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What Did You Do All Day?

Maternal Education and Child Outcomes

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Abstract

Female education levels are very low in many developing countries. Does maternal education have a causal impact on children's educational outcomes even at these very low levels of education? By combining a nationwide census of schools in Pakistan with household data, the authors use the availability of girls' schools in the mother's *birth* village as an instrument for maternal schooling to address this issue. Since public schools in Pakistan are segregated by gender, the instrument affects only maternal education rather than the education levels of both mothers and fathers. The analysis finds that children of mothers with some education spend 75 minutes more on educational activities at home compared with children whose mothers report no education at all. Mothers with some education also spend more time helping their children with school work; the effect is stronger (an extra 40 minutes per day) in families where the mother is likely the primary care-giver. Finally, test scores for children whose mothers have some education are higher in English, Urdu (the vernacular), and mathematics by 0.24–0.35 standard deviations. There is no relationship between maternal education and mother's time spent on paid work or housework—a posited channel through which education affects bargaining power within the household. And there is no relationship between maternal education and the mother's role in educational decisions or in the provision of other child-specific goods, such as expenditures on pocket money, uniforms, and tuition. The data therefore suggest that at these very low levels of education, maternal education does not substantially affect a mother's bargaining power within the household. Instead, maternal education could directly increase the mother's productivity or affect her preferences toward children's education in a context where her bargaining power is low.

This paper—a product of the Human Development and Public Services Team, Development Research Group—is part of a larger effort in the department to understand the long-term impacts of female education in low-income countries. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at jdas1@worldbank.org.

What Did You Do All Day? Maternal Education and Child Outcomes [*]

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Educating women is often viewed as the single most effective policy lever for improving incomes and impacting a wider set of human development outcomes in low-income countries. In their roles as mothers, women also pass on additional benefits of education to their children. This paper contributes to our understanding of inter-generational causal links in three ways. First, causal studies have focused on countries with high levels of female education; the typical margin studied has been the additional impact of secondary schooling or college education.[1] However, in much of the developing world, levels of female education are abysmally low. The average woman aged 25 and over in 2000 reported 3.2 years of education in India and Kenya, 0.5 years in Niger, 2.6 years in Guatemala and 1.2 years in Pakistan (Barro and Lee, 2000). We study whether the benefits of maternal education for child outcomes extend to such low levels of education. To isolate causal effects, we employ an instrumental variables approach where our instrument affects only maternal education, rather than the education of both fathers and mothers. Second, we broaden our outcome measures to child-learning in addition to educational attainment; to our knowledge, this is the first study in low-income countries to do so. Third, we demonstrate the importance of maternal and child time-use patterns in understanding the unique role mothers play in their children's lives.

This paper uses unique primary data from rural Pakistan—a country characterized by low maternal levels of education—to address the link between maternal education and their children's educational outcomes. We examine the difference between mothers with no education (75 percent of mothers in our sample) relative to those with some education reported by the remaining 25 percent (10 percent report higher than primary education and 15 percent primary schooling or less).[2] We develop causal estimates of the affect of maternal education by taking advantage of the gender segregated nature of schooling in the country and use the availability of girls' schools in the mother's birth village as an instrument for her education. Since boys cannot attend female schools, this instrument affects only the mother's education levels rather than the joint education levels of mothers and fathers. We present detailed maternal time-use, child time-use and child learning as evidence for the causal impact of maternal education on child educational outcomes.

[1] See Black and others, 2005, Currie and Moretti, 2003 and Berhman and Rosenzweig, 2002.
[2] The average years of education in our sample of mothers is 1.34 years which accords well with the 1.21 years reported in Barro and Lee (2000) dataset for females above the age of 25 in Pakistan.

The instrumental variable approach shows that the children of mothers with some education (relative to uneducated mothers) spend more time on educational activities outside school hours. The effect is large—an extra 75 minutes per day—and closely aligned with the results from Behrman and others (1999). Mothers with some education also spend more direct time with children on their school work. In households with no older children (>12 years) where the mother is likely to be the primary care-giver, time spent by mothers with some education directly with children on school work is large (an extra 40 minutes per day). In addition, mothers with some education facilitate learning by employing other members of the household in helping and reading to children by an extra 4.64 hours per week. Finally, and as a likely consequence of the increased time spent studying at home, there is a large impact of maternal education on child test-scores. Children of mothers with some education report test-scores that are between 0.24 and 0.35 standard-deviations higher than others; this represents to our knowledge the first causal estimate of maternal education on child learning outcomes in low-income countries. Given the poor learning environment in developing countries (see the TIMSS Report 2007, Andrabi and others, 2009, for Pakistan and Das and Zajonc, 2009, or the ASER Report, 2008 for India) even the "educated" mothers in our sample can barely read, write or perform simple mathematical operations. The results therefore shed light on how maternal education has an effect on child outcomes even at very low levels of cognitive achievement.

We also present supporting evidence that these effects are unlikely to arise from additional leverage "educated" mothers might have in the household's decision making process. This rationale asserts that educated mothers have more say in the bargaining process that takes place between the adult members of the household, particularly on decisions that directly affect the child such as enrollment. However, we do not find any evidence for increased bargaining power due to maternal education. Moreover, we do not see evidence for an impact on child outcomes that are more likely to require household-level (joint) decision making. Maternal education does not increase spending on child-specific goods and we are unable to detect an effect of maternal education on child enrollment although the latter could also be due to a lack of precision in our enrollment estimates. These results are therefore consistent with a direct increase in maternal productivity or a change in maternal preferences in contexts where bargaining power is low (or non-existent).

Our instrumental variable approach follows Currie and Moretti (2003) and Carneiro and others (2007) among others. We propose to use the availability of girls' schools in the mother's birth village as an instrument for her education. We obtain the birth village using verbal recall in interviews with mothers, and match this with the census directory of villages and data on schooling availability. The first-stage of this instrumental variable specification shows that the presence of a girls' school in the birth village of the mother at the time that she was of primary school-going age leads to a 11 point increase in the percentage of mothers with primary education. In years of education, the instrument adds 0.61 years of education for a mother. Given the very low levels of overall female education this effect is fairly large. Like in the previous literature using a similar instrument, the correlation remains after controlling for a full set of mother's age indicators and county (*teshils* in Pakistan) of birth fixed-effects. [3]

A prominent characteristic of the Pakistani educational environment leads us to believe that this instrument effectively captures the marginal effects of maternal education. Specifically, public schools in Pakistan are gender segregated, and at the time that the mothers in our sample were of school age, the only viable schooling options were public schools for girls. In previous applications of similar instruments in other countries, access to education affects the educational attainment of *both* girls and boys; discerning which of these channels affected the outcome in question is then critical. In our case, the presence of a girls' school affects the educational attainment of girls (the mothers in our sample) thus varying only female education levels. We believe that this could somewhat attenuate the possibility that our results are driven by simultaneous improvements in the education levels of fathers, which would be the case if schooling availability was not gender specific. To our knowledge, this is the first application of schooling availability at the birth village level in a *gender-segregated* schooling setting as an instrument for parental education in a low-income country context.

Encouragingly, the instrument also passes the falsification tests of the type discussed in Currie and Morretti (2003). Specifically, the presence of a girls' school in the birth village does not affect the mother's education if it was built after she had passed primary school going age. In our specifications, the effect of

[3] A *tehsil* in Pakistan is roughly the administrative equivalent to a county in the US.

having a girls' school in the village of birth is large and significant for mothers who were 7 years or younger when the school was built (relative to no school), but is zero for mothers who got a school between the ages of 8 and 15, or the age of 15 onwards. Furthermore, given gender segregation in public schools, we are also able to confirm that the presence of a *boys'* school in the birth village has no effect on mother's education. To the extent that similar village characteristics determine the construction of boys' and girls' schools, this offers further evidence in support of the exclusion restriction.

