. These results suggest that cognitive ability returns on child

health are less likely to reflect mother's childhood background factors such as inter-generational transmission of knowledge between parents and their offspring, or local childhood community environment factors such as school. In line with the literature, we find household economic resources, as measured by household total expenditure, to be an important determinant of children's health. Controlling for total household expenditure, the effect of maternal cognitive ability on child's health falls by 10 percent, suggesting the possibility that cognitive ability enhances child's health investment by improving the mother's ability to provide wealth to the household, perhaps by means of labor productivity and/or savings decisions. However, the fact that the effect of mother's cognitive ability remains significant suggests that cognitive ability may also improve children's health via other mechanisms instead of simply increasing the household's economic resources.

Since the literature on household decision-making suggests that child-rearing experience may be an important input in the health production function, by allowing parents to allocate household resources more efficiently (see Strauss and Thomas, 1995, for a review), a natural course of action is to investigate the relationship between mother's reasoning ability and child-care experience on returns to child health. Mother's fixed effects estimates compared between firstborn and not-firstborn children suggest that high maternal reasoning ability plays a more important role in improving the child's health when mothers experience motherhood for the first time, than when they have acquired experience with other children. These results hold only if we control for mother's unobserved characteristics, suggesting that OLS estimates of returns to mother's cognitive ability on child health are downward-biased 2SLS that use mother's previous childhood endowment variables as identifying instruments for maternal years of schooling and cognitive ability corroborates this hypothesis.

Our results are based on extremely rich information gathered in the Mexican Family Life Survey (MxFLS-1), which, in addition to usual household demographics, provides in a single instrument information on childhood background, migration retrospective information and fertility and childbirth histories for every household member above the age of 15, allowing us to construct measures of motherhood experience and mother's environmental background factors. To obtain a measure of reasoning ability, MxFLS-1 administered Raven's (1956) Colored Progressive Matrices, which do not require literacy, to every household member between 5 and 65 years of age. MxFLS-1 also provides data on household expenditure on durable and non-

durable goods, which we used to control for household economic resources. Anthropometric information is also available for every household member, allowing us to focus our analysis on child height-for-age z-scores as long-run health outcomes for every child living in the household between 0 to 17 years of age. This age range allows us to investigate the extent to which mother's cognitive ability plays an important role in early child development as well as through adolescence. Our results suggest that unlike other measures of maternal human capital (such as years of schooling), mother's cognitive ability has a greater impact on child's later growth development (10 to 17 years of age) than in early years (0-9 years old).

Section 2 of the paper presents the model, while Section 3 describes the data used in the analysis and Section 4 presents the empirical strategy and discusses our findings. Conclusions are found at the end of the paper.

2. Model

For simplicity, we define household welfare as a function of each parent's preferences as dependent upon parental (observed and unobserved) characteristics, and on *all* household members' private and public consumption.[2] This allows us to explain any altruistic behavior and externalities in consumption that are essential in modeling why parents allocate resources in the provision of health to their children:

$$W = \left[U^m\left(X, H, u_m, u_f, \varepsilon_m, \varepsilon_f\right), U^f\left(X, H, u_m, u_f, \varepsilon_m, \varepsilon_f\right)\right] \quad (1)$$

X represents a vector of market commodities, including leisure; H stands for all non-market goods produced at home, such as child's health investment; u_m and u_f denote mother's and father's observed background characteristics such as age and years of schooling; and ε_m and ε_f correspond to vectors of parental unobservable characteristics, such as tastes and cognitive ability.

The household welfare function is maximized, subject to the family budget constraint:[3]

$$PX = Y,$$
$$Y_i = E_j + ny_j \quad (2)$$

[2] We impose no *a priori* restriction on the household decision-making mechanism.
[3] For simplicity, we assume parental incomes to be the only source of family monetary resources.

P is a vector of market prices excluding the price of leisure; and Y stands for household total income, as a linear combination of household earnings (E) and non-labor income (ny_i). Earnings depend, as usual, on individual's wage and on a time constraint.

The health of the children in the family does not depend merely on the parents' preferences in the allocation of resources. Other variables such as child biological factors, community characteristics and each parent's specific technology in raising children become important elements in determining the health status of the child. This is captured by a non-market commodity production function that summarizes any private and public inputs in the procurement of health:

$$H = H\left(X, X_n, \theta, \eta_p, \eta_c\right) \quad (3)$$

H depends on any market purchased (*X*) and non-market (X_n) inputs that are related to the health status of the child, such as food intake, utilization of health services and breast-feeding, respectively. We also incorporate a vector of child's characteristics (θ), such as age and gender, that controls for biological factors influencing the child's health. η_p is a vector of parental-specific characteristics that reflects child-rearing technology. η_p can be thought of as parental age, years of schooling, cognitive ability and any other background endowments. η_c captures characteristics related to the environment that surrounds the household, such as community quantity and quality of public services, type of sewage, water facilities and garbage disposal services, public policy interventions such as health talks and vaccination campaigns, consumption goods prices, and regional climate.

The maximization process leads to aggregate market and non-market household commodity demands for each element of *X* and *H*, which includes child's health investments:

$$X^* = G_x\left(P, y_m, y_f; u_m, u_f, \varepsilon_m, \varepsilon_f; \theta, \eta_p, \eta_c\right)$$
$$H^* = G_z\left(P, y_m, y_f; u_m, u_f, \varepsilon_m, \varepsilon_f; \theta, \eta_p, \eta_c\right) \quad (4)$$

These reduced forms—including the demand for child health (such as child height)—depend on a vector *P* of commodity prices, and on the set of observed and unobserved household and community characteristics that reflect parental preferences and child-rearing technology in the allocation of resources within the household. Section 4 of the paper deals with the empirical

strategy estimating the child's health as a component of H^*.[4] We turn next to the description of the data.

3. Data

The data we use are drawn from the Mexican Family Life Survey, 2002 (MxFLS-1). This multi-purpose household survey is representative at the national, urban-rural and regional levels and was collected between the months of April and July 2002. The survey was designed by scholars at the Centro de Investigación y Docencia Económicas (CIDE) and the Universidad Iberoamericana, but it adopts the methodology and protocols followed in the Indonesian Family Life Surveys. The survey was fielded by the Mexican National Institute of Statistics, Geography and Informatics, the equivalent of the U.S. Bureau of the Census. Since this survey is new and so far little is known about it, a brief summary of it follows.

The multi-dimensional characteristic of the survey made it possible to collect detailed demographic, socioeconomic and health information about all the individuals who make up Mexican households. MxFLS-1 gathers, in a single database, detailed information on the areas discussed below.

