What Did You Do All Day? Mothers and Child Educational Outcomes

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Abstract: How do educated mothers affect their children's education, particularly when in a typical developing country, they themselves are barely educated? We answer this question using detailed data from rural Pakistan to examine a rich source of channels including detailed mothers' and children's time. By matching the availability of schools in the mother's birth village to her educational levels, we are able to present instrumental variables estimates that account for the selection into maternal education. Our IV estimates show that extra education for mothers does not lead to more paid work-hours or fewer hours doing house work. We are also able to show that that while mother's time spent with children on education related activities does not increase significantly, time spent by their children on educational activities at home goes up significantly; our IV estimates suggest that this is as much as 73 minutes more for every enrolled child. The learning impact of maternal education associated with this extra child effort is quite large. Test scores in English, Urdu and Mathematics go up between .22-.32 standard deviations.

Educating women is oft-viewed as the single most effective policy lever in low-income countries for improving incomes and impacting a wider set of human development outcomes such as health and fertility. Neither are the welfare gains restricted to the educated women themselves; in their roles as mothers, they pass on the benefits of education to their children. In a low-income country environment, because child enrollment is less than universal and drop-outs rates high, question on the enrollment status and retention have gotten the most attention. In such an environment, the majority of current generation of mothers never enrolled in school, and even those that did enroll barely made it to the primary level. In addition, given the low formal labor force participation of women and the prevalence of home based activities, children could be impacted on children through channels other than the increased bargaining and extra autonomy that this small increase in education might provide. Specifically, as mothers in these environments spend the bulk of their time at home, they could influence the home learning environment greatly. These barely educated mothers, ironically might affect child learning-- arguably the ultimate goal of education-- more than the child's enrollment status.

This paper adds to the discussion on mother's education and intergenerational human development linkages in two ways. First, we combine detailed data from rural Pakistan on mothers' and children's time use that allows us to isolate the effect of mother's education on a broad range of child behavior including time spent studying, playing, working for pay and house work in addition to enrollment and school choice. Matching children in households with specially designed tests given in all the schools in our sample villages, we can also see the impact of mother's education on learning outcomes. On the mother's side, we have a wealth of data on time use including details of housework, paid work and time spent working with the child on studies and on her roles and responsibilities in educational decision making. This allows us to examine the channels through which mother's education can make a difference. Second, by matching the availability of (girls) schools in the mother's birth village to her educational levels, we are

able to present instrumental variables estimates that account for the selection into maternal education.[1]

We find, once correcting for selection though the instrumental variable strategy, that educated mothers are not different from the uneducated ones in their importance in the decision of sending their child to school or of the choice of school. The estimated differences are small and not significant. Consequently, maternal education also does not affect child enrollment and school choice, even though in the OLS estimates on both choice and enrollment are large and significant. While mothers' time devoted to her children's studies at home changes with education, it is relatively small (18 more minutes a day in the IV estimated) and is not significant. Both educated and uneducated mothers in rural Pakistan spend most of their time doing housework (mostly in the home) and much less paid work. Any significant differences do not remain once we control for selection. Thus, one of the trade-offs discussed in the high-income country literature—the income-effect from greater labor force participation for educated mother's versus the direct effect of mother's spending more time with their children—is not significant in these data.

An important part of the data is children test scores on a specially designed and administered test in English, Urdu (the local language) and Mathematics. We find that children of educated mothers have significantly higher test scores—.22 to .32 of one standard deviation more. This is somewhat surprising particularly given the low educational achievement of even our educated mothers--a mother's mean education in our sample is only 1.4 years with 75% of the mothers having never gone to school. Also as mentioned above that education has little effect on a mother's time usage in the house, outside the house and time spent with the child on home work. Furthermore, the educational environment of all households is extremely sparse. More than 90 percent of mothers report spending zero minutes with their children on educational activities on a given day; more than 90 percent of the children were not read a book or told a story in the

[1] One word of caution—though we refer to "educated" mothers, the difference that we focus on is between mothers with *no* schooling and mothers with some schooling. This is discussed further below.

last week; more than 90 percent do not have a single book at home, even a newspaper. Only 25 percent have ever visited their children's school, and more than 60% percent of children are themselves responsible for maintaining contact with the school. Neither are the differences large across educated mothers--even in OLS specifications, educated mothers spend only around 25 minutes more on their own children's studies at home.

The answer to this puzzle lies in the child time use data. While the median enrolled child spends two hours per day studying at home—a large number--the children of educated mothers spend even more time relative to those whose mothers are illiterate. The OLS specification suggests that this difference is close to 40minutes a day; by our IV estimates, the difference increases to 75 more minutes a day. Having an educated mother moves a child from the 25th percentile of the distribution to close to the 75th percentile. Children's unstructured play time, house work and paid work are not significantly different.

These results highlight that educated mothers make a difference by creating an environment at home, where children are cajoled (or perhaps coerced) into spending more time on their education. In this environment, female empowerment does not seem to be consequence of education as education does not translate into greater decision making. However, it looks like that educated mothers are cordoning off the domain they have responsibility for and trying to ensure that their children exert more effort on their educational needs. This is very much in line with the results from Behrman, et. al (1999), but with a twist—educated mothers are not spending more time directly with their children on schoolwork, instead, somehow while busy cooking and cleaning inside the home, they are ensuring that their children exert significantly higher effort. Our work also point out the important role of child motivation and effort in the learning process. We cannot say at this time whether this motivation is intrinsic or extrinsic (related to pecuniary means) but is worth investigating further, possibly experimentally.

Since our causal interpretation of these results stems from an instrumental variable approach, some elaboration is in order here. Following Currie and Moretti (2003) and

Carneiro, Meghir and Parey (2007) among others, we propose to use the availability of schools in the mother's natal village as an instrument for her education. We obtain the birth village using verbal recall in interviews with mothers, and then match this with the census directory of villages around the time when the majority of the mothers were born. We are able to confirm the viability of this strategy for low-income countries, although there are some costs. In particular, roughly 20 percent of the mothers in our sample remain unmatched because their birth villages were not identifiable in the census directory; we discuss this matching problem in the data section below.

The first-stage of the IV regression is fairly strong, and suggests that the presence of a village in the school lead to a 10.8 percentage point increase in the percentage of mothers with primary education. Alternatively, having a girls school present in the birth village adds .55 years of education to a mother. Given very low initial numbers (1.4 years and 25 percent of mothers being educated), this is large. This correlation remains after controlling for a full set of mother's age indicators and tehsil (county) of birth fixed-effects.

Encouragingly, the instrument also passes the falsification tests discussed in Currie and Morretti (2003). Specifically, the presence of a boys' school in the natal village has no effect on mother's education; neither does the presence of a girls' school in the natal village affect her education if she was beyond the enrollment cutoff age when the school was built.