We interpret our results as follows. In the classic model of human capital accumulation (Becker 1985 and Becker and Tomes 1986), family characteristics should not be causally linked to child outcomes in the absence of credit constraints. The literature departs from this neutrality result in one of two ways. In one strand of the literature, the unitary model of the household is discarded, so that husbands and wives "bargain" with the ultimate outcomes depend on the relative weight given to the preferences of the two parents. Maternal education increases maternal bargaining power and if mothers care more about child outcomes than fathers (see for instance, Lundberg and others, 1993, 1997) an inter-generational link may be established. A second strand of the literature highlights the labor force participation channel. More educated mothers are more likely to participate in the labor force. If child-care is not fully contractible, then the effect of maternal education depends on the relative importance of higher income versus direct maternal presence, and the impact of maternal education on maternal presence. See, for instance, Cawley and Liu (2007) or Miller and Urdinola (2007) for evidence on the maternal *employment*-child outcomes link in the US and Colombia. The link between maternal education, employment and child outcomes is unclear. Bianchi (2000) shows in the US that maternal time with children remained unchanged between 1965 and 1995, during a period of dramatic increases in the labor force participation for women. Guryan and others (2008) show that while working women spend less time with children in the US, more educated women spend *more* time with their children *and* work more—because they cut down on leisure activities and housework. They confirm similar patterns in 14 other countries for which these data exist. In contrast to the evidence from these correlations, Behrman and Rosenzweig (2002) argue that the child educational outcomes are *causally* worse for

educated mothers in the US probably because of lower maternal presence, but they are unable to confirm the channel in their data.

In the Pakistani context, and for that matter in most developing country contexts, both the bargaining and the labor force participation channels are likely absent. Women in our sample spend the bulk of their time (just under 10 hours a day) on housework and we will demonstrate that there is no causal link between female education and labor force participation; indeed there is no link at all between female education and time on work *outside* the house. If increases in bargaining power do arise solely due to higher female earnings, the absence of significant levels of labor force participation among women in our sample means the bargaining channel is effectively shut off. Commensurate with this line of thought, we find no differences in self-reported decision-making regarding children's schooling between mothers with some education and mothers with none. Furthermore, the lack of work outside the house also closes the (potentially detrimental) channel of less maternal presence in children's lives. Instead, mothers with some education in our sample are acting within the domestic space they control by making sure that their children study more and by spending more time with them and creating a nurturing learning environment, which has a positive effect on their children's learning. As Behrman and others (1999) postulate, when both channels of bargaining and of maternal presence in the household are closed, it is likely that the effects of maternal education arise from the direct productivity benefits of higher female education, although these findings are also consistent with greater maternal preference for education *or* more information about how much effort is required for children to learn. The direct productivity channel suggests that mothers spend more time with their children because their marginal product in the production of education is higher; children spend more time because maternal and child effort are complements in the production function.

One question is whether the increase in time that children spend studying is at the expense of "child labor". In particular, if the extent of child labor *also* represents the bargaining position of the parents, we should similarly expect to see little difference in the activities reported by children. Key to our understanding of these results is the concept of "idle" children—children who are neither in school, nor at work (see for instance, Bacolod and Rajan, 2008, or Ravallion and Wodon, 1999). Primary-school age children in our

sample do not spend most of their waking time outside school in housework or paid-work; they spend the time playing. In fact, an average child who is in school spends 2.5 hours a day "playing"; an average child who is *not* in school spends just under 3.5 hours "playing". Given these large numbers, if a mother makes sure that her child spends an extra hour a day studying it does not imply any trade-off with other "productive" tasks that the child is responsible for, and thus probably avoids any conflict with the husband.

We feel that these results contribute to our understanding of education in low-income countries in a number of different ways. First, given low female labor force participation it is difficult to compute the rate of return to education for women in low-income countries. Our results suggest that one way to capture these non-labor market returns is through the application of time-use data in household surveys. Second, the findings suggest that some reorganization of the dominant line of thought linking maternal education to child outcomes may be necessary. Most studies of the inter-generational transmission of human capital show an association between maternal education and child enrollment, which are then assumed to be causal. Two recent studies (Behrman and Rosenzweig, 2002 and Black and others, 2005) show that in high-income countries, the causal effects of maternal education on child attainment levels are absent, or much smaller than previously believed. Desai and Alva (1998) argue along the same lines for lower income countries. Similarly, we are also unable to find any evidence for a link between maternal education and child enrollment. While this could be because our estimates are imprecise, there is a possibility that such a causal link is absent. Instead, we are able to document a causal link between child *learning* and maternal education. This is of direct interest for policy, since recent experiments have shown that government policy can increase enrollment (Fiszbein and Schady, 2009) while methods of improving learning remain tenuous.

Section 1: Data Description

We use a unique dataset on households and children from 112 villages in 3 districts of Punjab—home to 56 percent of Pakistan's population. The Learning and Educational Achievements in Punjab Schools (LEAPS) study follows a panel of households from 2003-2005 in 3 districts of the province—Attock, Faisalabad and Rahim Yar Khan. These districts represent an accepted stratification of the province into North (Attock), Central (Faisalabad) and South (Rahim Yar Khan). The villages were chosen randomly from

the list of all villages with an existing private school and are therefore bigger and richer than the average village in these districts.[4] However, it should be noted that almost half of the children in rural Punjab now live in a village with at least one private school, like that in our sampling list-frame. Here, we focus on the cross-section data from 2003.

Our data cover 1,697 mothers with 4,331 children between the ages of 5 and 15 in these households.[5] In addition to demographic and educational data, the survey also collected detailed parental and child time-use data, which forms the basis for a series of estimations in the paper. Given that these data are typically not available at the disaggregated level collected here (more on this below), a brief description of household inputs into education with an emphasis on time-use for a typical mother and a typical child in rural Pakistan is instructive. Table 1 provides summary statistics for the variables used in the regression analysis.

Mothers

A majority of mothers in our sample—76 percent—report not having gone to school at all and less than 10 percent report any education beyond the primary grade-level. Consequently, the average number of years of education for mothers is 1.34 years, a number comparable to many other developing countries (Barro and Lee, 2000). Of particular interest are the detailed time-use questions asked of mothers. Time-use is computed from a question that reconstructs an "average day in the last week" and allows the respondent to flexibly specify activities and time-slots. For instance, a respondent may say that she woke up at 6am, prepared breakfast and then readied her children for school till 7am. After that, she cleaned from 7am to 9 am and so on for the remainder of the day, till she went to sleep. To code the activities reported we used 11 different codes. Table 2, Panel A shows time allotted to different activities for mothers with no education and for those with some education across the five main codes, aggregating the remaining (entertainment, prayer, shopping, sickness, religious activity and other) into the residual category of "other activities".

Immediately striking is the remarkable similarity in time-use for most categories across mothers with some education and those with none. Apart from "rest", "housework" is the single largest category with both

[4] See Andrabi and others (2008) for more details on the rise of low cost, for-profit, secular private schools in rural Pakistan.
[5] Birth village information was not available for all the mothers. Summary statistics are provided for the matched sample of 1437 mothers. We return to the matching issue below.

educated and uneducated mothers reporting approximately 9½ hours a day. In contrast to the considerable allocation of time to housework, mothers work for pay an average of 40 minutes per day and only 11 percent of mothers report any paid work at all (conditional on reporting any paid work at all, mothers do report just over 6 hours a day on this activity). The average time spent on paid work is slightly higher for uneducated mothers (44 vs. 29 minutes/day) compared to mothers with some education. Time spent "looking after children's needs" accounts for 1½ hours a day and is again very similar across education levels—93 minutes and 99 minutes for uneducated and educated mothers, respectively. Where we do see some difference across maternal educational levels is in the time spent on children's educational needs—this is virtually 0 for uneducated mothers and 20 minutes a day for mothers with some education. These numbers from Pakistan accord well with previous work in rural India, where mothers were spending no more than 90 minutes a day on childcare (Desai and Jain, 1994).

Since some paid work is done inside the house and some housework could be outside the house, it is further useful to classify total work done—both paid and unpaid—as inside versus outside the house. We do so using sub-categories such as cooking, cleaning, livestock and unpaid farm work for every main category in our survey. The data present a picture of a mother's life that is centered largely inside the house. A typical mother's working day involves spending over 8 hours a day inside the house and an hour and 40 minutes outside. In fact, if anything, mothers with some education spend less time outside the house (an hour vs. two hours) and more time inside (9½ vs. 8 hours) than uneducated mothers. This paucity of paid work and, more generally, the fact that the bulk of work is inside the house has implications for bargaining models of household decision-making that rely, quite literally, on "outside" options.