Household-Level Data

This information is gathered from one single respondent and consists of: total expenditure and auto-consumption/production by the household, agricultural land ownership and detailed information about each plot, non-agricultural businesses, non-labor income, asset ownership (wealth), saving decisions, formal and informal credit, debts, economic household shocks, crime and victimization suffered by household members, business or plot, and detailed information about every event; total non-labor household income, dwelling characteristics, living arrangements and environmental shocks suffered by the household/community.

Individual-Level Data

Information from every member of the household is collected on the following matters: retrospective data on schooling; retrospective histories of migration, marriage, births and deaths of children, labor force participation, labor income of adults; monetary and in-kind transfers,

[4] In this context, H* corresponds to a vector of household aggregate health demand including child's health.

time allocation of adults and children, credits and loans, human capital investment levels and decision-making; socio-demographic and geographic information of the individuals that make up the extended family (including non co-resident parents and siblings), individual health status both objective and subjective of all members in the household (own perception; habits and functioning indicators; chronic diseases; morbidity, anthropometric outcomes; hemoglobin levels; demand for health services), reproductive health of all women of childbearing age in the household, and the use of contraceptive methods.

Since the well-being of the individuals also depends on the environment that surrounds them (community infrastructure and services and quality of the services offered), MxFLS-1 also conducted fieldwork activities at the community level in addition to the household interviews. The MxFLS baseline included the application of a locality/community questionnaire, with the objective of embodying qualitative and quantitative information at the community level about: schools, health services, and socioeconomic past and present infrastructure characteristics. Instruments were applied in every community in which MxFLS-1 respondents lived. These instruments consisted of interviews with community leaders and personnel in charge of health institutions and schools. The following information was gathered: history, economic and physical infrastructure of the locality (for example, wages, availability of public services, existence of roads, natural disasters, crimes), and a price module collecting local prices and availability of food, medicine and basic goods.

The MxFLS-1 sample consists approximately of 8,400 households. For this study we selected all children less than 18 years of age who could be linked to their biological father or mother living in the household. The total number of observations in this sub-sample is 13,871 children. Descriptive statistics can be found in Table 1.

While the child-age distribution in our sample is relatively homogeneous, 27 percent of the children are first-born. The height z-scores of the different child-age categories present an inverted U-shape related to the age of the child, suggesting that Mexican children are smaller at birth than children in the standard (US) sample, though they catch up as toddlers and deviate again during their teenage years.

Mothers in our sample are on average 35 years old and 153 centimeters tall and have Raven Z-score distributions that are relatively skewed to the right. Mothers entered primary school on average at the age of 6.5, and 26 percent of them report having failed a grade in

elementary school. On average, mothers have had 6 years of schooling, although 9 percent are illiterate and almost 20 percent have had more than 10 years of education. Their mothers, however, only attained 2.3 years of schooling and their fathers 2.6. This huge generational difference alludes to the increase in the average schooling of the population that has taken place in Mexico in the last few decades.

Approximately 60 percent of mothers live in urban areas today, in contrast to only 22 percent who lived in urban areas when they were 12 years of age. This suggests there has been vital rural migration to the cities over time.

4. Empirical Strategy and Findings

In terms of the determinants of child health, mother's human capital has proven to be an important variable for estimating what has been denominated "'returns to schooling" in the procurement of health. These returns have often been overstated by the exclusion of the mother's unobserved characteristics, which are very hard to find in one single source, leading to biased estimates of the impact of maternal years of education. Therefore, we start our empirical analysis by assessing the importance of other measures of human capital, such as mother's height and maternal cognitive ability as child health determinants in addition to years of schooling. We start with standard parental characteristics as determinants of child health, and marginally add variables to understand the contribution of each one to the child's height.

In line with the literature, OLS results in Table 2 (column 1) show increasing returns to mother's years of education in child's height.[5] Child's height increases by 0.21 percent if the mother attended some level of elementary school. However, if she finished high school or higher levels of education, the height of the child increased by 0.50 percent relative to children whose mother is illiterate. Moreover, mother's years of schoolings estimates are about 40 percent higher than father's returns to schooling. Nevertheless, schooling, like other measures of human capital, is arguably correlated with unobservable individual characteristics, such as mother's background, that affected both mother's schooling achievement in the past and has a present influence on her children's health. We add to our specification mother's height, which reflects not only biological and inherited, factors but also early investments in the health of the mother that are usually correlated with childhood household human capital and economic resources. Consequently, the

inclusion of this additional control results in lower returns to schooling, indicating that with all else constant, taller mothers more successfully procure their offspring's health (column 3).

We next raise the question of whether maternal cognitive ability provides additional health benefits to children once we control for household traditional human capital variables. *Ceteris paribus*, a mother with higher reasoning ability may be in a better position to process relevant information in the procurement of her children's health. Likewise, cognitive ability may allow her to reduce the learning cost of new motherhood, and allow her to learn faster from child- rearing experience in general when it comes to procuring her children's health. Returns to cognitive ability have been studied in the context of labor markets (Alderman, Behrman et al., 1996) and as a determinant of individual cognitive achievement (e.g., Glewwe, 1994, and Knight and Sabot 1990).[6] We know of no other study, however, that analyzes reasoning ability in the determination of child health outcomes.

To obtain a measure of reasoning ability, MxFLS-1 administered Raven's (1956) Color Progressive Matrices test, an instrument that does not require literacy and involves the matching of patterns. This test was administered to all household members between 5 and 65 years of age. We use the test score of adult females biologically linked to children in the household as our measure of mother's cognitive ability. For this study individual maternal Raven test scores were normalized as a percentage deviation from MxFLS-1's Raven test score mean to obtain a continuous distribution of maternal cognitive ability with mean 0 and variance 1 that is not truncated at either tail. (Table 1 shows the distribution of maternal (standardized) Raven z-score).

To see the effect of this variable alone, Table 2 (column 3) displays the results when mother's Raven z-score is included, but not mother's height. As before, returns to schooling drop, suggesting that schooling effects confound typically unobservable characteristics such as the mother's reasoning ability to procure health. This variable is statistically significant.

Table 2 (column 4) indicates the results when both mother's height and cognitive ability are jointly included. As expected, returns to schooling drop even more than in previous specifications, indicating the relevance of including other parental characteristics when estimating schooling returns to health. Of particular note is the fact that maternal height

[5] See, for example, surveys by Cochrane, Leslie, and O'Hara (1982) and Behrman and Deolalikar (1988).
[6] Cognitive ability has also been studied in non-economic analyses (e.g., Nokes et al., 1992).

estimates are robust to the inclusion of mother's cognitive ability. In contrast, mother's returns to reasoning ability on child health decrease by 40 percent in magnitude. However, cognitive ability after controlling for mother's height and years of education remains highly significant and accounts for one-fourth of the returns to schooling, suggesting that maternal cognitive ability is indeed an important variable in child health's long-run outcomes.