The remainder of this paper is structured as follows. Section 2 briefly summarizes the literature. Section 3 presents describes the data set. Section 4 discusses the empirical strategy and provides the results. Section 5 concludes with a discussion of the results and some caveats.

Section 2: Related Literature

The literature on mother's time-use highlights a key tradeoff in child rearing that arises from the relationship between female education and labor force participation. While the

income-effect of the extra paid work helps in improving child outcomes, it also decreases the direct time that the mother interacts with the child. Cawley and Liu (2007) for instance, estimate the effect of paid-work on child cognitive outcomes using state-level instrumental variables. They find diminished cognitive ability among children and a decline in total parental time because fathers do not fully compensate for the decline. In the developed world there is considerable evidence that more educated mothers do spend more time away from home in the labor market. This is true not just in the United States but also in the United Kingdom (Carneiro, et. al, 2007).

In two well known studies, Behrman and Rosenzweig (2002) and Behrman et al. (1999) bring out the importance of the institutional, social and cultural context of women's time use. They point out that a woman's education has a greater effect on child outcomes in India, largely because her time spent outside the house doesn't change but becomes of higher quality, pointing to the importance of home schooling and time spent with the child. They hypothesize that the reason of finding no effect in the US in their twinning study is because of the increased labor force hours that educated women spend outside the home. [2]

One strand of literature on the child educational outcomes has been driven by concern for child labor and its impact on enrollment.[3] There have been recent papers that have recognized that children can spend time on other activities besides school or work. Macleod and Ranjan (2008) discuss the prevalence of "idle" children who are neither in school nor at work. They emphasize child ability and its impact on the school-work tradeoff. Child effort, the key finding in our paper, is not factored into their model. Ravallion and Wodon (1999) also point out that in response to a targeted food subsidy program enrollment increased by more than the fall in child labor, suggesting that children have other time usage. They acknowledge the lack of data on child studying at

[2] There is a large literature on the effect of maternal education on child health outcomes both in the developed and developing countries using various empirical strategies as well See e. g. Grossman, Michael and Robert Kaestner (1997)
[3] See Orazem (2003) for a detailed survey.

home or after-school tutorials that could very well be the major activity being displaced by work.

There are a number of ways in which the literature has addressed the issue of endogeneity of the educational decision. One well known strand is based on analysis of twins and adoption as in the Behrman and Rosenzweig study mentioned earlier. More pertinent to this paper is the literature using instrumental variables. The empirical strategy most commonly used in this literature has fallen into two broad categories. Both look at the institutional features of the environment to generate exogenous variation in educational outcomes. The most common method, starting with Angrist and Krueger (1999) exploits variation across states, municipalities or other geographical units in compulsory schooling laws to generate variation in parental educational that is exogenous to parental ability. Black, Devereux and Salvanes (2005) use differing implementation (across municipalities) of changes in Norwegian compulsory schooling law from seventh grade to the ninth grade to capture the exogenous variation. That study is particularly relevant because it aims to establish the causal intergenerational link of educational outcomes. They find very little effect of a mother's education on child schooling as measured by the number of years of child education.

We follow the second set of papers that uses variation in cost of schooling at time of the schooling decision as an instrument. Card (1993, 1999) was the first to introduce variation in college proximity at the time of the college decision of the parent. Currie and Moretti (2003) use the above strategy to look at the effect of a mother's education on intergenerational transmission of health outcomes in the US data. Carneiro, Meghir and Parey (2007) also follow the same method for looking at effect of mother's education on child outcomes in the UK. To our knowledge, school proximity at the birth village level has not been used to instrument for the parental educational decision in the developing country context. These two studies are relevant for our work as they also investigate the channels through which maternal education transmits to child outcomes. However, our set of mother and child time usage is more detailed than either of those studies. Also,

their relevant margin of education for the mother also is going to college as opposed to any schooling in our data.

Section 3:

Data Description

This paper uses a unique dataset on children from 112 villages in 3 districts of Punjab – which is home to 56% of Pakistan's population. The Learning and Educational Achievement in Punjab Schools (LEAPS) project was jointly undertaken by the World Bank, Pomona College and Harvard University in collaboration with the Government of Punjab. The study follows a panel of roughly 1800 households from 2003-2005. The estimation in the present paper exploit the cross-section from 2003. The sample villages are drawn from three districts – Attock, Faisalabad and Rahim Yar Khan. The 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. [4] The LEAPS survey also collected detailed parental and child time-use data. The sample size in the survey was 1844 mothers and their children aged 5-15 in these households.[5] Table 1 provides the summary statistics for the variables used in the analysis. Distributions and more detailed breakdowns are presented in the figures.

Mothers

76% of the mothers report not having gone to school at all and the mean years of their education is 1.34 and less than 10% go beyond the fifth grade. Detailed parental time use questions were asked of mothers. We focus on three categories—housework, paid work and time spent "looking after/helping children with studies". Both housework and paid work were further divided into sub-categories. Housework is the most important categories as far as time is concerned. Paid work is a key variable in discussing trade-offs with time spent at home and also in discussions of female autonomy in household

[4] These villages are bigger and richer than average villages in these districts. However, it should be noted that about a third of the children in rural Punjab live in a village with a private school. See Andrabi, Das, Khwaja (2008) for more details on private schools in Pakistan.

[5] We describe in detail further on that the birth village information was not available for all the mothers so the summary statistics are provided for the matched sample of 1561 mothers.

bargaining models. Time spent helping with children's studies is the time dimension most relevant to our study.[6] Other categories were minor as far as time usage is concerned. The exception is the category for time spent on children's daily needs. On detailed questioning by the field surveyors from the mothers, maternal response was that unlike time spent on studying which is a well defined activity, time spent on children in the day is typically lumped together with housework and is confounded by many in the "other" sub-category of housework.[7]

Figure 1 provides the kernel density of the three categories. House work is the highest time usage in all the activities. Women in these household spend on the average 9.3 hours a day in house work. A quarter of them do it for more than 12 hours a day and 10% for more than 14 hours. The 25th percentile of the distribution is seven hours. Paid work, in comparison is little. While the mean minutes worked are 31 minutes per day, only 9.7% of the women report doing any paid work. Time spent on children's studies averages a mere five minutes a day and fewer than six percent of the mothers say they help their children in school work at all.

Figures 2, 3, and 4 provide some further breakdowns by education levels. Educated women do a little more house work (580 minutes vs. 551 minutes) and a little less paid work (27 minutes versus 32 minutes). This finding is greatly in contrast with the developed world, as mentioned in the literature review, where one of the research questions has been to assess the trade-off in the finding that more educated mothers work more. Uneducated mothers spend virtually no time (< 1 minute per day) helping their children in studies while educated mothers spend 20 minutes per day. 22% of educated mothers say they spent any time helping the children in their studies and the number rounds off to zero percent for the uneducated ones.