The comparison with the United States is of interest. The Americans' Time-Use survey data between 2003 and 2006 show that the average mother spends 13.96 hours a week, or just under 2 hours a day on all types of childcare—a number roughly comparable to our categories of "looking after children's needs" and "children's educational needs". Of this, the bulk of time is spent on "basic child care" - feeding, medical care, putting a child to sleep. 2.1 hours a week, or just less than 20 minutes a day is spent on "educational child care". The gradient of time spent on childcare with maternal education is positive and significant—Guryan

and others (2008) show that women with 16+ years of education spend 9.7 hours more every week on childcare relative to high-school dropouts. In contrast to the broad agreement on time spent in childcare, Pakistani women allocate a lot more of their time to housework. *Non-employed* women in the US spent just over 3½ hours a day on housework in 1995 and employed women 2½ hours a day (Bianchi and Robinson 1998-99)—less than a quarter of the time spent by women in our rural Pakistani sample. The difference in time allocated to childcare is then perhaps not as large as we may have imagined given the dominance of housework in the Pakistani context.[6]

Children

The survey also covered every child between the ages of 5-15 in the sampled households for a total of 4,331 children. The mean age for a child in our sample is 10 years and 47 percent of the sample is female. Overall child enrollment is 66 percent with girls 10 percentage points less likely to be enrolled than boys; given our list frame and the private school explosion in rural Pakistan (see Andrabi and others, 2008), 30 percent of the children in our sample are enrolled in private schools.

Child time-use was reported by parents for a typical school-day in the previous week. The main categories are: rest, play (unstructured, unsupervised, leisure time), time in school, time spent on educational activities (school preparation, homework, formal tutorial sessions), paid work, housework and the residual category, "other". Apart from "Rest," "Play" is the largest component of the out of school day for the children averaging 183 minutes, followed by educational activities at around two hours per day. Less time is spent by children on housework and paid work, at 65 and 16 minutes respectively. Given the concern in the literature on issues of child labor, both inside the house and in paid-work, the comparison of these categories for enrolled and out-of-school children is of interest. Table 2, Panel B shows that children who are out-of-school do spend more time on housework—out-of-school children spend 197 minutes on housework compared to 24 minutes for children enrolled in school. The extent of paid-work is fairly low with enrolled children reporting virtually no paid-work and out-of-school children reporting 62 minutes a day. Of particular

[6] The Americans' Use of Time survey classifies childcare as a primary or secondary activity, where the former is child spent exclusively with children while the latter includes time spent on multiple tasks, one of which is with children (such as cooking while supervising homework). The usual caveats of comparability across surveys with different questions thus apply in force.

interest is that "play-time" for both enrolled and out-of-school children is the single largest time-use category of these three in the children's daily lives. Out-of-school children report 278 minutes per day but even enrolled children report more than 150 minutes per day of play time. This play-time for enrolled children leaves plenty of "idle" time that can be spent in extra educational work outside the school, without eating into either their house or paid-work commitments. This is very much in line with Bacolod and Ranjan's (2008) emphasis on idle time as a third category to be taken into account when discussing the tradeoffs between child labor and enrollment.

The age of the child has a clear association with time-use patterns in these data and Figure 1 explores the variation in time-use by the child's age and the educational status of the mother. There are several noteworthy patterns. First, consistent with other studies of time-use (deTray, 1983) children spend more time on housework and on paid-work as they age; they also spend less time on play so that, by the time they are 15 years old, play-time has dwindled to less than 60 minutes compared to 300 minutes when they were 5. For children in their teenage years, the burden of housework is quite high. In our companion work, Andrabi and others (2009), we discuss the issue of housework and show that this increase in housework is largely concentrated among teenage girls who are out-of-school. This issue demands a separate, more focused explanation. Second, children of educated mothers spend less time on housework, paid-work and play-time, largely because the gradient of time spent in housework and paid-work with age is lower for them. Third, these children spend significantly more time across all ages on educational work outside the school. The difference is consistent across ages averaging about 40 more minutes a day up to age 10 and more so after that—for children with uneducated mothers, homework time declines quite sharply after age 10, while it remains constant for children with educated mothers. These data on the time that children spend in study at home combined with the relatively small direct involvement of mothers' time on their children's education suggest that mothers with some level of education, even when they are not directly involved in a child's home study, are creating a space for these children to focus on their schoolwork.

To assess the link between maternal education and child outcomes, we also used school-based testing to assess all enrolled children in Grade 3 in the village. These children were tested in the subjects of English,

Urdu (the vernacular) and Mathematics. We then matched the children who were tested in the school to children in our household survey, eventually yielding a sample of 676 children for whom we have both test-scores and household survey data. We use item-response scaled scores as our measure of learning achievement.[7] Table 2, Panel C shows a strong correlation between maternal education and child test-scores for this smaller sample. The difference of 0.43 standard deviations in English, 0.25 in Mathematics and 0.35 in Urdu corresponds to roughly 1 additional year of learning in these villages. This is a first indication of a link between maternal education and child cognitive outcomes.

Section 2: Econometric Specification and Identification strategy

To establish causal links between maternal education, time-use and test-scores, we require variation in maternal education that is arguably exogenous to her ability. Our instrumentation strategy follows an established literature first proposed by Card (1999) that uses maternal access to a school in her *birth* village at the time of her enrollment decision as an instrument for educational attainment. We obtain the birth village using verbal recall in interviews with mothers, and then match this with the census directory of villages, the national census of schooling conducted by the Government of Pakistan and the Educational Management Information System data collected by the Government of Punjab and the National Education Census 2005. This allows us to obtain the year of formation of schools in all villages in Pakistan.

We match 85 percent of all mothers (1,437 of 1,697) with their birth village information. The primary reason for missing mothers was that in the data entry process, the English spelling of the village name was often spelt in different ways making it harder to match to the census directory. In addition, some mothers give their village name as a residential location that is smaller than the official census village designation.[8] While there is some possibility that "more able" mothers are able to provide better verbal recall information, we do not find any correlation between the probability of a match and village or maternal characteristics. Table A1 in the Appendix provides the means of important variables for the matched and unmatched sample. For all the variables, the differences are negligible. Only differences in age are significant at the 10 percent

[7] IRT scores ensure that change in one part of the distribution is equal to a change in another, in terms of the latent trait captured by the test. All items were modeled using the three parametric logistic (3PL) item response function and estimated using BILOG-MG.
[8] The Surveyor General of Pakistan mapping information on localities does not follow the census village designation and has many localities marked that are not in the census list. A digital village area map for Pakistan does not exist!

level, but the difference is qualitatively small (0.2 years for children). In the matched sample that we use for all our estimations, mothers are split evenly between those living in the same village they were born in (44 percent) and those born outside the current village (56 percent).

Two important institutional aspects of the educational setting in Pakistan provide further appeal for our identification strategy. First, Pakistan does not have universal school coverage in rural areas. Village coverage of school construction was ramped up mainly as a result of the Government of Pakistan's Sixth 5-year plan in the early 1980s. Because school construction took place over a period of time, we have women of different ages living in the same village that they were born in with differential access to schooling at the time of their enrollment decision. This allows us to exploit within village variation in schooling opportunities for mothers who have not moved from their birth village. Further, part of our identification is also based on the mothers who report a different birth village from the current village of residence. Second, as a matter of policy, the Government of Punjab's public schooling system is segregated by gender at all educational levels. Girls' schools are prevalent to a lesser degree and are generally of a later vintage than boys' schools. This permits greater current village variations in the data. In addition, it avoids the problem faced in a number of other studies of the school construction *jointly* affecting maternal and paternal schooling.

Our econometric specification for the first stage is as follows.

$$MotherEducated_i = \beta_0 + \beta_1 School\,\mathrm{Pr}esent_i + \sum_{k=1}^{N} \beta_k MotherAge_i + \sum_{m=1}^{M} \beta_m BirthTehsil_i + \varepsilon_i \quad (1)$$

Here, "MotherEducated" is an indicator variable that takes the value 1 if the mother reports non-zero years of schooling and 0 otherwise and $SchoolPresent_i$ is an indicator variable that take the value 1 if the mother had a girl's school in her birth village when she 7 or younger. The Government of Pakistan's own guidelines use the age of 6 as the normal school starting age, but 7 years is more reasonable given the widespread practice of delayed enrollment. A cutoff age higher than that is probably inaccurate since the enrollment window for girls in rural Pakistan is quite small. Nevertheless, our results are robust to small variations in the specific cutoff and we find that increasing this cutoff to 9 years does not change the results significantly.