The focus of our analysis is an extended age range from 0 to 17, though the socioeconomic child health literature has traditionally adopted a narrower range when studying the effect of parental characteristics on child's health. Nevertheless, Barrera (1990) suggests the presence of nonlinearities in the returns of maternal years of schooling on child's health as youngsters grow up to adolescence. To investigate this possibility, and to understand where these nonlinearities are, we next replicate Table 2's analysis for children between 0 to 9 years old and for children between 10 to 17 years of age. Results based on Tables 1 and 2 in the Appendix show the presence of nonlinearities in the returns of mother's schooling and mother's cognitive ability. Moreover, the returns to these two measures of maternal human capital deviate as the child grows up. Mother's schooling becomes less important in determining her child's height as he/she gets older, while her cognitive ability seems to have a lagged effect and provides higher returns on child health as the child enters adolescence.

Testing Some Mechanisms by which Maternal Reasoning Ability May Operate

Individual cognitive ability has often been treated as a predetermined variable in economic analyses. Nevertheless, there is controversy over what cognitive ability—and in particular what the Raven test score—represents. Cognitive ability may reflect innate individual reasoning capacity. However, an individual's cognitive ability may well capture part of his childhood human capital endowment—such as parental transmission of knowledge and/or school quality, among other factors, or may also be affected by the individual's own life-path experience.

Understanding the path through which maternal cognitive ability operates on child health investment decisions is important for policy implications. The design of social programs may have little to say on this matter, if maternal cognitive ability is mainly innate. Nevertheless, the role of social programs becomes important if reasoning ability mainly reflects school quality; or parents-to-mother transmission of knowledge and inheritance of good health practices.

This section of the paper investigates some means by which maternal reasoning ability enhances her offspring's health. We begin our analysis by exploring the relationship between maternal cognitive ability and some variables that reflect her human capital endowment. Table 3 shows OLS estimates of mother's Raven z-score. Results show that mother's age is not an important factor in explaining her performance when taking the Raven test, once years of schooling is taken into account. In contrast, there is an increasing correlation between years of schooling and the Raven z-score. Whether this reflects causality of schooling on cognitive ability, or cognitive ability affecting years of schooling, is unclear.

MxFLS-1 collects extensive information on non-co-resident relatives, regardless of their place of residence and independently of whether they are currently alive. We use years of schooling of the mother's parents as proxies of maternal background household resources. Estimates of mother's parents' years of schooling (Table 3, column 2) suggests that mother's background endowment in the form of parental human capital is an important factor in determining her reasoning ability, despite controlling for mother's years of schooling. The non-significance of the estimates of whether any mother's parent lives in the household may suggest that parental human capital has a higher impact on her reasoning ability during childhood than through a permanent mother-parent relationship during adulthood. Our results also show a higher impact of mother's mother's years of schooling on her cognitive ability than of mother's father's years of schooling. Mother's height is also positively correlated with mother's reasoning ability after controlling for all background variables.

Using individual retrospective information on migration and school attendance gathered in MxFLS-1, we are able to construct two proxy variables for maternal childhood environment: a) whether she lived in an urban community between the ages of 0 to 12 and b) whether she studied in a public primary school or a private institution. The significant estimate of the categorical variable that indicates if the mother lived in an urban area from 0-12 years of age suggests that a richer and more resourceful environment during childhood positively relates to better cognitive ability in adulthood, even after controlling for individual and parental years of schooling (Table 3, column 3), and current household resources, as expressed by household total expenditure (column 4).

An analysis of Table 3 suggests that maternal cognitive ability is not independent of childhood background characteristics. This background endowment may also influence current

household decisions on child's health. Therefore our next step is to investigate to what extent the path through which maternal cognitive reasoning ability operates on child's height is associated with her background endowment. Table 4 presents this analysis. Column 1 replicates the parsimonious specification in Table 2 (column 4), for ease of comparison. Columns 2 through 6 of Table 4 investigate the sensitivity of the effect of maternal cognitive ability on child's height if mother's childhood endowment information is gradually added to the specification.

The results in Table 4 (column 2) indicate that grandmother's schooling is weakly but positively associated with grandchildren's health, while grandfather's schooling has no effect. Both effects are jointly not significant given that we are controlling for mother's height, schooling and cognitive ability. These results are corroborated in column 3 when additional covariates are included for whether the grandparents reside in the same dwelling. The idea of including the latter variables relates to a possible impact on the child's wellbeing if co-resident grandparents dedicate time and resources towards their grandchildren. The coefficients of mother's returns to schooling do not change in either of the specifications, nor do the returns to mother's cognitive ability on child's height.

In Table 4 (column 4) we add additional background covariates. We include an indicator if the mother lived in an urban area up to the age of 12 and whether she studied in a public primary school. The use of both variables is intended to partly reflect the environmental influences on the mother when she was growing up as well as serve as a measure of the possible quality of her schooling. Whether the mother studied in a public elementary institution or a private one provides no additional improvement in the height of her children. This may partially reflect a lack of power in our indicator, given that 97.5 percent of the mothers in our sample attended a public school.[7] The mother's residence in an urban community during her elementary school years, however, does have a positive impact on her children's health. The impact doubles the returns of maternal cognitive ability. Both environment background variables are jointly significant and their inclusion reduces the returns to schooling by 50 percent. However, the impact of maternal cognitive ability on her children's height remains robust and continues to be highly statistically significant.

Nonetheless, it is possible that mothers who lived in urban areas when young continue to live in urban areas now and consequently, the urban dummy variable confounds the effect of

[7] This is similar to the national proportion of Mexicans attending public schools.

childhood background infrastructure with current community resources. For this reason, specification in Table 4 (column 4) further controls for whether the mother and her children currently live in an urban setting. The impact of having lived in an urban area when young completely disappears after this control is included. However, the coefficient of returns to mother's reasoning ability remains extraordinarily robust.

All results related to background characteristics speak to the fact that they do not mediate the impact of mother's cognitive ability on child's height. Maternal cognitive ability apparently is yet another form of human capital that determines the health of the child in an important way independently of observed mother's childhood background and years of schooling.

This makes us question whether the relationship between the cognitive ability of the mother and the health of her children is associated with mechanisms of intermediation of daily living. For example, these mechanisms could be related to exploiting the mother's experience as a mother with subsequent children; a better capacity to take advantage of available resources in the community for procuring the health of her children (in terms of infrastructure and social programs); or through the possibility of attracting more wealth to the household in the form of higher long-term income. The following section investigates two of these three possible channels.

Returns of Maternal Cognitive Ability as a Means of Enhancing Household Economic Resources

Another way in which cognitive ability might operate is through wealth measures, since higher human capital is related to higher labor productivity, higher earnings, and thus higher wealth, and higher wealth is related to better health. We thus further investigate whether economic resources brought to the household can explain in part the path through which the cognitive ability of the mother affects her children's health. Table 4 (column 5) controls for total household expenditure. In line with the literature, household expenditure is positive and highly correlated with children's health. Yet its inclusion has no effect on mother's returns to schooling and only a small effect on her Raven's score.