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[6] The full list of categories is: Sleeping/Rest, Housework, Paid Work, Looking after Children, Looking after children's studies, Shopping, Sickness, Child Studies, Media Entertainment, Other Entertainment, Prayer/Religious, Other. House work and paid work are further broken down into detailed sub-categories.

[7] We do our housework regressions both with and without this measure but it doesn't change any results. The housework numbers reported do not include this measure.

Figure 3 breaks down house work into sub categories. The "other" is a residual category that includes tasks that are harder to define. The large time in this category for both educated and uneducated mothers (161 minutes for educated and 143 for uneducated) reflects the fluidity of a typical mother's day in the rural developing country. Cooking is the single largest category with educated mothers spending more time (256 minutes) on it than uneducated ones (221 minutes).

Educated mothers, however, do less unpaid farm work and tend less to livestock than uneducated ones. From the point of view of influencing children's effort in school work, it might be misleading to include in house work, tasks done outside the house. Equivalently, there might be some paid work that is being done within the boundaries of the home. The next figure divides task done inside the house from those done outside. Mainly, farm work, livestock and unpaid outside non agricultural work are added to work done outside the house and household paid production (a minor time usage on average) is added to paid work done inside. It doesn't change the pattern very much. The finding therefore that educated women do more housework is robust to different specifications.

Children

The sample size is children aged 5-15 in these households. The mean age for a child is 10 years and 47% of the sample is female. Enrollment statistics one generation later are much improved. The overall child enrollment is 66%. Given the private school revolution in rural Pakistan, 70% of the children go to public schools. We look at four categories of child time. Time spent on studies includes preparation for school, doing homework and after school tutorials. Play time is defined as unstructured, not explicitly monitored, leisure time. Paid work and housework follow the usual definitions. Play is the largest component of the household day for the children averaging 167 minutes, followed by study time which comes in at 115 minutes per day for all children. Restricted to enrolled children only, average study time goes up to 150 minutes per day. House work and paid work come in further down in time usage averaging 56 and 12 minutes respectively. This is important to keep in mind as the child's play time can pick up the "slack" over any

changes in enrollment or time spent in school work. Even enrolled kids have play time of more than 150 minutes per day.

Enrollment, school choice and time usage patterns are quite influenced by age in rural areas. Figures 5 and 6 break down child variables by gender and age. As is well known, Girls enrollment is lower than boys and both show a familiar hump shaped pattern seen in many developing countries. Enrollment for both boys and girls peaks at around 10 years of age. Girls, however, show a much sharper drop after age 10 and enrollment at age 15 less than half of that at age 10. A gender gap in enrollment still exists on the average with boys at 73% and girls at 57%. School choice between public and private shows a similar pattern up to age 10 but then girls public school enrollment drops sharply. Detailed analysis of enrollment and choice is beyond the purview of the paper, but out companion work, Andrabi, et. al (2009) discusses this pattern in more detail.

Child time breakup also shows some interesting patterns. Girls do more housework than boys on the average. However, until ages 9-10, the housework trajectory moves slowly upward for both boys and girls and is quite similar but past that age, girls' enrollment drops and housework increases dramatically. Play time falls with age and the slopes for both boys and girls are quite similar. Older girls after the age of 10 substitute play with housework while boys are doing a bit more paid work as they get older. Study time increases with age and the pattern is similar for both boys and girls.

There are four things to take away from the above. First, in spite of other activities, there is considerable play time for girls and boys. Secondly, the child study time numbers combined with the low numbers for involvement in child study time for mothers suggest that mothers even when not directly involved in a child's home studying are definitely creating a space for these children to be able to focus on their work. The issue of large amounts of time spent at home doing housework is important to note here. Third, the issue of increasingly large amounts of house work for teenaged, un-enrolled girls demands a separate, more focused explanation outside the scope of this paper. Finally,

paid work does go up with age for boys but its magnitude is considerably smaller than both play and home studying. Kids are both idle and studying.

We have taken a broad descriptive sweep of the home work, leisure and learning environment in this section. For the rest of the paper, we ask a narrower question. Is this environment significantly different in households with educated mothers? We spend some time discussing the question of endogeneity of the mother's education and then estimate a causal impact on the outcomes and channels discussed above.

Section 4:

Econometric Specification and Identification strategy

We need variation in a mother's education that is exogenous to her ability to identify the causal effect of her education on child outcomes and on her own time usage and activities within the household. Our instrumentation strategy follows an established literature first proposed by Card (1999) to look at whether a mother had access to a school in her *birth* village at the time of her enrollment decision. 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 get the year of formation of schools in all villages in Pakistan.

There were some issues with matching mother's birth village to the population census and schooling data bases. About 15 percent (283 out of 1844) of the mothers remain unmatched because their birth villages were not identifiable in the census directory. The unmatched villages result primarily due to two reasons. First, the English spelling of the village name can be misspelled and therefore all attempts at matching it to the census directory fail. Secondly, some mothers give their village name as a residential location

that is smaller than the official census village designation.[8] However, we think that this matching problem is random and not systematically tied to any particular village characteristics. Table 2 provides the means for some characteristics for the matched and the unmatched sample. For all the variables, the differences are small. Only age differences are significant at the 10% level but they too are small (.83 years for mother and .2 years for children). In the matched sample, our mothers are split roughly 50-50 between those living in the same village they were born in and those born outside the current village. The full sample has 56% of mothers born outside the village.

Our sampling strategy constrains us considerably as all the sample villages (by construction of the sample) have schools present currently. Fortunately, two important institutional aspects of the educational setting in Pakistan help us achieve identification. First, Pakistan does not have universal school coverage in the rural areas. Village coverage has been steadily increasing over the last thirty five years. Moreover, construction ramped as a result of the Government of Pakistan's sixth five year plan in the early 1980s. Therefore, we get part of the identification from mothers who have a different birth village (approximately 50% of the mothers in the sample) than the current village. But, because of school construction over time, we also have women of differing ages living in the same village that they were born in who have had differential access to schooling at the time of their enrollment decision.

Secondly, as a matter of policy, the Government of Punjab 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 and therefore allow us to get more within current village variation in the data.

Our econometric specification for the first stage is as follows.

[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!

$$MotherEducated = \beta_1 + \beta_2 GirlsSchoolPresent + \beta_3 AGE + \beta_4 BirthTehsil + + \varepsilon \quad (1)$$

We use an age cutoff of 7 years for a mother to be classified as one with a girls' school present. Government of Pakistan uses six years as its normal school starting age but there is considerable delayed enrollment so seven years is more reasonable. One cannot pick too high an age cutoff, as stated earlier, the enrollment window for girls in rural Pakistan is quite short. Our results are robust to small variations in the specific cutoff and having an age cutoff up to 9 years does not change the results significantly.