To account for other potentially confounding factors in the IV specification, our first stage includes additional conditioning variables. First, the expansion in school construction over the last three decades implies that younger mothers had systematically greater exposure to a school at the time of their enrollment decision. Since other changes in the environment affecting enrollment are also time-varying, we control for age directly in the first-stage with a full set of age dummies—one for each year—for all mothers in the sample. Second, it could be that schools were built in a targeted manner in specific villages. We therefore also control for a full set of *tehsil* dummies—a *tehsil* is an administrative unit one level below the district, equivalent roughly in size to a US county. The province of Punjab, where our sample is drawn from, has 34 districts and 104 *tehsils* in the latest (1998) census. Since roughly 50 percent of our mothers were born in a different village, there are 72 different *tehsil* fixed effect dummy variables. Given the sample size, including a full set of birth-village dummies (over 400) leaves us with too little within-village variation to achieve identification.

The second stage regressions are therefore specified as follows.

$$MotherOutcomes_i = \gamma_0 + \gamma_1 MotherEducated_i + \gamma_2 MotherAge_i + \gamma_3 BirthTehsil_i + \xi_j \quad (2a)$$

$$ChildOutcomes_{ij} = \alpha_0 + \alpha_1 MotherEducated_i + \alpha_2 Age_i + \alpha_3 BirthTehsili_i + \alpha_4 ChildAge_j + \alpha_5 ChildGender_j + \varepsilon_{ij} \quad (2b)$$

Equation (2a) is a mother level equation. The variable *MotherEducated* is instrumented using the first stage regression (1) and is estimated using 2SLS. The variable *SchoolPresent*, which captures the presence of a school in the birth-village at the time of the enrollment decision, is the excluded variable from Equation 2a. *MotherAge* and *BirthTehsil* are the same variables as in the first stage and are in the second stage regression because of their potential direct effect on child level outcomes. All specifications cluster for the standard errors at the village-level. Equation (2b) is run at the child level and adds a full set of indicator variables for child age and a dummy variable for child gender to the set of explanatory variables. The subscript *i* refers to the mother and *j* to the child. In the 2SLS estimation, all child-related controls are also included in the first stage regression.

Finally, we also present bivariate probit results with the same specifications as above for all the discrete variables used in the analysis. Although the linear IV specifications are unbiased in terms of the Local Average Treatment Effects (LATE), the efficiency of the IV estimator is low at the sample sizes that we are

working with; the biprobit estimates buy us greater precision, but at the cost of assuming a standard bivariate normal distribution over the error terms in Equation (1) and the outcome equations.

We postpone two important questions regarding the estimation strategy to our discussion on robustness and limitations in Section 4. First, we cannot implement an identification strategy that relies solely on the interaction between age and the presence of schools as the instrument given the small sample size. We show in Section 4 that introducing an additional control for whether the mother's birth village *ever* received a school does not alter our coefficients, although in some cases we lose precision by doing so. Second, the causal effect of maternal education could work entirely through assortative matching. In Section 4, we test whether observable attributes of the current household (including spousal education and time-use) are causally linked to maternal education. We show that they are not. This suggests that at these low levels of education, the assortative matching seen in correlations is likely due to the signaling effects of education rather than the education per se.

Section 3: Results

First Stage

Table 3 presents the first-stage regression and the results of two falsification tests to check the validity of our instrument. The first column uses mother's years of education as a dependent variable. The next three columns use an indicator variable for whether a mother is educated as the dependent variable; our IV results are presented using this indicator variable rather than the continuous version.[9] Column 2 runs the regression for all mothers in the sample, Column 3 for all enrolled children in the sample as some of our time use variables are applicable only for enrolled children and Column 4 for all children in the sample to match the IV regressions specifications further below. Columns 5 and 6 present falsification tests.

Column (1) shows that a girls' school in the birth-village increases a mother's years of education by 0.61 years. Given that the average years of education are 1.34, this is a large increase. Columns (2), (3) and (4) show that a girls' school in the birth village increases the likelihood of a mother reporting some education by

[9] We have replicated all our results continuous version of maternal education and all our results are similar. Given that 75 percent of mothers in our sample report no education, the difference between mothers with some education and mothers with no education is the main source of variation in the data.

11.42, 12.05 and 10.96 percentage points respectively. The increased probability is both statistically significant and of a large magnitude since only 25 percent of all mothers reports any education at all. The instrument satisfies the criteria for detecting weak instruments discussed in Stock and others (2002), with F-statistics of 15.86, 13.35 and 14.60 in the three specifications we use in the second stage.

Even though controls for mother's age and *tehsil* fixed-effects should in principle account for alternate channels through which school presence could affect child outcomes, further falsification tests make a stronger case for the validity of the instrument. These are presented in columns 5 and 6. The first falsification test divides mothers into four categories—those that received a girls' school by age 7, those that received a girls' school between the ages of 8-15, those that received a girls' school after age 15 and those that never received one. Given the enrollment profiles for girls in Pakistan—increasing between ages 5 and 10 and dropping quite steeply after that—a valid instrument should imply that receiving a school after the relevant age should not have any effect on enrollment. Column (5) shows that the mother born in a village that received the school by age 7, relative to one who never received it, is 10 percentage points more likely to report some education. For those who received a school between the ages of 8-15 or after 15 years of age (relative to having never received it), the effect is small, of the wrong sign and insignificant at all conventional levels of confidence. The difference in coefficients between the first age group and the latter two age-groups is statistically significant at the 1 percent level. The difference between mothers born in villages that received a school after age 15 and between the ages of 8-15 is statistically insignificant.

The second falsification test reflects the sex-segregated nature of school provision in the province of Punjab. If one thinks that unobservable village-level political variables or other factors that resulted in the construction of a girls' school could also affect maternal education through other means than access to schooling, our instrument would be invalid. Since the process of setting up boys' schools should follow a similar but independent process, one might expect to see these direct effects to show up, at least to some extent in villages with boys schools. Column 6 presents the effects of the presence of a *boys'* school in the village by age 7 on the mother's education. The coefficient is small (-0.05) and not significantly different from zero.

Maternal Education and Time Use:

Our first set of results examines the difference in time-use patterns of mothers and their children across maternal education levels. We use three outcome variables. Recall that we collected data on children's time-use on educational activities outside school; our first outcome variable is the composite time spent by children on schoolwork at home, preparation for school and any extra paid tutorials. In addition, a specific time-use category was used to record the time spent by the mother on children's educational needs. This is our second outcome variable. Finally, for every enrolled child we specifically enquired how much time was spent in helping or reading to the child *by any family member* during the preceding week. Given a large number of mothers and households who report "0" time spent with children on their educational needs, we also present specifications that examine the link between *any* time spent and maternal education. These results are presented in Tables 4A-C.

Across the entire sample in the OLS specification, a child of a mother with some education spends 43 more minutes on educational activities outside the school (Table 4A, Column 1). In the IV specification, the estimates increase to 75 minutes, with some loss in precision. To check that these results are not driven by an increase in enrollment, we estimate the same specifications for enrolled children only. The results are stable and in this sub-sample, the preferred IV estimate increases to 77 minutes. To calibrate this increase in terms of the overall distribution, the 75 minute increase in study time moves a child from the 25th percentile to roughly the 75th percentile in the time distribution, and is almost identical even to the *point* estimates reported in Behrman and others (1999).

Columns 1 and 2 in Table 4B examine *maternal* time use in helping children with schoolwork. We use both the continuous version of the maternal time variable as well as a discrete version, where the outcome variable takes the value 1 if the mother spent any time at all on children's educational needs—informative because only 6 percent of mothers fall in this category, with the remainder reporting zero time spent. For the sample of all mothers, the IV specifications suggest no relationship between maternal education and maternal time spent on children's educational needs. Although OLS results are significant, the IV coefficient is smaller with large standard errors. This could, in part, reflect the low precision of the IV estimator. Therefore, we

also present the Average Treatment Effect on the Treated (ATT) from the bivariate probit specification for the discrete outcome variable. Here, the results are identical to the OLS specification and highly precise. The increase in the probability of a mother spending any time at all is 21 percentage points for mothers with some education, which is large given the low overall numbers in the data.

Following a sample-cut suggested by Behrman and others (1999), we then look at families where there is no child older than 12 in the household (Column 2, Table 4B). Although the distinction is endogenous, behavior in these households sheds more light on the mother's role for a couple of reasons. First, mothers with the educational levels in our sample may not be directly able to help older children in their more complex schoolwork. Second, older siblings themselves could potentially help the younger ones, thus decreasing the necessity for direct maternal supervision (see for instance, Tiefenthaler, 1997 on the role of older daughters as "mother-substitutes" and Bianchi, 2000). Finally, younger children may need more direct supervision and help in schoolwork so that the time allocation of mothers' and of other household members to these activities could well increase.