It is possible, however, that mothers with greater cognitive ability are in a better position to exploit economic resources and health infrastructure at the community level to improve the health of their children. To explore this possibility, Table 4 (column 6) further controls for

community fixed effects. Estimates of mother's cognitive ability decrease by 40 percent when adding community controls, suggesting that a fraction of maternal cognitive ability operates through economic resources available to the household.

Community Fixed Effects (CFE) control for a fraction of the heterogeneity in resources that are available to the household but do not control for unobservables at the household or even at the mother level that are correlated to her levels of human capital and also to determinants of her children's height. These unobservables may even escape mother's childhood background, contaminating our OLS and CFE estimates. For example, if higher cognitive ability is associated with higher individual labor productivity (per Alderman, Behrman et al., 1996) and this in turn increases the mother's opportunity cost to devote her time to child-rearing activities, then OLS and CFE returns of cognitive ability on child's health may be biased downward. This argument, of course, applies to the two other measures of maternal human capital that were used: years of schooling and mother's height.

To analyze this possibility, Table 5 presents 2SLS estimates of returns to mother's schooling and cognitive reasoning on child's height. Ideally, we would like to rely on a sufficient set of identifying instruments to correctly and simultaneously assess the returns of mother's height, years of schooling, and reasoning ability on child's height. Unfortunately that is not possible. We are unable to find good instruments with sufficient power to explain mother's height. Instead, conditional on child's age and gender, father's education, mother's height, household total expenditure, and an indicator for current urban place of residence, we use mother's childhood background information to simultaneously instrument maternal cognitive ability and years of schooling.[8] First-stage regressions are shown in the Appendix.

Table 5 compares OLS with 2SLS estimates. The results in column 2 show that 2SLS estimates of maternal years of schooling are of larger magnitude than their OLS counterparts and remain jointly significant. Similarly, the returns of maternal reasoning ability on child's health increase and remain significant. We conclude, therefore, that the returns of mother's years of schooling and cognitive ability on child health are correlated with unobservable heterogeneity that is not associated with mother's childhood endowment.

Returns of Maternal Cognitive Ability as a Means of Reducing the Child-Care Learning Costs of New Motherhood

We conclude by investigating the relationship between mother's reasoning ability and child-care experience on returns to child health. *Ceteris paribus*, mothers with higher cognitive ability may shorten their learning curve with respect to child-care information acquisition in new motherhood, and consequently augment their firstborn child's health relative to firstborns of mothers less cognitively able. Using individual fertility and birth histories gathered in MxFLS-1 of females if reproductive age, we construct an indicator variable that takes the value of one for every child in our sample identified as firstborn and as a household member. Next, in order to test the new motherhood learning hypothesis, we proceed to fully interact our core model with this indicator. Table 6 summarizes the results based on OLS and Mother's Fixed Effects (MFE) estimates. To allow for comparison between OLS and MFE models, we restrict our sample to mothers with at least two children living in the household, one of whom is recorded as firstborn.

Results suggest no differential effects between firstborns and other children in mother's returns to height and years of schooling on child's health. Nevertheless, maternal cognitive ability seems to play a more important role inn the child's health when females embark on motherhood, rather than in later maternity, when they have acquired more experience. This result, however, only holds at the 10 percent significance level controlling for mother's unobservable characteristics, (see Table 6, column 4). While this result should be taken with caution, it supports the conclusion that mother's returns to cognitive ability on child health are likely to be downward biased in the presence of unobservable heterogeneity.

5. Conclusions

The empirical literature on child health suggests that mother's human capital plays a central role in childrens health outcomes. Some efforts have been made to separate the differential mechanisms through which mother's human capital impacts health outcomes.

Nevertheless, little is known regarding the importance of the mother's cognitive ability in procuring her children's health. This paper stands apart from the economic literature that

[8] We use as identifying instruments: mother's father and mother's mother years of schooling; whether the mother lived in an urban area from the ages of 0-12 , 13-15 and 15 to 18; whether she attended a public elementary school; and whether she failed any grade at the primary, secondary and/or high school level.

assumes individual cognitive ability as predetermined, and investigates possible mechanisms through which mother's reasoning ability operates on her children's health.

Our results suggest that although mother's cognitive ability is correlated with childhood endowments, the relationship between mother's reasoning ability and the health of her children is more likely to be associated with mechanisms of intermediation of daily living. Results of returns to maternal cognitive ability on children's height suggest that cognitive ability plays an important role in new motherhood, possibly by attracting more wealth to the household in the form of long-term economic resources.

References'

Alderman, H., J.R Behrman, D.R Ross, and R. Sabot. 1996. "The Returns to Endogenous Human Capital in Pakistan's Rural Wage Labour Market." *Oxford Bulletin of Economics and Statistics* 58(1): 29-55.

Barrera, A. 1990. "The Role of Maternal Schooling and its Interaction with Public Health Programs in Child Health Production." *Journal of Development Economics* 32: 69-91.

Beaton, G.H., R. Martorell, K.J. Aronson, et al. 1993. *Effectiveness of Vitamin A Supplementation in the Control of Young Child Morbidity and Mortality in Developing Counties.* Toronto: United Nations Administrative Committee on Coordination/Subcommittee on Nutrition State-of-the-Art Series.

Behrman J.R., and A. Deolalikar. 1988. "Health and Nutrition". In: H. Chenery and T.N. Srinivasan, editors. *Handbook of Development Economics*. Amsterdam: North Holland.

Behrman J.R. and B.L. Wolfe. 1987. "Women's Schooling and Children's Health: Are the Effects Robust with Adult Sibling Control for the Women's Childhood Background?" *Journal of Health Economics* 6(3): 239-54.

----. 1989. "Does More Schooling Make Women Better Nourished and Healthier? Adult Sibling Random and Fixed Effects Estimates for Nicaragua." *Journal of Human Resources* 24(4): 644-63.

Bleichrodt, N., and M.P. Born. 1994. "A metaanalysis of research on iodine and its relationship to cognitive development." In: J.B. Stansbury, editor. *The Damaged Brain of Iodine Deficiency – Cognitive, Behavioral, Neuromotor, Educative Aspects*. New York: Cognizant Communications Corp.

Cochran, S., J. Leslie, and D. O'Hara. 1982. "Parental education and child health: Intracountry evidence." *Health Policy and Education* 2: 213-250.

Fogel, R.W. 1990 "The Conquest of High Mortality and Hunger in Europe and America." Cambridge, Mass: NBER Working Paper No. 16.