The expansion in school construction over the last three decades implies that younger mothers would systematically be more exposed to a school when they were of school starting age. Since other changes in the environment affecting enrollment were taking place over time, age should be controlled for directly as well in our first stage for our instrument to have validity. We therefore put in a complete set of mother age indicator variables. We control for the tehsil of birth fixed effects. The tehsil is an administrative unit one level below the district, equivalent roughly in size to a US county. For information, the province of Punjab has 34 districts and104 tehsils in the latest (1998) census. As roughly 50% of our mothers were born in a different village, we have 72 different tehsil fixed effect dummy variables. Given the sample size, going one level down to the village for fixed effects would leave us with very little within village variation.

This is a reasonably demanding econometric specification and we believe that any residual variation left over in a mother's educational outcome is not systematically related to her unobservable characteristics. The results of the first stage are given in Table 3. We only report the result on the school present variable. The first column uses mother's years of education as a dependent variable. The next three columns use the binary variable whether a mother is educated as the dependent variable. The binary variable is the one we use for our second stage regressions as the relevant margin is whether a mother is educated at all. In any case, we have run all our regressions with the

continuous variable and all our results go through. Columns 2, 3, and 4 run the regression at mother level, the enrolled child level and all children level to match the different levels of second stage regressions. Column (1) shows that having a girls school in the birth village increases a mother's years of education by .55 years. Given that the average years of education is 1.4, this is a large increase. Columns (2), (3) and (4) show that the having a girls school in the birth village increases the likelihood of a mother being educated by 10.44, 12.19 and 10.95 points respectively. The increased probability is both statistically significant and of a large magnitude as the average likelihood of these mothers being educated is.24. The instrument is not weak as the F-statistic are 14.07, 13.67 and 14.55 in the three specifications we use in the second stage

Even though controls for mother's age and tehsil fixed effects should in principle take care of the exclusion restriction, we can argue more against the point that there still exists residual variation correlated with certain unobservable characteristics. We present some falsification tests in Table 4 that we believe show the validity of the instrument.

The first validity test divides villages into three categories—those that got a girls school by age 7, those that got between the ages of 8-15 and those that got them after age 15 or never got one. Given the enrollment drops that one sees once girls go past the age of 10 seen in our data, the instrument validity should mean that getting a school after the relevant age should not have any effect on enrollment. Column (1) shows that the mother born in a village that got the school by age seven is 8.8 percentage points more likely to attend than one that got the school in ages 8-15. This difference is statistically significant at the 1% level. The difference between mothers born in villages that got after age 15 and between ages 8-15 is statistically insignificant. An associated test, shown in column (2), drops those observations where girls got a school by age 7 and compares those who got between ages 8-15 versus those that got it after they had crossed 15 years. The difference (-.0388) in these two categories is small and insignificant.

The second test reflects the segregated nature of girls school provision in the province of Punjab. If one thinks that unobservable village level political economy or some other

factors that brought a girls school to the village could also affect girls' education through other means than the presence of a school, then our instrument would be invalid. Since the process of setting up boys schools could follow a similar but independent process of setting up, then at least some of the same factors that (and possibly can affect girls education) lead to creation of a girls school, should also be present in villages with boys schools. Column (2) of Table 4 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 (-.0505) and not significantly different from zero.

Results

In the second stage, we will be looking at child's time usage in various activities including studying and other education related activities in the house and enrollment and school choice decisions. For the mother we look at mother's time usage in paid work, housework and in helping her children in studies, as well as her responsibility in educational decision making.

The outcome regressions are as follows.

$$MotherOutcomes = \gamma_0 + \gamma_1 MotherEducated + \gamma_2 AGE + \gamma_3 BirthTehsil + \xi \quad (2a)$$

Equation (2a) is a mother level equation. The variable *MotherEducated* is instrumented using the first stage regression (1) and is run as 2SLS. *SchoolPresent* is the excluded variable from equation 2a. *Age* and *BirthLocality* are the same variables as in the first stage and are in the second stage regression because of their potential direct effect on the child level outcomes.

Equation (2b) is run at the child level and adds a fullest of indicator variables for child age and a dummy variable for child gender to the right hand side. The child specific variables are subscripted. As the system is run as 2SLS so the child related controls are also added to the first stage regression.

$$ChildOutcomes =$$

$$\alpha_0 + \alpha_1 MotherEducated + \alpha_2 AGE + \alpha_3 BirthTehsil + \alpha_4 AGEc + \alpha_5 FEMALEc + \upsilon \quad (2b)$$

We first examine school enrollment and school choice results, followed by mother's time use, then child's time use and test scores. Columns (1) and (2) in Table 5 presents the OLS and IV results on enrollment; Columns (3) and (4) similarly do so for school choice. Columns (5) and (6) and (7) and (8) look at whether the mother was responsible for school choice and school enrollment. The mother responsibility questions were asked of enrolled children only. In the OLS regressions, children of educated mothers are 17 percentage points more likely to be enrolled and 19 percentage points less likely to be in a public (vs. private) school. In the IV specifications, the results completely disappear. The coefficient on the enrollment result falls to .01 and on enrollment to .04. The standard errors increase as well. Similar results are reported in the literature, e.g. Black, et. al (2007) where, controlling for selection, the effect of parental education falls dramatically pointing to selection into maternal education. .

In our case, the outcome results are consistent with the decision making results. In both the OLS and IV regressions on whether the mother is the person principally responsible for the enrollment and school choice decision. Mother's education does not matter. In both these cases (columns 5-8), the coefficients in the OLS are small and insignificant and the coefficients in the IV are not much different from those in the OLS; they are also small and with large standard errors.

On mother's time usage, we had looked at house work in different ways. For the regressions, we examine the effect of maternal education on work done inside the house, work done outside the house, paid work, and time spent with child on helping with study. The OLS results on work done inside the house and done outside the house are similar to the sample means presented earlier. Educated mother do 52 more minutes of work inside and 47 minutes less outside the house. Both of these differences are significant at the 1% level. In the IV specification, the magnitudes of the coefficients fall to 29.6 and -38.9 respectively. The estimates moreover become more imprecise as standard errors increase.

On the paid work front, the IV coefficient jumps up to 51.07 from -.32 but once again, due to large standard errors, the estimate is not significantly different from zero. On mother's time helping the child both the OLS and IV have similar magnitudes 19.5 and 18.5 minutes more time spent. But the standard errors increase so that the significant OLS difference does not remain so in the IV specification.

Thus on mother's time one is left to conclude that difference between educated mothers and uneducated ones on the time dimension are too imprecisely measured to make any fine statements. The differences on housework even though not significant are still small (29 minutes) compared to the sample average of 560 minutes. These results have interesting similarity to the recent findings on US historical data in Ramey (2008) who finds very little change in women's housework time over the last century. The results are in the same vein as Behrman and Rosenzweig's (1999) work on the importance of mothers in home schooling children. In the developed country literature, the main tradeoff for mother's education in terms of time spent with a child in school work comes with the increased labor force participation that education generates. In this context, the tradeoff does not exist as there is little change in hours worked inside the house. Of course, the other side of the tradeoff, higher income earned, is also not present in this case. However, as noted, the increase in time spent by the mother in child studies—18 minutes-- is not that large and too imprecisely measured.