Table 4B shows a large difference by maternal education in the time-use for these households. All three specifications using the discrete variable indicating whether mothers spent any time on children's educational activities (OLS, IV and biprobit) are similar in magnitude and suggest an increase between 29 (OLS) and 23 (IV) percentage points. The biprobit estimate at 27 percentage points lies between the OLS and IV results and is larger than the result obtained for all households. Additionally, in these families, mothers with some education spend more time—40 more minutes—on children's educational needs; the effect is more precisely estimated in the IV specification than for all families.

Finally, Table 4C shows that maternal education also has an effect on the contribution of other household members to child learning. Using the hours spent in the last week by any family member on reading to children or telling them stories as the dependent variable, we find that children living in households with "educated" mothers are more likely to be read to, by 23 (OLS) to 26 (biprobit) percentage points and that this increase is associated with an additional 4.64 hours (IV) spent on this activity by all household members.

These results on maternal and child time allocation paint a picture of the learning environment that is very different in households with mothers who have some education. Of interest is that, while time spent directly on children's educational needs does increase for mothers with some education, child study time increases even more dramatically. Mothers with some education create a space whereby their children are able to spend an extra hour and fifteen minutes each day studying and preparing for school.

Learning Outcomes

To assess whether maternal education has an impact on learning outcomes, we matched children in our household survey to those who were tested in school through our study in Grade 3, eventually yielding a sample of 676 children for whom we have both test-scores and household survey data. The key econometric issue that this poses, in addition to that arising from the selection into maternal education, is that the children for whom we observe test-score data may systematically differ from children for whom test-score data are not available. This arises both because some children are not enrolled, but also because children may be absent on the day of the test (10 percent of all children in the relevant grade were not administered the test due to absenteeism). Therefore, IV specifications followed for other outcome data may be biased if such selection is not accounted for. Following Angrist (1995), the test-score equation is determined through a linear equation conditional on the existence of a test-score observation and a censoring equation indicating whether the test score is missing. Thus, although presence of a school is a valid instrument for maternal education, it is not a valid instrument in equation for selection into the test scores.

There are two potential solutions. One approach is to follow Heckman (1978). If we assume that errors are jointly normally distributed, homoskedastic and independent of the instrument, we obtain the familiar "Mills-ratio" as the relevant expectation function conditional on participation. This Mills ratio is then directly included in test score equation as the appropriate selection-correction. An alternative approach, proposed by Heckman and Robb (1986) and developed by Ahn and Powell (1993), uses the "control-function" approach, where we condition on the predicted probability in the test score equation. In essence, this method proposes to estimate the effect of maternal education by using pair-wise differences across children for whom the non-parametric probability of participation is very close. The approach is implemented

by first estimating the censoring equation directly, and then including the predicted probability of participation and its polynomials as additional controls in the test score equation.

Specifications using Heckman's selection model and the "control function approach base identification on the non-linearity of the selection equation (see Duflo, 2001, as an example). Augmenting the instrument set with potential candidates that are correlated to the probability of being tested in school but uncorrelated to the test-score can help in identification and the efficiency of the estimator. Following literature on the distance to school as a determinant of enrollment and absenteeism in Pakistan (see for instance Holmes, 2003), we propose using the distance to the closest eligible school as an additional instrument in the selection equation.

To construct this distance variable, we collected geographical coordinates of all households in the household survey as well as the coordinates of all schools in the village. We then computed straight-line distances for every household-school pair and computed the minimum distance to an eligible school, incorporating both the level of the school and its gender status (boys only, girls only or coeducational) as well as the gender of the child. The distance to the closest eligible school is a strong predictor of enrollment, and of concern for us, larger distances also make it more likely that the child was not tested in the school as part of the testing exercise.

The results from this exercise are presented in Table 5. Columns 1 presents the OLS specification; column 2 presents the results based on specifications based on the Heckman correction while Columns 3 present results using the control-function approach. As before, all specifications include a full set of dummies for mother's age as well as the birth *tehsil* (county); in addition, we include additional controls for the age and gender of the child. We find a strong causal effect of maternal education on child-test scores in the subjects of English and Urdu, with children of mothers with some education reporting test-scores at the end of Grade III that are 0.35 standard-deviations higher than those of children whose mothers report no education at all. This impact is significant at the 1 percent level of confidence. The effects are smaller for Mathematics, and suggest a 0.25 standard-deviation boost for children with "educated" mothers; significant at the 5 percent level of confidence. These results appear to be robust to the methods used to control for selection with

similar qualitative and quantitative findings, from specifications that account for selection, by specifically controlling for the probability of selection (Columns 2-3). The non-parametric approach yields almost identical coefficients, and both the Heckman and the control-function estimates are remarkably similar to those obtained in the OLS regressions.

Although fraught with comparability issues, the impact of mother's education on learning is similar to, and indeed in many cases, greater than the impacts of widely reported experimental interventions. The language effects in our sample are greater than those associated with an extra teacher or computer-aided learning program reported in Banerjee and others (2007). The Math score is comparable to the learning incentives experiment in multi-subjects reported in Kremer and others (2009).

Other Channels: Household Bargaining

In the literature on middle and high-income countries, maternal education is typically associated with greater bargaining power within the household; this is the classic link between education and female empowerment. If mothers give greater weight to child outcomes, an increase in women's bargaining power will favor children. Lundberg and others (1997) classic study shows that money given to mothers leads to greater expenditures on children relative to money given to fathers. One channel through which this link has been posited to work is through greater labor force participation and income generating potential for educated women.

There is little direct evidence for these empowerment/bargaining effects in our data. We test whether maternal education affects time spent on paid work time and time spent outside the house. We follow the same estimation and reporting strategy as in time use channels. Since paid work by mothers is very low in the data, we present both the discrete variable measuring the presence of any paid work and the continuous version using daily minutes of paid work. As previously, we present the Average Treatment Effect on the Treated (ATT) from a bivariate probit specification for the discrete variables.

There are several noteworthy "non"-results reported in Table 6. First, the effect of maternal education on the time spent by the mother working outside the house is negative in both the OLS and IV (57 and 84 fewer minutes). It is significant in the OLS but with lower precision for the IV. Second, there is a

small effect of maternal education on whether the mother does any paid work at all (-1, 5 and 1 percentage points in the OLS, IV and biprobit specifications), but in all cases the effect is not significant. Third, in time-use we do find and an increase in time allocated to paid-work in the IV specification (59 minutes more) but the estimate is imprecise and is not consistent with the negative correlation in the OLS regression. Taken across the three measures it is likely that this channel, where education affects paid work and time outside the house, which is so prominent in the discussion on developed countries, is missing in this low income country environment.

Given that education does not appear to increase mothers' outside options, we should also not expect to see any changes in the decision making role for the mother who has some years of schooling. Our survey asks two questions about the mother's decision making in their children's education: whether the mother was principally responsible for the child's enrollment decision and whether the mother was principally responsible for the choice of school. The effect of maternal education is uniformly small and insignificant in all three specifications (OLS, biprobit and IV) for both these questions. Finally, we are unable to detect a causal effect of mother's education on enrollment or school choice even though there is a large positive effect of maternal education on enrollment and a large negative effect on enrollment in public schools in the OLS specification. This is consistent with Black and others (2005), Behrman and Rosenzweig (2002) and a detailed survey by Strauss and Thomas (1995) that points out the inconclusive nature of many studies relating child outcomes to maternal education.[10]

Results on schooling expenditures also confirm that on the *intensive* margin (allocations conditional on school enrollment) maternal education has little impact on child inputs other than the time allocations discussed previously. We estimate the impact of maternal education on disaggregated schooling expenditures (books and supplies and uniforms and shoes) and total educational expenditures (Table 6). For all three outcome variables we are unable to detect a causal impact of maternal education on child allocations. Finally, we examined whether the causal impact of maternal education on time allocations for educational needs

[10] At the same time, we want to caution against reading too much into this result. Given the relatively small sample, the precision of our estimates does *not* allow us to rule out that the OLS and IV coefficients are statistically the same, and therefore rule out the positive enrollment effects of maternal education.

extended to children's *general* needs. We find no correlation or causal link between maternal time on children's general needs and maternal education. The OLS estimate is precisely 0 and the IV estimate is of the wrong sign (Table 6). Take together these results strongly suggest that improvements in education at low starting levels do not alter bargaining power within the household. However, education still has an impact. The channel that figures prominently and causally is the way in which both mothers and children allocate their time in a household learning environment created by "educated" mothers.