Glewwe, P. 1994. "Are Rates of Return to Schooling Estimated from Wage Data Relevant Guides for Government Investments in Education? Evidence from a Developing Country." LSMS Working Paper No. 76. Washington, D.C.: World Bank.

Glewwe, P., and Jacoby, H. 1994. "Student Achievement and Schooling Choice in Low Income Countries: Evidence from Ghana." *Journal of Human Resources* 29: 842-64.

Knight, J.B., and R.H. Sabot. 1990. *Educational Productivity and Inequality: The East African Natural Experiment*. New York: Oxford University Press.

Nokes, C., S.M. Grantham-McGregor, A.W. Sawyer, E.S. Cooper, B.A. Robinson, and D.A.P. Bundy. 1992. "Moderate to Heavy Infections of Trichuris trichiura Affect Cognitive Function in Jamaican School Children?" *Parasitology*, 104: 539-47.

Raven, J.C. 1956. *Guide to the Coloured Progressive Matrices Sets A, Ab, B*. London: Lewis.

Raven, J.C.,J.H. Court,and J. Raven. 1993. "Test de Matrices Progresivas. Escalas Coloreada, General y Avanzada." Paidos Iberica, Eds.

Schultz, T.P. 1984. "Studying the impact of household economic and community variables on child mortaility." In: H. Mosley and L. Chen, editors. *Child survival: Strategies for Research, Population and Development Review*, Supplement to Vol. 10.

Strauss, J., P. Gertler, O. Rahman, and K. Fox. 1993. "Gender and Life-Cycle Differentials in the Patterns and Determinants of Adult Health." *Journal of Human Resources* 28: 791-837.

Strauss, J., and D. Thomas. 1995. "Human Resources: Empirical Modeling of Household and Family Decisions." In : J.R. Behrman and T.N. Srinivasan, editors. *Handbook of Development Economics*, 3B. Amsterdam, The Netherlands : North-Holland.

Thomas, D. 1990. "Intra-household resource allocation: and inferential approach." *Journal of Human Resources* 25: 635-664.

----. 1994. "Like Father Like Son; Like Mother, Like Daughter : Parental Resources and Child Height." *Journal of Human Resources* 29: 950-988.

Thomas, D., J. Strauss, and M. Henriques. 1990a. "Child Survival, Height for Age and Household Characteristics in Brazil." *Journal of Development Economics* 33:197-234.

----. 1990b. "How Does Mother's Education Affect Child Height?" *Journal of Human Resources* 26(2): 183-211.

Wachs, T.D. 1995. "Relation of mild-to-moderate malnutrition in human development: correlational studies." *Journal of Nutrition* 125: 2245s-2254s.

World Health Organization. 1995. "Physical Status: The Use and Interpretation of Anthropometry." WHO Technical Report Series 854. Geneva, Switzerland: World Health Organization.

Wolfe, B.L., and J.R. Behrman. 1982. "Determinants of Child Mortality, Health, and Nutrition in a Developing Country." *Journal of Development Economics* 11: 163-193.

TABLE 1
Descritptive Statistics

	mean	st. dev
Child´s Demographics		
Male	0.501	0.500
Age Distribution		
0 - 3 years old	0.190	0.392
4 - 6 " "	0.154	0.361
7 - 9 " "	0.168	0.374
10-12 " "	0.175	0.380
13-15 " "	0.171	0.376
16-17 " "	0.142	0.349
First Born Child	0.273	0.427
Height Z- Score		
0 - 3 years old	-0.630	1.317
4 - 6 " "	-0.536	1.163
7 - 9 " "	-0.427	1.105
10-12 " "	-0.624	1.094
13-15 " "	-0.825	0.968
16-17 " "	-1.304	0.851
Mother´s Demographics		
Age	35.623	8.234
Height (cms)	153.171	6.438
Cognitive Ability test		
Raven Z-score *	0.000	1.000
10th pctile Raven Z-score	-1.187	-
25th " "	-0.828	-
50th " "	-0.110	-
75th " "	0.608	-
90th " "	1.326	-
Years of schooling	6.367	3.644
0	0.091	0.288
1 to 6	0.476	0.499
7 to 9	0.233	0.423
10 or more	0.199	0.400
mother lives in urban community today	0.582	0.493
Mother´s Background		
age when beginning primary school	6.484	0.851
studied in public primary school	0.975	0.155
failed a grade in primary	0.259	0.438
failed a grade in secondary	0.014	0.116
failed a grade in high school	0.005	0.071
Mother's Parents		
Years of schooling of the Mother´s mother	2.332	2.538
Years of schooling of the Mother´s father	2.647	2.624
Mother´s mother is a Household member	0.086	0.280
Mother´s father is a Household member	0.049	0.217
Mother Lived in urban area when 0 - 12 years old	0.224	0.417
Household Characteristics		
ln (Total Hhold Monthly Expenditure)	8.258	0.768
Total Hhold Expenditure ($000)	5.243	5.008
Sample Size	13871 obs.	

* standarized over the sample mean
Source: MXFLS

TABLE 2
Effect of Mother´s Human Capital Variables on Child´s Height for Age Z-Scores

	(1)	(2)	(3)	(4)
Child´s characteristics				
male	-0.0353	-0.0256	-0.0333	-0.0248
	(0.0187)*	(0.0174)	(0.0186)*	(0.0174)
Age spline				
from 0 to 3 years	0.0872	0.0894	0.0874	0.0896
	(0.0227)***	(0.0227)***	(0.0227)***	(0.0227)***
4 to 6	-0.0063	-0.0092	-0.0042	-0.0082
	(0.0163)	(0.0156)	(0.0163)	(0.0156)
7 to 9	0.0403	0.0284	0.0394	0.0281
	(0.0138)***	(0.0130)**	(0.0137)***	(0.0130)**
10 to 12	-0.1001	-0.0936	-0.1013	-0.0943
	(0.0129)***	(0.0121)***	(0.0128)***	(0.0121)***
13 to 15	-0.0743	-0.0855	-0.0756	-0.0859
	(0.0129)***	(0.0120)***	(0.0128)***	(0.0120)***
16 to 17	-0.1822	-0.1801	-0.1836	-0.1811
	(0.0121)***	(0.0126)***	(0.0122)***	(0.0127)***
Mother´s characteristics				
mother´s age	0.0097	0.0118	0.0097	0.0118
	(0.0019)***	(0.0017)***	(0.0019)***	(0.0017)***
mother´s years of schooling				
1 to 6	0.2123	0.1401	0.1794	0.1256
	(0.0512)***	(0.0419)***	(0.0514)***	(0.0421)***
7 to 9	0.4776	0.2660	0.4041	0.2343
	(0.0549)***	(0.0460)***	(0.0556)***	(0.0467)***
10 or more	0.5406	0.3285	0.4397	0.2842
	(0.0580)***	(0.0491)***	(0.0595)***	(0.0504)***
F-joint sig. mother´s schooling	48.6270	20.0240	31.1170	13.8550
	[0.0000]***	[0.0000]***	[0.0000]***	[0.0000]***
mother´s height	-	0.0600	-	0.0594
		(0.0019)***		(0.0019)***
mother´s raven z-score	-	-	0.0838	0.0384
			(0.0135)***	(0.0119)***
Father´s years of schooling				
1 to 6	0.1410	0.1002	0.1198	0.0909
	(0.0656)**	(0.0553)*	(0.0655)*	(0.0553)
7 to 9	0.3111	0.2151	0.2771	0.2004
	(0.0693)***	(0.0586)***	(0.0691)***	(0.0586)***
10 or more	0.3125	0.1775	0.2709	0.1597
	(0.0721)***	(0.0621)***	(0.0720)***	(0.0621)**
F-joint sig. father schooling	12.6380	6.9550	10.2500	6.1380
	[0.0000]***	[0.0000]***	[0.0000]***	[0.0000]***
Observations	13629	13629	13629	13629
R-squared	0.1010	0.2090	0.1060	0.2100