In addition to the mother's time use, we also collected data on children's time use. Time use questions were asked of all kids in the household. Table 7 presents child time spent on study time as well as play time, housework and paid work. The most remarkable finding in this paper is the extra time spent on education related work by enrolled children of educated mothers. The OLS results had an increase of 17.8 minutes per day. The IV estimate for enrolled kids is 73.6 more minutes per enrolled child per day. While the standard errors do increase, the result is still significant at the 10 level. The increase in the IV coefficients is noted by many observers using such an instrumental variable strategy. Card (1999) provides a justification; those that are affected by the instrument,

the compliers, are the ones who would not have gone to school in the absence of the instrument.

Play time, paid work and housework time for children do not significantly change with mother's education. Play time is smaller by 39 minutes in the IV specification but is imprecisely estimated so is not significant. The same goes for paid work. In both play and paid work, the point estimate in the IV is larger than the OLS but so are the standard errors. The house work differences are small in the IV (2 more minutes) and insignificant.

The child time usage has shown one striking result—that of children of educated mothers increasing their study time by 73.8 more minutes. This is equivalent to moving a child from the 25th percentile in the study time distribution to the 75th percentile. The result becomes important if it translates into greater learning gains for these kids as well. We now turn to test scores to do precisely that.

Test Scores and Mother's Education

Children in all the schools in the sample villages were tested in English, Urdu and Mathematics. We use IRT test scores in all three subjects as an outcome variable. The tests were scored by the authors using Item Response Theory so that the scale has cardinal meaning. [9] In the previous specifications, we focused on child and maternal outcomes that were collected through the household survey in the same instrument that collected maternal education and the birth village of the mother. In contrast, our data on cognitive outcomes is observed only in tests administered at the school. We manually matched the children who were tested in the school to children in our household survey, eventually yielding a sample of 716 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

[9] Preserving cardinality is important for longitudinal analysis since many other transformations, such as the percent correct score or percentile rank, are bounded artificially by the transformations that describe them. By comparison, 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.

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 without missing data may be biased if such selection is not accounted for.

Following Angrist (1996), 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 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 by using pair-wise differences in for two children (in our case) for which 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 itself can help in identification and the efficiency of the estimator. Following a large 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 enrolment, 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 8. Columns 1-3 present specifications based on the Heckman correction while Columns 4-6 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 mother's with some education reporting test-scores at the end of Grade III that are 0.31 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 0.22 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 4-6). The non-parametric approach yields almost identical coefficients.

The learning impact of mother's education is comparable and indeed in many cases greater than the impacts of widely reported experimental interventions. The language effects in our sample are greater than the language effects in the Balsakhi and the CAL program reported in Banerjee, et. al (2007). The Math score is comparable to the learning –incentives experiment in multi-subjects reported in Kremer, et. al (2003).

While effort and test scores are both endogenous variables, still a positive correlation between them would be suggestive of a direct link. Increasing child study time by one hour increases the language test scores .08 of a standard deviation.

Section 5: Conclusions

This is the second of two papers looking at the effect of female education on education in a context where labor markets for women are severely under-developed, transportation costs are high, and education levels for women are low. In the first paper (Andrabi, Das, Khwaja, 2007), we showed that the combination of these factors implies that the supply of schooling at the very local village level is upwards sloping and therefore investments in secondary education for women leads to a greater supply of teachers, and consequently, a larger supply of private schools. This established an intergenerational linkage for female education in secondary schooling through the supply curve. Consistent with results from the United States, the results also suggested the presence of a significant subsidy to education as a result of the under-developed market for women's labor.

Here, we used the same environmental context to look at whether under-developed female labor markets also affected outcomes at home. Again, consistent with findings from the literature, we find that they do. However, our channels are very different from those proposed previously. While we confirm Behrman and Rosenzweig's intuition that in low-income countries education for women does not lead to more work-hours, we are also able to show that the additional time that mothers spend with children as a result of more education is quantitatively small. Where mother's education really seems to matter

is in the time that their children spend on educational activities outside school; our IV estimates suggest that this is as much as 73 minutes more for every enrolled child. Test scores of children of educated mothers go up significantly. The extra effort pays off.

In our mind, this changes the way we think about the trade-off defined in the literature between the income effects from paid-work and the payoffs from direct time spent with children. The way the literature has posited this trade-off is that work outside the home results in a direct decline in time with children, leading to worse cognitive outcomes in the long-run. In the low-income country context that we are looking at, mothers spend all their day trying to keep the house running and food on the table; there is little slack in the daily routine for spending quality time with children. An educated mother asks the child to sit in the kitchen and study while she is cooking; a mother without any schooling does not.

The low educational achievement of mothers in our sample (as measured by years of education) does not lead to more enrollment or 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. This is not surprising as one cannot reasonably expect such low levels of education leading to higher bargaining power in the household or more control over decision making. Ironically, the very same low educational achievement mothers have has a greater effect on learning, an outcome that on the surface is much harder to improve. Mothers do not need to be at an advanced cognitive level to have their children study. Perhaps, by spending some years in school, mothers learnt 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 emphasize the role of parental-child interaction and child effort in studying as an important channel in improving learning. We cannot determine whether this extra motivation is intrinsic or generated through extrinsic means such as pecuniary incentives. This raises two questions: What is the trade-off between maternal presence

and child effort? Are there models of delegation that could mitigate the trade-off, if there indeed is one?

There are two broad depictions of the world that these results are consistent with. One model is that educated mothers are more efficient at creating a conducive atmosphere for learning, and that maternal presence is critical for child effort. The second is a learning-by-doing model. In this model, maternal presence need not be required—the mother can be working on other things, or could delegate with appropriate instructions.

If, in the low-income country context that we look at, the presence-effort tradeoff is absent *or* there are effective models of delegation, increasing labor force participation for women may lead to a very different set of outcomes than those seen in high-income countries. The income effect is potentially large, and the downside in child investments could be smaller. Alternatively, if maternal presence is still important, there is a strong case to be made for modes of production where mothers enjoy the flexibility of working from home.

There are a couple of issues with our results that limit the validity of our conclusions; these would require further exploration. The first is that, like with all IV estimates, we are presenting 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. The second problem is that our reduced form specifications do not account for sorting in the marriage market. If female education allows them 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. To our knowledge, this problem remains unsolved. These problems could be alleviated through an experimental approach, where mothers are given (remunerated) tasks to be performed at home or outside and the impact on child-effort is evaluated.