Section 4: Robustness and Limitations

There are some limitations to the estimates presented here. First, like with all IV estimates, we estimate the Local Average Treatment Effect, or LATE. It is likely that the compliers—mothers who shifted their education levels as a result of school presence—behave differently from the sample of all mothers (Card, 1999). Second, our sample sizes are much smaller than previous studies in the literature (Currie and Moretti (2003) for instance, use more than 600,000 observations in their IV sample.). This is primarily because there are no standard datasets from low-income countries that allow mothers to be matched to their birth-villages. The data therefore have to be collected from scratch and villages have to be matched manually after data collection. We also required detailed data on child learning and time-use that precluded using larger pre-existing household surveys. Thus achieving large sample sizes was beyond the scope our data collection exercise. Consequently, given the well known problems of poor efficiency in IV estimates for smaller samples (in the case of discrete variables, Chiburish and others, 2006, show that effect sizes of 0.15 can be detected in 95 percent of cases with IV estimates only once the sample size crosses 22,000), several of our estimates are plagued by low precision.

Given the small sample size, we were also unable to include birth-village fixed effects in the primary specifications. This introduces a concern that variation across villages in the availability of schools could be directly correlated with current child outcomes, perhaps because of the long-term presence of the school itself. Table A2 in the Appendix presents the main results in the paper after introducing a dummy variable for whether the mother's birth-village ever received a school; the excluded instrument then captures only the variation in age-specific enrollment possibilities for the mother. Our results on the time spent by children in

schoolwork at home and the effect of maternal education on test-scores remain unchanged and significant. The size of the coefficient on maternal time with children remains the same, but the precision drops substantially due to the additional control. Therefore, it is unlikely that particular characteristics of villages that received schools explain the variation we now observe in the time-use patterns and test-scores of children across educated and uneducated mothers.

Third, and perhaps critical for our interpretation of the channels through which maternal education affects child outcomes, is that our reduced form specifications do not account for sorting in the marriage market. If education allows mothers to choose "better" husbands (there is certainly a strong correlation in spousal education), we are certainly attributing too much to the direct effects of maternal education on child effort. This channel may be qualitatively less important in our case given the gender-segregation of schools in Pakistan. Previous studies that use schooling availability as an instrument have to address the problem that there is a single instrument that affects both maternal and paternal education; an issue that does not arise here. Accounting for assortative mating requires a second instrument (which we do not have) that determines the quality of the match in the marriage market. Black and others (2005) suggest that the potential importance of this channel can at least be assessed by examining the causal link between maternal education and observable spousal/household characteristics and this check is presented in Table 7. Clearly, in the OLS specifications, mothers with some education also have more educated spouses, spouses who spend more time with their children, live in richer households (as measured by log per-capita expenditures), have smaller families are more likely to have electricity (which has been independently linked to child outcomes in other studies in low-income countries) and are more likely to live in concrete housing. In both the IV and biprobit specifications none of these remain significant, and in the IV specifications the coefficient estimate for spousal education, father's time with children and household expenditures is of the wrong sign. The coefficient on the type of housing drops to zero. Nevertheless, there is limited evidence that mothers with some education *are* more likely to locate in villages that are electrified and have fewer children, although the

estimate is highly imprecise. We thus note the possible importance of this location and fertility effects as independent channels for our results.[11]

Section 5: Conclusions

We are able to demonstrate a causal link between maternal education and time spent by their children on educational activities outside school. Our IV estimates suggest that this is as much as 75 minutes more for every child. In addition, mothers with some education also spend more time with their children on schoolwork, an effect that is particularly large and significant (40 minutes) for families where the mother is likely to be the primary care-giver. They also facilitate greater contribution from other household members in reading and helping their children with schoolwork. This extra effort put in by the mothers, children and households pays off. Test scores are significantly higher for children whose mothers have some education.

We believe that these results most likely reflect a direct productivity effect of maternal education or an effect on maternal preferences in a context where bargaining power is low or non-existent. The low educational achievement of mothers in our sample (as measured by years of education) does not lead to greater enrollment and does not affect the school choice decision. In response to questions on mother's role in decision making, "educated" mothers were no more responsible for these decisions than their unschooled counterparts. This is perhaps not surprising at such low levels of education and paid work that are typical of developing countries. Ironically, these very same mothers with low levels of education do enhance their children's learning, an outcome that is ostensibly much harder to achieve. Mothers do not need to be at an advanced cognitive level to make their children study. Perhaps, by spending some years in school, mothers learned that learning requires considerable effort. Consequently, they are clearer on the steps (and effort) that their children need to take to improve their cognitive achievement. The findings in this paper thus emphasize the role of parental-child interaction and child effort in studying as an important channel for improving learning.

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[11] It is tempting, but likely incorrect, to correct for this by using current village fixed-effects. By introducing within-village comparisons, we are comparing uneducated mothers who were selected to live in "better" villages with similarly selected educated mothers. It is very likely that these uneducated mothers differ in some other unobserved dimension---perhaps along the same characteristics that education provided for other mothers in the sample.

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Tables and Figures

Table 1: Summary Statistics

	(1) Mean	(2) S.D.	(3) N
All Children			
Age (years)	9.97	2.93	4331
Female (fraction)	0.47	0.50	4331
Enrolled (fraction)	0.76	0.43	4331
Educational Activity (minutes/day)	117.30	88.98	4331
Paid Tutorials (minutes/day)	14.36	39.11	4331
Study (minutes/day)	57.83	60.22	4331
School Preparation (minutes/day)	45.11	34.97	4331
Enrolled Children			
Public Schools (fraction)	0.71	0.45	3305
Mother Responsible for the Choice of School (fraction)	0.07	0.25	3270
Mother Responsible for the Enrollment Decision (fraction)	0.10	0.31	3270
Does anybody help the child or read to him/her? (Y/N)	0.38	0.49	3149
Time anybody in the family spent helping child or reading to him/her (hours/week)	3.00	4.81	3149
School Expenditures (Rs./Month)			
Paid Tutorials	9.40	34.72	3124
School Fees	31.12	55.93	3124
Supplies	35.90	26.07	3124
Uniforms and Shoes	41.40	26.34	3124
Mothers			
Education (years)	1.34	2.75	1437
Educated (Y/N) (fraction)	0.24	0.43	1437
Age	37.87	7.56	1437
Girls School Present in Birth Village by Age 7	0.55	0.50	1437
Time Spent on Children's General Needs (Minutes/Day)	94.47	141.29	1437
Time Spent Helping Child With Schoolwork	5.05	22.77	1437
Was Any Time Spent Helping Child With Schoolwork? (Y/N) (fraction)	0.06	0.23	1437
Paid Work (Minutes/Day)	40.67	131.71	1437
Any Paid Work (Y/N) (fraction)	0.11	0.31	1437
Time Outside the House	99.33	157.58	1437
Time Inside the House	501.88	225.67	1437

Notes: Data from the LEAPS survey of households in 2004. "Paid Tutorials" are expenditures on private tuitions outside school. All expenditures are reported in Pakistani Rupees (Rs.) (at the time of the survey, $1 was approximately Rs.65).