OLS regressions with Robust Std. Errors with clustering at the mother´s level
Standarized errors in parenthesis. [p-values] bellow F-test values for joint significance
Source: MXFLS

TABLE 3

Effect of Mother´s Human Capital and Childhood Background Variables on her cognitive ability Raven Z-Score

	(1)	(2)	(3)	(4)
mother´s age	-0.00004	0.0010	0.0041	0.0022
	(0.0014)	(0.0014)	(0.0014)***	(0.0015)
mother´s years of schooling				
1 to 6	0.4024	0.3998	0.2391	0.2099
	(0.0457)***	(0.0461)***	(0.0534)***	(0.0531)***
7 to 9	0.8412	0.8342	0.6299	0.5748
	(0.0516)***	(0.0511)***	(0.0541)***	(0.0541)***
10 or more	1.2852	1.2198	0.9813	0.8921
	(0.0535)***	(0.0551)***	(0.0560)***	(0.0580)***
F-joint sig. mother´s schooling	240.0700	194.7090	184.7260	134.5520
	[0.0000]***	[0.0000]***	[0.0000]***	[0.0000]***
mother´s height	0.0163	-	0.0134	0.0125
	(0.0025)***		(0.0024)***	(0.0023)***
Mother´s Background				
mother´s parents				
years of schooling of mother´s mother	-	0.0324	0.0232	0.0205
		(0.0059)***	(0.0057)***	(0.0057)***
years of schooling of mother´s father	-	0.0143	0.0090	0.0074
		(0.0052)***	(0.0051)*	(0.0052)*
F-joint sig. parents´ schooling	-	31.7670	17.0550	13.6840
		[0.0000]***	[0.0000]***	[0.0000]***
Mother´s mother is a Hhold member	-	-0.0542	-0.0461	-0.0440
		(0.0510)	(0.0522)	(0.0514)
Mother´s father is a Hhold member	-	-0.0095	0.0016	-0.0070
		(0.0637)	(0.0608)	(0.0605)
F-joint sig. parents Hhold members	-	1.3800	0.7350	0.8660
		[0.2550]	[0.4810]	[0.4230]
mother lived in urban area when 0 - 12 years old	-	-	0.2019	0.1827
			(0.0329)***	(0.0342)***
mother studied in public primary school	-	-	-0.0810	-0.0446
			(0.0710)	(0.0711)
F-joint sig. urban-public	-	-	22.2820	15.6950
			[0.0000]***	[0.0000]***
Household Wealth				
ln (Total Hhold Monthly Expn)	-	-	-	0.1120
				(0.0202)***
Observations	6087	6087	6087	6019
R-squared	0.1930	0.1930	0.2140	0.2190

See notes table 2. OLS regressions with (Robust Std. Errors with clustering at the community level)
Source: MXFLS

TABLE 4
Effect of Mother´s Human Capital Variables on Child´s Height for Age Z-Score

	(1)	(2)	(3)	(4)	(5)	(6)
mother´s years of schooling						CFE
1 to 6	0.1256	0.1236	0.0759	0.0699	0.0687	0.0192
	(0.0421)***	(0.0421)***	(0.0520)	(0.0520)	(0.0523)	(0.0487)
7 to 9	0.2343	0.2274	0.1703	0.1546	0.1427	0.0842
	(0.0467)***	(0.0471)***	(0.0563)***	(0.0566)***	(0.0571)**	(0.0542)
10 or more	0.2842	0.2733	0.2175	0.2008	0.1843	0.1391
	(0.0504)***	(0.0514)***	(0.0599)***	(0.0604)***	(0.0612)***	(0.0585)**
F-joint sig. mother´s schooling	13.8550	12.0360	7.7530	6.3410	4.9090	4.1340
	[0.0000]***	[0.0000]***	[0.0000]***	[0.0000]***	[0.0020]***	[0.006]***
mother´s height	0.0594	0.0591	0.0590	0.0593	0.0590	0.0473
	(0.0019)***	(0.0019)***	(0.0019)***	(0.0019)***	(0.0020)***	(0.0020)***
mother´s raven Z-Score	0.0384	0.0370	0.0339	0.0346	0.0318	0.0207
	(0.0119)***	(0.0119)***	(0.0120)***	(0.0121)***	(0.0121)***	(0.0120)*
Mother´s background						
mother´s parents						
years of schooling of mother´s mother	-	0.0092	0.0088	0.0084	0.0077	0.0035
		(0.0052)*	(0.0052)*	(0.0053)	(0.0053)	(0.0052)
years of schooling of mother´s father	-	-0.0028	-0.0034	-0.0042	-0.0051	-0.0023
		(0.0050)	(0.0051)	(0.0051)	(0.0051)	(0.0051)
F-joint sig. parents´ schooling	-	1.5880	1.4130	1.2620	1.1350	0.2350
		[0.2040]	[0.2044]	[0.2830]	[0.3210]	[0.791]
Mother´s mother is a Hhold member	-	0.0664	0.0598	0.0656	0.0640	0.0677
		(0.0461)	(0.0460)	(0.0464)	(0.0465)	(0.0450)
Mother´s father is a Hhold member	-	-0.1015	-0.0979	-0.0990	-0.1064	-0.1257
		(0.0553)*	(0.0552)*	(0.0555)*	(0.0561)*	(0.0557)**
mother lived in urban area when 0 - 12 years old	-	-	0.0607	0.0349	0.0357	0.0207
			(0.0271)**	(0.0289)	(0.0290)	(0.0308)
mother studied in public primary school	-	-	0.1150	0.1156	0.0908	0.1118
			(0.0875)	(0.0885)	(0.0890)	(0.0912)
F-joint sig. urban-public	-	-	3.2450	1.5100	1.2130	0.9420
			[0.0390]	[0.2210]	[0.2970]	[0.3900]
mother lives in urban community today	-	-	-	0.0743	0.0672	-
				(0.0250)***	(0.0253)***	
Hhold Wealth						
ln (Total Hhold Monthly Expenditure)	-	-	-	-	0.0447	0.0161
					(0.0167)***	(0.0166)
Observations	13629	13629	13629	13479	13346	13346
R-squared	0.2100	0.2110	0.2120	0.2130	0.2130	0.2540