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Tables and Figures

Table 1
Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Mother					
Age (Years)	1561	37.78411	7.576543	18	66
Education (Years)	1561	1.34337	2.75215	0	20
Educated (Fraction)	1561	0.236387	0.424999	0	1
Mother Time (Minutes/Day)					
House Work	1496	560.2574	233.3967	0	960
Paid Work	1491	31.04963	104.1636	0	540
Paid Work (Y/N?)	1491	0.097921	0.297307	0	1
Help with Study	1515	4.930693	22.45306	0	180
Help With Study (Y/N)	1515	0.055446	0.228923	0	1
Work Outside The House	1490	88.31879	136.1532	0	600
Work Inside The House	1492	484.008	233.2999	0	960
Child					
Age (Years)	4717	9.921984	2.948069	5	15
Female (Fraction)	4717	0.473818	0.499367	0	1
Enrolled	4606	.6508369	.4767573	0	1
Public School (if enrolled)	3503	0.706537	0.455414	0	1
Child Time (Minutes/Day)					
Study	4614	115.1658	87.42976	0	360
Paid Work	4623	11.95003	76.55237	0	660
House Work	4599	56.83736	138.9967	0	720
Play	4495	167.3293	150.406	0	600

Source: The LEAPS Data Set, 2003, www.leapsproject.org

Table 2
Matching Statistics

	Matched Mothers	Unmatched Mothers	Difff
	(Mean)	(Mean)	
Mother Age	37.78	38.65	0.834462*
			(0.504)
Mother Education (years)	1.34	1.43	-0.084
			(0.181)
Mother Educated (Y/N?)	0.236	0.2444	-0.007
			0.028)
Child Age (Years)	9.92	9.72	0.206*
			(0.115)
Child Female	0.474	0.495	-0.021
			(0.018)
Child Enrolled	0.762	0.768	-0.007
			(0.015)
Child Public	0.706	0.689	0.017
			(0.02)

Standard Errors in parentheses; * reflects difference significant at 10% level.

Table 3
First Stage Regression
Mother's Education

	(1)	(2)	(3)	(4)
	Mother's years of education	**Mother Educated?**	**Mother Educated?**	**Mother Educated?**
Girls School Present in Birth Village by Age 7	0.5584	0.1044	0.1219	0.1093
	(0.1702)***	(0.0278)***	(0.0330)***	(0.0286)***
Observations	1561	1561	3518	4739
R-squared	0.16	0.17	0.18	0.17
F test: schoolpresent7=0	10.76	14.07	13.67	14.55
Prob > F	0.001	0.000	0.000	0.000

Robust standard errors in parentheses, clustered at the village level

* significant at 10%; ** significant at 5%; *** significant at 1%

All regressions control for a full set of mother's age indicator variables and fixed effects for mother's birth tehsil (county).

Regressions 1 and 2 are at the mother level. Regression 3 is at the enrolled kids level and Regression 4 is for all kids.

Table 4
First Stage Regression
Mother's Education
Falsification Tests

	(1)	(2)	(3)
	Mother Educated?	**Mother Educated?**	**Mother Educated?**
Girls School Present in Birth Village by Age 7	0.0884		
	(0.0308)***		
Girls School Present in Birth Village Ages 8-15	-0.0434	-0.0388	
	(0.0321)	(0.0341)	
Boys School Present in Birth Village by Age 7			-0.0575
			(0.0363)
Observations	1561	703	1564
R-squared	0.17	0.19	0.17

Robust standard errors in parentheses, clustered at the village level

* significant at 10%; ** significant at 5%; *** significant at 1%

All regressions control for a full set of mother's age indicator variables and fixed effects for mother's birth tehsil (county).

The missing category in Equations (1) and (2) is girls school present after age 15 or never present in the birth village. Equation (2) looks at mothers who did not have a girls school by age 7.

Table 5
School Choice and Enrollment
Mother's Role in Decision making

	(1)	(2)	(3)	(4)
	Child Enrolled	**Child Enrolled**	**Child in public school, if enrolled**	**Child in public school, if enrolled**
	OLS	IV	OLS	IV
Mother Educated?	0.1720	0.0117	-0.1904	0.0401
	(0.0169)***	(0.1622)	(0.0306)***	(0.3031)
Observations	4606	4606	3503	3503
R-squared	0.20	0.18	0.12	0.08

	(5)	(6)	(7)	(8)
	Was Mom responsible for school choice?	**Was mom responsible for school choice?**	**Was mom responsible for child being in school?**	**Was mom responsible for child being in school?**
	OLS	IV	OLS	IV
Mother Educated?	0.0196	0.0694	0.0190	-0.0220
	(0.0192)	(0.1389)	(0.0259)	(0.1611)
Observations	3579	3579	3579	3579
R-squared	0.11	0.11	0.14	0.13

Robust standard errors in parentheses, clustered at the village level

* significant at 10%; ** significant at 5%; *** significant at 1%

All regressions control for a full set of mother's and child age indicator variables, child gender and fixed effects for mother's birth tehsil (county).

Table 6
Mother's Time Use

	(1)	(2)	(3)	(4)
	Work Inside the House		Work Outside the House_Paid and Unpaid	
	OLS	IV	OLS	OLS
Mother Educated?	52.4106	29.6152	-47.0499	-38.9160
	(14.7442)***	(122.1014)	(7.5394)***	(90.8761)
Observations	1492	1492	1490	1490
R-squared	0.22	0.22	0.13	0.13

	(5)	(6)	(7)	(8)
	Paid Work		Helping Child Study	
	IV	IV	OLS	IV
Mother Educated?	-0.3265	51.0709	19.4754	18.5475
	(6.9169)	(67.2966)	(2.4284)***	(13.3838)
Observations	1491	1491	1515	1515
R-squared	0.12	0.08	0.21	0.21

Robust standard errors in parentheses, clustered at the village level

* significant at 10%; ** significant at 5%; *** significant at 1%

All regressions control for a full set of mother's age indicator variables and fixed effects for mother's birth tehsil (county). The IV specification uses Girls School Present in Mother's Birth Village by Age 7 as an instrument.

Table 7
Child Time Use

	(1)	(2)	(3)	(4)
	Study (Enrolled Kids Only)		Play	
	OLS	IV	OLS	IV
Mother Educated?	17.8171	73.5868	-27.4476	-39.0109
	(4.1472)***	(39.3143)*	(5.7943)***	(67.7669)
Observations	3419	3419	4495	4495
R-squared	0.17	0.06	0.25	0.25

	(5)	(6)	(7)	(8)
	House Work		Paid Work	
	OLS	IV	OLS	IV
Mother Educated?	-27.9278	2.0546	-10.0621	-22.4717
	(4.1939)***	(40.1409)	(2.1331)***	(25.1071)
Observations	4599	4599	4623	4623
R-squared	0.28	0.27	0.07	0.07

Robust standard errors in parentheses, clustered at the village level

* significant at 10%; ** significant at 5%; *** significant at 1%

All regressions control for a full set of mother's and child age indicator variables, child gender and fixed effects for mother's birth tehsil (county). Mother's Educated instrumented in the IV regressions with girls' school present in birth village by age 7.