Table 2: Time Use, Maternal education and Learning (minutes/day)

	(1) Mother Not Educated (N=1096)	(2) Mother Educated (N=341)	(3) Difference in Means
Panel A: Maternal Time Use			
Rest	608.69	575.5	33.19
	(5.77)	(7.4)	(2.98)
Housework	560.46	596.2	-35.75
	(7.49)	(10.62)	(-2.44)
Paid-Work	44.28	29.08	15.20
	(4.23)	(5.38)	(1.86)
Children's General Needs	93.16	98.67	-5.50
	(4.29)	(7.54)	(-0.63)
Children's Educational Needs	0.3	20.32	-20.02
	(0.17)	(2.29)	(-15.29)
Other	137.82	124.37	13.45
	(5.84)	(6.98)	(1.20)
Mother's Time outside the house	113.40	54.10	59.29
	(6.25)	(5.02)	(6.14)
Mother's time inside the house	475.71	563.15	-87.44
	(7.79)	(14.05)	(-5.47)
Panel B: Child Time Use			
	Child Not Enrolled (N=1026)	Child Enrolled (N=3305)	Difference in Means
Rest	650.92	598.83	52.09
	(4.89)	(2.10)	(11.20)
School	0	356.27	
	(0)	(1.36)	
Housework	197.31	24.14	173.17
	(8.23)	(1.17)	(34.37)
Paid Work	62.46	1.57	60.88
	(5.68)	(0.35)	(18.87)
Educational Activities	8.74	151	-142.25
	(1.14)	(1.25)	(-61.00)
Play	278.48	154.63	123.85
	(8.41)	(2.05)	(20.80)
Other	226.30	153.57	72.73
	(7.73)	(2.60)	(11.45)
Panel C: Maternal Education and Child Test Scores			
	Mother Not Educated (N=483)	Mother Educated (N=193)	Difference in Means
English	-0.18	0.25	-0.43
	(0.04)	(0.07)	(0.08)
Urdu	-0.14	0.22	-0.35
	(0.05)	(0.06)	(-0.08)
Math	-0.13	0.12	-0.25
	(0.05)	(0.07)	(0.09)

Notes: Mean and Standard errors in parentheses, t-stats in parentheses for difference in means. Time allocations are based on a flexible time-use surveys where respondents tell the surveyors what they did in a typical day during the last week. Test scores are from a school-based test administered to all children in Grade 3 in all schools in the village. The results reported are Item-Response scaled scores where the distribution was standardized with respect to the universe of test-takers. Numbers reflect standard-deviations from the mean.

Table 3: First Stage Regressions and Falsification Tests

	Mother's Education					
	(1) Mother Education (years)	(2) Mother Educated (Y/N)	(3) Mother Educated (Y/N)	(4) Mother Educated (Y/N)	(5) Mother Educated (Y/N)	(6) Mother Educated (Y/N)
	First Stage Regressions				Falsification Tests	
Girls School Present by Age 7	0.61 [0.17]a	0.11 [0.03]a	0.12 [0.03]a	0.11 [0.03]a	0.10 [0.04]b	
Girls School Present Ages 8-15					-0.04 (0.04)	
Girls School Present After Age 15					-0.01 (0.04)	
Boys School Present by Age 7						-0.05 (0.04)
Observations	1437	1437	3305	4331	1437	1424
R-squared	0.162	0.174	0.184	0.171	0.175	0.169
F test: Girls School Present by Age 7=0	12.55	15.86	13.35	14.60		
Prob > F	0.000	0.000	0.000	0.000		

Notes: Robust standard errors in parentheses, clustered at the village level (a): significant at p<0.01; (b): significant at p<0.05; (c): significant at p<0.1. Regressions 1, 2, 5 and 6 are at the mother level. Regression 3 is at the enrolled children's level and Regression 4 is for all children. The omitted variable in Equations 1, 2 3, 4 is girls' school present after age 7 or not present at all. The omitted variable in Equation 5 is girls' school not present at all. The omitted variable in Equation 6 is boys' school present after age 7 or not present at all. All regressions control for a full set of mother's age indicator variables and fixed effects for mother's birth *tehsil* (county).

Table 4A: Maternal Education and Child Time Use

	Children	
	(1) All Children	(2) Enrolled Children
Child Time on educational activity outside school (mins/day)		
OLS	42.84 [4.40]a	19.8 [4.47]a
IV	75.34 [45.25]c	77.15 [41.71]c
Observations	4331	3305

Notes: Robust standard errors, clustered at current village level; (a): significant at p<0.01, (b): significant at p<0.05, (c): significant at p<0.1. For discrete variables, we report both the IV coefficient and the Average Treatment on Treated using a biprobit specification. Girl's school present in mother's birth village is the excluded variable in the IV and the biprobit. All regression control for full set of indication variables for mother's age, mother's birth village *tehsil*. In addition, Child-level regressions control for a full set of indicator variables for child's age and child gender.

Table 4B: Maternal Education and Mother and Family Time Use

	Mothers	
	(1) All children	(2) Families with no child above 12
Did the mother spend any time on children's educational needs? (daily)		
OLS	0.21 [0.03]a	0.29 [0.04]a
IV	0.12 [0.13]	0.23 [0.22]
Biprobit	0.21 [0.03]a	0.27 [0.04]a
Observations	1437	580
Mother's time spent on children's educational needs (mins/day)		
OLS	19.12 [2.46]a	25.32 [3.71]a
IV	14.00 [13.64]	40.29 [23.57]c
Observations	1437	580

Notes: Robust standard errors, clustered at current village level; (a): significant at p<0.01, (b): significant at p<0.05, (c): significant at p<0.1. For discrete variables, we report both the IV coefficient and the Average Treatment on Treated using a biprobit specification. Girl's school present in mother's birth village is the excluded variable in the IV and the biprobit. All regression control for full set of indication variables for mother's age, mother's birth village *tehsil*. In addition, Child-level regressions control for a full set of indicator variables for child's age and child gender.

Table 4C: Maternal Education and Family Time with the Child

Enrolled Children	(1) OLS	(2) IV	(3) Biprobit	(4) n
Any time in week spent helping/reading with child by any member of the household? (Y/N)	0.23 [0.03]a	0.24 [0.27]	0.26 [0.09]a	3149
Time spent helping/reading with child (hrs/week)	2.12 [0.34]a	4.64 [2.79]c		3149

Notes: Robust standard errors, clustered at current village level; (a): significant at p<0.01, (b): significant at p<0.05, (c): significant at p<0.1. For discrete variables, we report both the IV coefficient and the Average Treatment on Treated using a biprobit specification. Girl's school present in mother's birth village is the excluded variable in the IV and the biprobit. All regression control for full set of indication variables for mother's age, mother's birth village *tehsil*. In addition, Child-level regressions control for a full set of indicator variables for child's age and child gender.

Table 5: Child Test Scores and Maternal Education			
	(1) OLS	(2) Heckman Selection	(3) Control Function
English	0.34 [0.10]a	0.35 [0.09]a	0.35 [0.11]a
Urdu	0.33 [0.11]a	0.35 [0.09]a	0.35 [0.11]a
Math	0.24 [0.12]b	0.25 [0.10]b	0.24 [0.12]b
Observations	676	4218	663

Notes: Robust standard errors, clustered at the village level in parentheses; (a): significant at p<0.01, (b): significant at p<0.05, (c): significant at p<0.1. The Heckman selection and control function estimates use the distance to school as an additional excluded variable in the determination of testing results. The results are presented as the causal impacts of maternal education on standard-deviation changes in test-scores. All regressions control for a full set of child age indicator variables, child gender and birth_tehsil fixed effects.

Table 6: Maternal Education, Preferences and Bargaining

	OLS	IV	BiProbit	n
Time Spent by Mother on Paid Work (Y/N)	-0.01 (0.02)	0.05 (0.19)	0.01 (0.09)	1437
Time Spent by Mother Outside the House (minutes/day)	-57.30 [8.28]a	-84.11 (105.93)		1437
Time Spent by Mother on Paid Work (minutes/day)	-10.89 (7.86)	58.74 (84.68)		1437
Was the Mother Responsible for the School Enrollment Decision (Enrolled children only) (Y/N)	0.02 (0.03)	-0.02 (0.17)	0.01 (0.07)	3307
Was the Mother Responsible for the choice of School (Enrolled children only) (Y/N)	0.02 (0.02)	0.05 (0.15)	0.05 (0.03)	3307
Is the Child Enrolled (Y/N)	0.17 [0.02]a	-0.01 (0.17)	0.09 (0.07)	4331
Is the Child enrolled in a Public School (Y/N)	-0.19 [0.03]a	0.07 (0.32)	0.02 (0.10)	3305
Total Education Expenditure per Child (Rs./month)	58.62 [6.49]a	19.85 (54.75)		3160
Books and Supplies per Child (Rs./month)	11.43 [1.51]a	11.75 (10.90)		3160
Uniforms and Shoes per Child (Rs./month)	7.09 [1.47]a	-17.92 (14.95)		3160
Time Spent by Mother on Children's General Needs (minutes/day)	-0.01 (7.83)	-30.25 (87.77)		1437