See notes table 2 . OLS regressions with Robust Std. Errors with clustering at the mother´s level. Regressions include
Source: MXFLS

TABLE 5
Effect of Mother´s Human Capital Variables on Child´s Height for Age Z-Score

	(1) OLS	(2) 2SLS
Mother´s characteristics		
Mother´s years of schooling		
1 to 6	0.1122 (0.0423)***	0.1198 (0.0698)*
7 to 9	0.1934 (0.0477)***	0.3129 (0.1920)
10 or more	0.2328 (0.0522)***	0.1579 (0.1757)
F-joint sig. mother´s schooling	8.0850 [0.0000]***	2.0740 [0.0000]***
mother´s height	0.0592 (0.0019)***	0.0558 (0.0023)***
mother´s raven z-score	0.0345 (0.0120)***	0.1861 (0.0927)**
mother lives in urban community today	0.0779 (0.0238)***	0.0531 (0.0264)**
Hhold Wealth		
ln (Total Hhold Monthly Expenditure)	0.0451 (0.0167)***	0.0194 (0.0196)***
Observations	13346	13346
R-squared	0.2120	0.1960

See notes table 2

Regressions include controls for spline of child´s age (0 to 3, 4 to 6, 7 to 9, 10 to 12, 13 to 15 and 16 to 17 years); child´s gender; father´s years of schooling in categorical variables (1 to 6, 7 to 9, 10 or more years of schooling). Mother´s years of schooling and mother cognitive ability are instrumented with mother´s parents years of schooling; whether the mother lived in an urban area when she was 0-12 years old; whether the mother attended a public primary school; mother´s age when beginning primary school; and whether the mother failed any grade when studying primary, secondary or high school.

Source: MXFLS

TABLE 6
Effect of Mother´s Human Capital Variables on Child´s Height for Age Z-Score

	(1) First Born	(2) Other children	(3) OLS diff	(4) Mother´s FE diff
Mother´s years of schooling				
1 to 6	0.2472	0.1412	0.106	0.1094
	[0.0080]***	[0.097]*	[0.3820]	[0.4510]
7 to 9	0.2704	0.2646	0.0058	0.0343
	[0.0090]***	[0.003]***	[0.9630]	[0.8210]
10 or more	0.3196	0.2581	0.0615	0.1325
	[0.0030]***	[0.012]**	[0.6390]	[0.4060]
F-joint sig. mother´s schooling	3.1400	3.9820	1.0310	0.6550
	[0.0270]***	[0.009]***	[0.3810]	[0.5800]
mother´s raven Z-score	-0.0053	0.0007	-0.006	0.0569
	[0.0170]***	[0.9770]	[0.0740]*	[0.0720]*
mother´s height	0.0702	0.0636	0.0066	0.0009
	[0.0000]***	[0.0000]***	[0.2260]	[0.8510]
Observations	6870	6870	6870	6870
R-squared	0.2050	0.2050	0.2050	0.5970

See notes table 2. Robust Std. Errors with clustering at the mother´s level. Regression model full interacted with first born child indicator variable. P-values under coefficients. Sample restricted to mothers with at least one first born child living in
Source: MXFLS

TABLE 1 APPENDIX

Effect of Mother´s Human Capital Variables on Child´s Height for Age Z-Scores (children <=9 years old)

	(1)	(2)	(3)	(4)
Child´s characteristics				
male	-0.1243	-0.1124	-0.1233	-0.1119
	(0.0282)***	(0.0268)***	(0.0282)***	(0.0268)***
Age spline				
from 0 to 3 years	0.0853	0.0882	0.0843	0.0882
	(0.0231)***	(0.0232)***	(0.0231)***	(0.0232)***
4 to 6	-0.0097	-0.0105	-0.0078	-0.0097
	(0.0165)	(0.0158)	(0.0164)	(0.0157)
7 to 9	0.0436	0.0285	0.0426	0.0282
	(0.0151)***	(0.0143)**	(0.0151)***	(0.0142)**
Mother´s characteristics				
mother´s age	0.2245	0.1487	0.1898	0.1355
	(0.0813)***	(0.0705)**	(0.0814)**	(0.0707)*
mother´s years of schooling				
1 to 6	0.5125	0.2978	0.4317	0.2673
	(0.0840)***	(0.0744)***	(0.0852)***	(0.0754)***
7 to 9	0.5848	0.3700	0.4765	0.3286
	(0.0872)***	(0.0778)***	(0.0896)***	(0.0799)***
10 or more	0.0129	0.0134	0.0131	0.0135
	(0.0027)***	(0.0024)***	(0.0027)***	(0.0024)***
F-joint sig. mother´s schooling	30.6620	12.4410	18.7790	8.8420
	[0.0000]***	[0.0000]***	[0.0000]***	[0.0000]***
mother´s height	-	0.0588	-	0.0582
		(0.0027)***		(0.0027)***
mother´s raven z-score	-	-	0.0834	0.0330
			(0.0189)***	(0.0174)*
Father´s years of schooling				
1 to 6	0.2224	0.1618	0.2075	0.1570
	(0.1073)**	(0.0961)*	(0.1068)*	-(0.0960)
7 to 9	0.4053	0.2619	0.3737	0.2510
	(0.1101)***	(0.0990)***	(0.1097)***	(0.0991)**
10 or more	0.4091	0.2288	0.3711	0.2156
	(0.1129)***	(0.1024)**	(0.1125)***	(0.1024)**
F-joint sig. father schooling	8.7540	3.3360	7.1680	2.9740
	[0.0000]***	[0.0190]***	[0.0000]***	[0.0300]**
Observations	7027	7027	7027	7027
R-squared	0.0520	0.1450	0.0560	0.1460

OLS regressions with Robust Std. Errors with clustering at the mother´s level

Standarized errors in parenthesis. [p-values] bellow F-test values for joint significance

Source: MXFLS

TABLE 2 APPENDIX
Effect of Mother´s Human Capital Variables on Child´s Height for Age Z-Scores (children >9 years old)