Table 8

Test Scores

	(1)	(2)	(3)	(4)	(5)	(6)
	Test Scores: English Heckman	**Test Scores: Urdu Heckman**	**Test Scores: Math Heckman**	**Test Scores: English Control Function**	**Test Scores: Urdu Control Function**	**Test Scores: Math Control Function**
Mother Educated?	0.3185	0.3158	0.2220	0.3162	0.3135	0.2207
	(0.0851)***	(0.0851)***	(0.0931)**	(0.1074)***	(0.1050)***	(0.1158)*
Observations	4595	4595	4595	716	716	716
Prob > chi(2)	0.00	0.00	0.00			
Adj R-sq				0.09	0.05	0.05

Figure 1

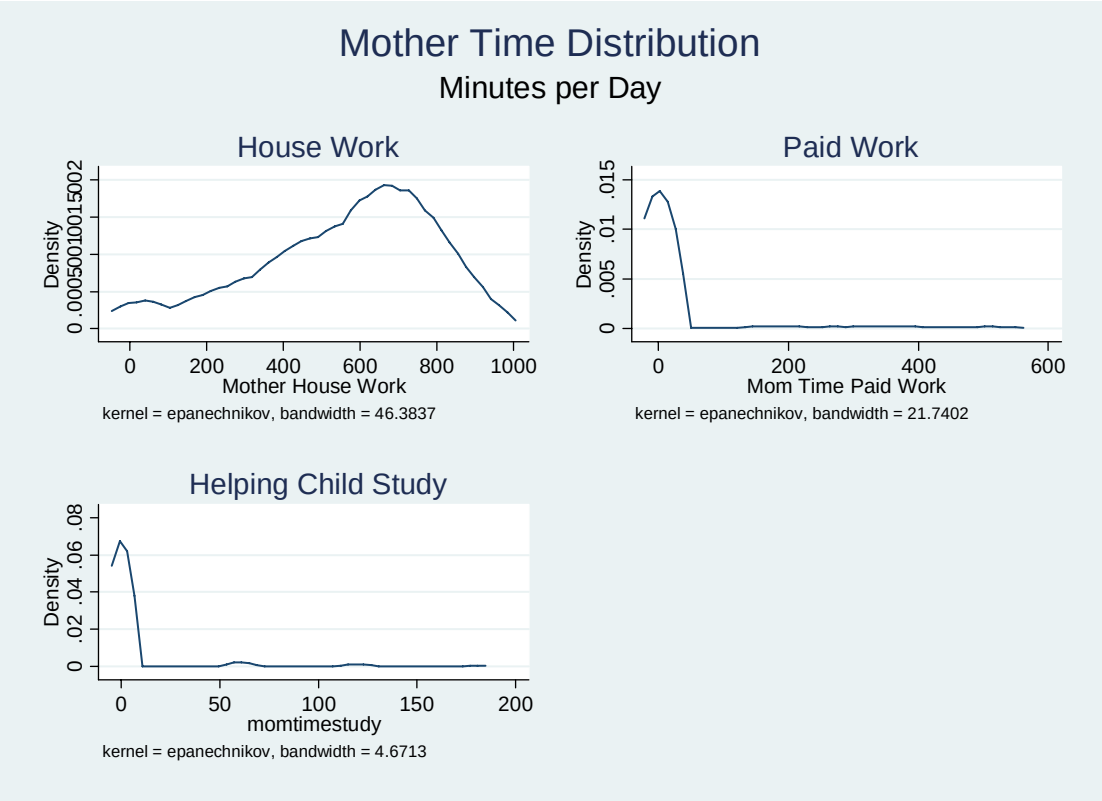

Figure 2

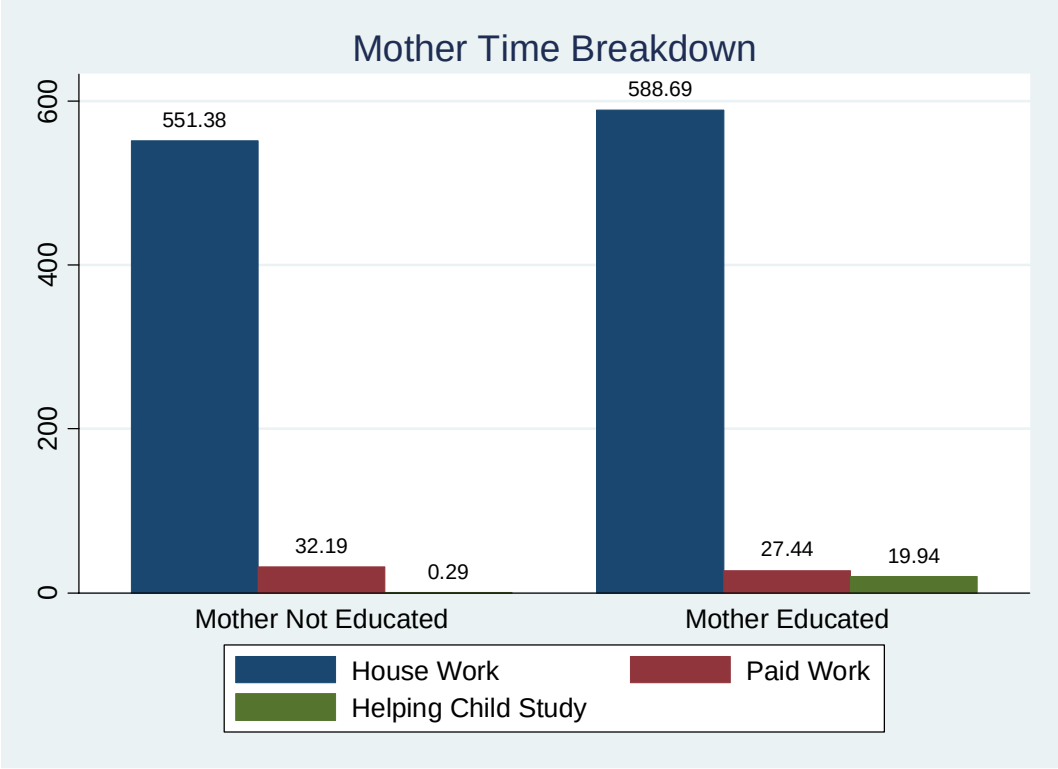

Figure 3

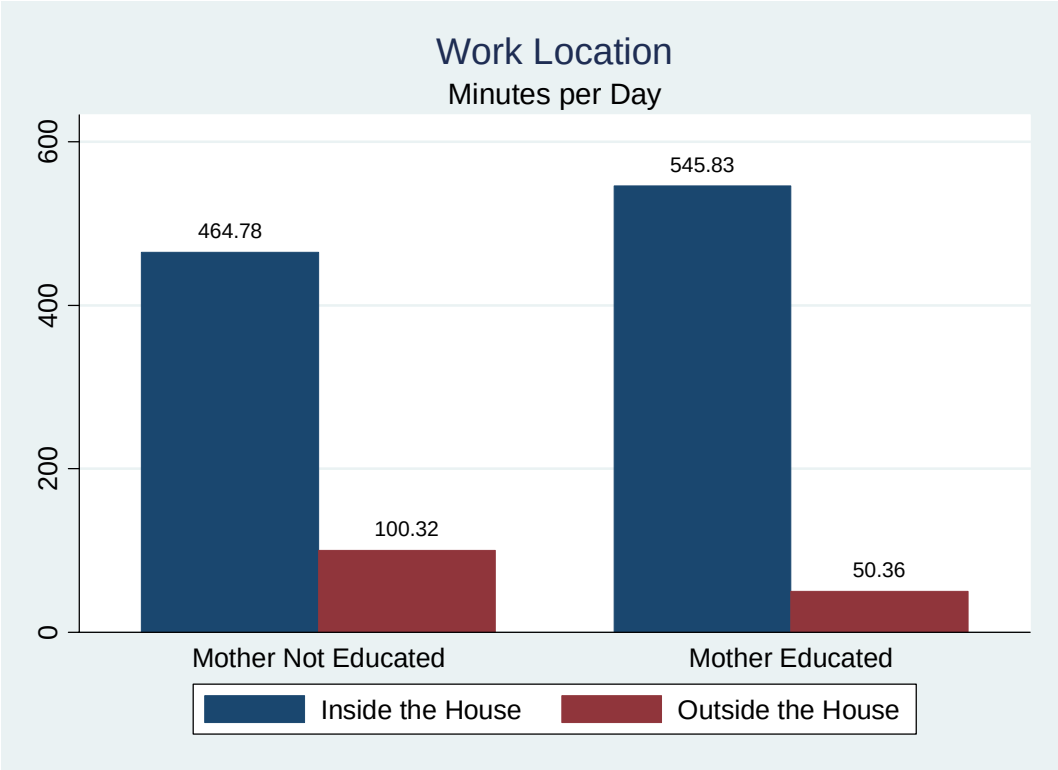

Figure 4

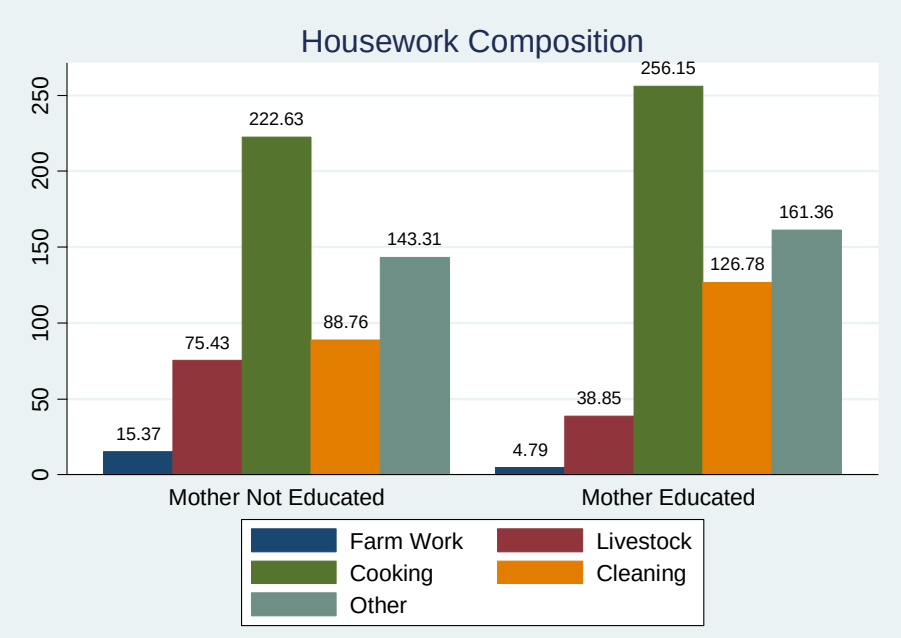

Figure 5

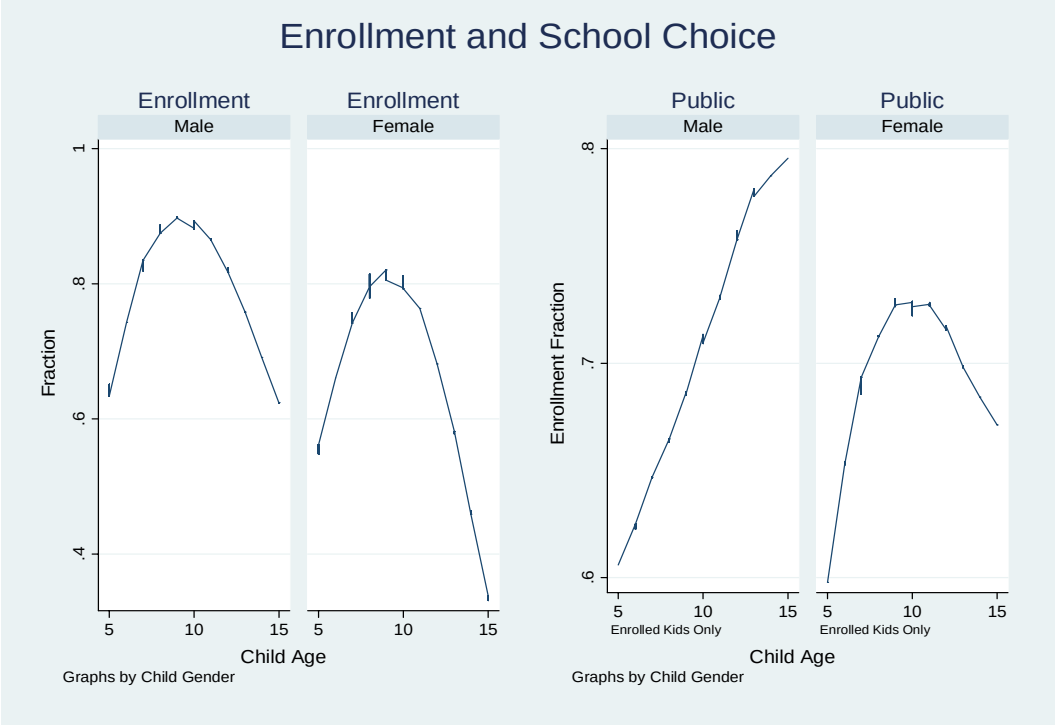

Figure 6