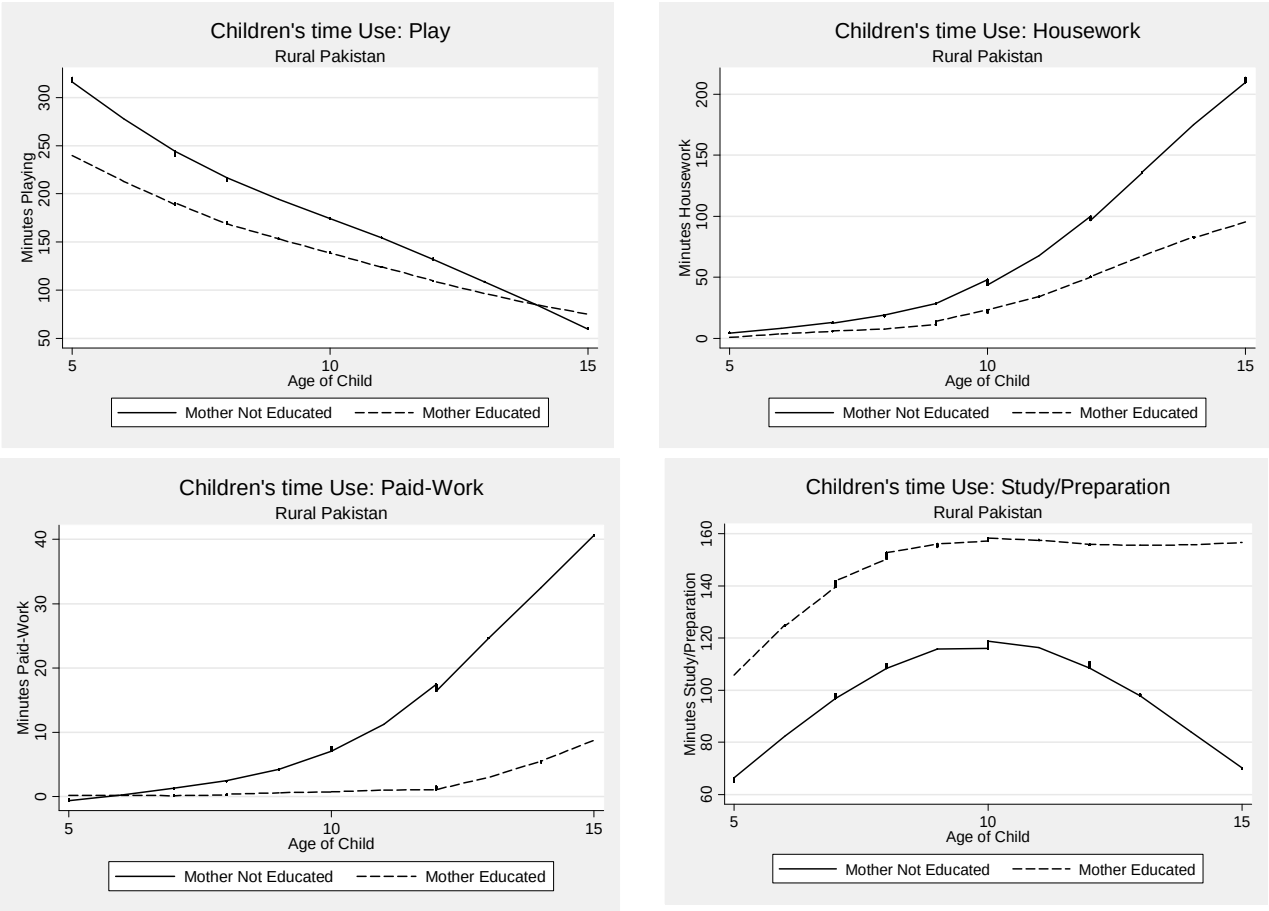
Notes: Robust standard errors, clustered at current village level (a): significant at p<0.01, (b): significant at p<0.05, (c): significant at p<0.1. For discrete variables, we report both the IV coefficient and the Average Treatment on Treated using a biprobit specification. Girls' school present in mother's birth village is the excluded variable in the IV and the bivariate probit specifications. All expenditure regressions are presented in Pakistani Rupees (Rs.) per month. At the time of the survey, $1 was approximately (Pakistani) Rs.65. All regressions control for a full set of indicator variables for mother's age and mother's birth village *tehsil*. In addition, child level regressions control for full set of indicator variables for child's age and child gender.

Table 7: Maternal Education and Spousal Characteristics

	OLS	IV	Biprobit	n
Dad Educated	0.30 [0.04]a	-0.13 (0.29)	.06 (0.12)	1232
Time Spent by Father on Child's Educational Needs	7.02 [2.60]a	-4.53 (15.31)		1209
(Log) Expenditure	0.36 [0.05]a	-0.09 (0.43)		1437
Electricity	0.10 [0.02]a	0.13 (0.27)	0.08 (0.08)	1434
Concrete Housing	0.14 [0.03]a	0.03 (0.28)	0.05 (0.13)	1437
Number of children	-0.09 (0.09)	-0.40 (0.73)		1437

Notes: Robust standard errors, clustered at current village level (a): significant at $p<0.01$, (b): significant at $p<0.05$, (c): significant at $p<0.1$. Electricity is an indicator variable for whether the household has electricity; concrete housing is a standard measure of wealth and has been shown to be directly associated with better school performance. All regressions control for full set of indicator variables for mother's age and mother's birth village *tehsil*. Girls' school present in mother's birth village is the excluded variable in the IV and the bivariate probit. For all variables, the regressions suggest no causal relationship between spousal attributes, spousal time allocation and household-level characteristics with maternal education.

Figure 1: Children's Time-Use and Age, and Maternal education



Notes: The figures show non-parameteric graphs relating child time-use with age for the sample of mothers with some education relative to those with no education. To focus on the relative differences between these groups, the vertical axis are different across the graphs. Child time use is based on a time allocation module completed for every child through the LEAPS survey in 2003.

Appendix: Table A1
Matching Statistics

	(1) Mothers matched in the sample (n=1437)	(2) Mothers unmatched in the sample (n=260)	(3) Mean Diff
Mother			
Age	37.87	37.34	0.53
	(0.20)	(0.52)	(0.52)
Education (years)	1.34	1.38	0.04
	(0.07)	(0.19)	(0.19)
Educated (Y/N?)	0.24	0.23	0.01
	(0.011)	(0.026)	(0.02)
Time Spent on Child Needs (minutes/day)	94.47	88.50	5.97
	(3.73)	(8.41)	(9.46)
Time Spent on Child School Work (minutes/day)	5.05	3.46	1.59
	(0.60)	(1.14)	(1.49)
Child			
Age (Years)	9.97	9.74	0.23
	(0.04)	(0.10)	(0.11)
Female	0.47	0.49	-0.02
	(0.01)	(0.02)	(0.02)
Enrolled	0.76	0.76	-0.00
	(0.01)	(0.02)	(0.02)
Public	0.71	0.69	0.02
	(0.01)	(0.02)	(0.02)

Notes: Means and standard error of the mean in parentheses. The table compares attributes of children and mothers for the sample of mothers whose reported birth village could be matched to a village in the Pakistani census with the mothers whose villages we were unable to find. The reasons for the "missing mothers" are detailed in the text.

Appendix: Table A2

Mother's Education, Child and Maternal time use and Child Test Scores

	(1) OLS	(2) IV	(3) OLS	(4) IV
Variables				
	All Children		Enrolled Children	
Child Time on Educational Activity (mins/ day)	42.80 [4.41]a	70.03 [40.04]c	19.74 [4.47]a	67.33 [33.90]b
Observations	4331	4331	3305	3305
	All Mothers		Mothers With No Child Above 12	
Time spent on children's educational needs (mins/ day)	19.11 [2.47]a	11.82 (14.48)	25.11 [3.68]a	35.11 (33.20)
Observations	1437	1437	580	580
Test Scores				
	English	Urdu	Math	
Heckman Selection Model	0.35 [0.09]a	0.35 [0.09]a	0.24 [0.10]b	
Observations	4218	4218	4218	
Control Function Approach	0.35 [0.11]a	0.35 [0.11]a	0.24 [0.12]c	
Observations	663	663	663	

Notes: Robust standard errors, clustered at current village level (a): significant at p<0.01, (b): significant at p<0.05, (c): significant at p<0.1. In addition to controls set in Tables 4A-C and 5, an extra control for whether a school was always present in the village is included in these specifications. All coefficients are similar to those in the previous IV specifications (Tables 4A-C) although precision is reduced in the case of the mother's time spent on children's educational needs in families with no child above the age of 12.