	(1)	(2)	(3)	(4)
Child´s characteristics				
male	0.0580	0.0663	0.0610	0.0679
	(0.0237)**	(0.0219)***	(0.0237)**	(0.0219)***
Age spline				
10 to 12	-0.0810	-0.0909	-0.0819	-0.0913
	(0.0220)***	(0.0210)***	(0.0220)***	(0.0210)***
13 to 15	-0.0768	-0.0859	-0.0772	-0.0860
	(0.0133)***	(0.0123)***	(0.0133)***	(0.0123)***
16 to 17	-0.1762	-0.1765	-0.1792	-0.1778
	(0.0126)***	(0.0135)***	(0.0128)***	(0.0135)***
Mother´s characteristics				
mother´s age	0.0068	0.0105	0.0067	0.0105
	(0.0024)***	(0.0021)***	(0.0024)***	(0.0021)***
mother´s years of schooling				
1 to 6	0.2020	0.1323	0.1708	0.1167
	(0.0509)***	(0.0423)***	(0.0513)***	(0.0428)***
7 to 9	0.4401	0.2319	0.3748	0.1999
	(0.0584)***	(0.0494)***	(0.0596)***	(0.0508)***
10 or more	0.4775	0.2714	0.3839	0.2243
	(0.0648)***	(0.0553)***	(0.0664)***	(0.0569)***
F-joint sig. mother´s schooling	27.3750	9.9610	17.7520	6.4680
	[0.0000]***	[0.0000]***	[0.0000]***	[0.0000]***
mother´s height	-	0.0612	-	0.0605
		(0.0023)***		(0.0023)***
mother´s raven z-score	-	-	0.0854	0.0455
			(0.0155)***	(0.0137)***
Father´s years of schooling				
1 to 6	0.0993	0.0666	0.0745	0.0539
	(0.0641)	(0.0548)	(0.0643)	(0.0550)
7 to 9	0.2603	0.2047	0.2273	0.1881
	(0.0712)***	(0.0610)***	(0.0710)***	(0.0609)***
10 or more	0.2624	0.1656	0.2199	0.1445
	(0.0779)***	(0.0676)**	(0.0780)***	(0.0677)**
F-joint sig. father schooling	7.4330	5.8890	6.0950	5.3030
	[0.0000]***	[0.0010]***	[0.0000]***	[0.0010]***
Observations	6602	6602	6602	6602
R-squared	0.1250	0.2580	0.1300	0.2600

OLS regressions with Robust Std. Errors with clustering at the mother´s level

Standarized errors in parenthesis. [p-values] bellow F-test values for joint significance

Source: MXFLS

TABLE 3 APPENDIX
First Stage Regressions

	MOTHER´S RAVEN Z´SCORE	MOTHER´S PROBABILITY OF ATTENDING 1 - 6 YRS OF SCHOOLING	MOTHER´S PROBABILITY OF ATTENDING 7 - 9 YRS OF SCHOOLING	MOTHER´S PROBABILITY OF ATTENDING 10 OR + YRS OF SCHOOLING
Mother´s characteristics				
mother´s age	0.0010	0.0050	0.0085	0.0019
	(0.0013)***	(0.0006)***	(0.0005)***	(0.0004)***
mother´s height	0.0139	0.0059	0.0056	0.0006
	(0.0012)***	(0.0005)***	(0.0005)***	(0.0004)***
mother lives in urban	0.0391	0.0425	0.0199	0.0262
community today	(0.0187)**	(0.0086)***	(0.0080)***	(0.0064)***
Father´s years of schooling				
1 to 6	0.2081	0.1058	0.0289	0.0032
	(0.0344)**	(0.0158)**	(0.0148)**	(0.0119)**
7 to 9	0.3672	0.0907	0.1070	0.0650
	(0.0383)**	(0.0176)**	(0.0165)**	(0.0132)**
10 or more	0.4770	0.1938	0.0443	0.2412
	(0.0415)**	(0.0191)**	(0.0179)**	(0.0143)**
Hhold Wealth				
ln (Total Hhold Monthly Expn)	0.1277	0.0639	0.0096	0.0533
	(0.0116)**	(0.0053)***	(0.0050)**	(0.0040)***
2SLS model identifying instrum. variables				
Mother´s background				
mother´s age when beginning	0.1112	0.0503	0.0348	0.0175
primary school	(0.0105)**	(0.0048)***	(0.0045)***	(0.0036)***
mother studied in public	0.0948	0.0216	0.1284	0.1020
primary school	(0.0580)	(0.0266)**	(0.0250)**	(0.0201)**
mother lived in urban area	0.1084	0.0455	0.0398	0.0107
when 0 -12 years old	(0.0370)**	(0.0170)**	(0.0160)**	(0.0128)**
mother lived in urban area	0.0002	0.0217	0.0300	0.0107
when 13-15 years old	(0.0426)**	(0.0196)**	(0.0184)**	(0.0147)**
mother lived in urban area	0.1632	0.0632	0.0195	0.0699
when 16-20 years old	(0.0306)**	(0.0140)**	(0.0132)**	(0.0106)**
mother failed a grade in	0.1406	0.0746	0.0334	0.0386
primary	(0.0190)**	(0.0087)***	(0.0082)***	(0.0065)***
mother failed a grade in	0.0898	0.3800	0.1962	0.1887
secondary	(0.0713)	(0.0328)**	(0.0308)**	(0.0247)**
mother failed a grade in	0.2336	0.1691	0.2614	0.4227
high school	(0.1138)	(0.0523)	(0.0491)**	(0.0394)**
Mother´s parents				
mother´s mother with 1 to 5	0.1585	0.0390	0.0270	0.0187
years of schooling	(0.0210)**	(0.0096)***	(0.0090)***	(0.0072)***
mother´s mother with 6 or more	0.2175	0.1348	0.0504	0.0844
years of schooling	(0.0283)**	(0.0130)**	(0.0122)**	(0.0098)***
mother´s father with 1 to 5	0.0240	0.0371	0.0173	0.0369
years of schooling	(0.0215)**	(0.0099)***	(0.0093)***	(0.0074)***
mother´s father with 6 or more	0.0693	0.0679	0.0087	0.0930
years of schooling	(0.0291)**	(0.0133)**	(0.0125)**	(0.0100)**
Mother´s mother is a Hhold	0.0788	0.0330	0.0163	0.0291
member	(0.0368)**	(0.0169)**	(0.0159)**	(0.0127)**
Mother´s father is a Hhold	0.0764	0.0286	0.0015	0.0190
member	(0.0449)**	(0.0206)**	(0.0194)**	(0.0155)**
Observations	13508	13508	13508	13508
F test all variables joint sig.	84.4900	156.3400	69.9100	202.0200
P- value	[0.0000]***	[0.0000]***	[0.0000]***	[0.0000]***
R-squared	0.2240	0.3482	0.1928	0.4084

Regressions include controls for spline of child´s age (0 to 3, 4 to 6, 7 to 9, 10 to 12, 13 to 15 and 16 to 17 yrs) and child´s gender
Source: MXFLS