Gender-differences in learning outcomes: evidence from Pakistan

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Author's Declaration

I, the undersigned, Saheem Khizar, hereby declare that I am the sole author of this thesis. To the best of my knowledge this thesis contains no material previously published by any other person except where due acknowledgement has been made. This thesis contains no material which has been accepted as part of the requirements of any other academic degree or non-degree program, in English or in any other language. This is a true copy of the thesis, including final revisions.

Saheem Khizar
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Abstract

This paper examines the socio-cultural constraints that play a role in widening gender-based learning gaps in Pakistan. The paper provides evidence that these learning differences are not uniform across age. We find no evidence of the difference in learning across genders at the early age of child. However, as they grow, the gender-based learning gap increases. The paper uses a countrywide dataset on children's learning level. It conducts an empirical analysis of different socio-economic and cultural factors including household wealth, household size, parental education level, school enrollment to study its gender-specific effects on the learning levels of children. The paper proposes a set of possible policy solutions that can help improve gender-based learning differences in Pakistan and other developing countries facing similar challenges of quality education and school enrollment.

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Introduction

The importance of school education cannot be emphasized more. If imparted correctly, it is one of the most effective ways to bring people out of their inter-generational poverty trap. Recognizing its importance, United Nations Educational, Scientific and Cultural Organization has declared education to be a basic human right ("Education as Global Public Good" 2016). The world leaders from around the world gathered at the United Nations' Headquarters in New York in September 2000 to unanimously pass a set of eight Millennium Development Goals (MDGs). The MDG 2 was about achieving universal primary education around the globe by 2015 ("Millennium Summit (6-8 September 2000)"). Although MDGs helped built a momentum towards achieving the universal primary education by the target date of 2015, however, we stayed far from achieving our goal. There are still over 265 million children worldwide that are out of school. Given that the world could not achieve its target of MDGs, the world leader met once again to pass a set of 17 Sustainable Development Goals (SDGs). Once again they promised to provide free and quality education to boys and girls around the world as set out by the SDG 4 ("Quality Education Why It Matters" 2018).

Pakistan as a signatory to these international commitments has a responsibility to ensure that it provides equal access to the means of quality education to all school-aged children in the country. To fulfil its international commitments, Pakistan as a country also recognizes education to be a basic human right of each school-aged child. In 2010, article 25-A, the right to education (RTE), was made part of the constitution of Pakistan which declared free and compulsory education to be a legal right of all children from age 5 to 16 ("Article: 25A Right to Education" 2010).

However, the current state of educational affairs in Pakistan is worrying. According to the "Pakistan Education Statistics 2016-17" (2018) report, out of the 51.53 million school-aged children in Pakistan who are between the age of 5 to 16, about 22.8 million are still out of school. Of these 22.8 million out of school children in Pakistan, 12.16 million of these are girls whereas

10.68 million are boys. The report also highlights that the Gender Parity Index (GPI) based on Gross Enrollment Ratio (GER) for primary education is 0.87 which means that there are only 87 enrolled girls in primary school for every 100 boys. This ratio, as reported by the "Pakistan Education Statistics 2016-17" (2018) report, is worse for the regions of Balochistan and Federally Administered Tribal Areas (FATA) at 0.61 and 0.56 respectively. Rest of the regions across Pakistan are doing comparatively better. The report mentions socio-cultural constraints of the tribal regions of Balochistan and FATA to be the deterrent of girls' enrollment in schools ("Pakistan Education Statistics 2016-17" (2018)).

If we move forward ahead of school enrollment to have a look at statistics on children's learning levels in the country, the story becomes much worse. Children who are even enrolled in schools are not learning effectively. According to the UN, more than half of the primary and lower secondary age children do not possess a basic level of reading and proficiency in math ("Goal 4: Sustainable Development Knowledge Platform"). The "Annual Status of Education Report (ASER) (2016)" also reports a similar story of learning levels from Pakistan. About 54% children from class 5 are unable to solve a two digit division, whereas about 54% children of the same grade cannot read a simple sentence in English. The situation is very frightening because these are the expected learning levels for children in class 2 whereas only about half of the children from class 5 have achieved it in practice.

Given the important role education can play and that there exists gender-based gaps in Pakistan, this paper conducts an empirical analysis of gender-based learning gaps using a countrywide dataset. The paper helps test the hypothesis that the gender-based learning gaps do not exist towards the early age. We find that during the early age, girls perform equally as good as boys. However, as they grow, the gender-based learning gaps starts becoming bigger. The paper looks into different socio-cultural constraints that play a role in widening these gender-based learning gaps in children. We use regression analysis to control for socio-economic and cultural factors that

might be responsible for a difference in the learning level of girls. Given that we have controlled for socio-economic factors such as household wealth, household size, parental education and the type of school a child is enrolled in and whether a child is taking extra tutoring help, it is expected that the differences in the learning level of girls come due to an increased workload they have to involve in at their households. The rural society of Pakistan is patriarchal in nature where girls have to take up more household responsibilities from a very young age. Our empirical analysis indicates that these gender-based roles where girls are assigned more household chores and a parental preference for investing more resources in boys can be a possible reason for a lower learning level of girls beyond the age of seven. However, we would need richer data to conduct further research in order to establish a more robust causal relationship.

Literature Review

Gender-based learning differences has long been debated by researchers across the world. Researchers such as Davies and Brember (1999) find that boys outperform girls in math but not in English. However, these gender-based learning differences do not exist in early grades. Other studies such as that of Coley (2001) finds that the literacy skills of young girls are higher compared to young boys. Ready et al. (2005) study the learning differences between boys and girls during the kindergartner using a nationally representative dataset of children collected by the Early Childhood Longitudinal Study (ECLS), the U.S. Department of Education. They find that the girls not only enter into kindergartner with a stronger literacy skills compared to boys but they also learn better through the kindergartner year i.e. the learning gap widens between boys and girls towards the end of the kindergarten year. The researchers find that the reason for better learning by girls is mainly their better learning approach – they are more attentive in class and persistent with the assigned tasks compared to boys. The researchers attributes two-third of the learning advantage by girls to their attentiveness in the classroom. Similarly Gambell and Hunter (1999) have studied the gender-based learning differences in children in Canada. They find females to be outperforming boys in reading and writing not just at the elementary level but also at middle and secondary level. The learning gap between boys and girls does not narrow down with age, so by the time boys complete high school, they are disadvantaged in literacy compared to girls. However, given that the socio-cultural background of the U.S. and Canada would be very different from the socio-cultural norms of rural areas of Pakistan, the findings from the above listed studies might not be completely applicable for the rural context of Pakistan.

Alderman et al. (1996) has worked on decomposing the gender gaps in cognitive skills within the children of Pakistan. They find that Pakistan historically has one of the largest gender gaps in education, especially in its rural areas. They also notice substantial intra-country differences in the gender gap. For instance, the girls' enrollment ratio was found relatively higher in the province of

Punjab compared to Sindh. The researchers attribute lack of schools for girls to be the main reason for gender gaps in cognitive skills.

But setting up school alone might not be enough to bridge the gender gaps. Teachers play an important role in the functionality of schools. If teachers are absent from school, then children would be discouraged from coming to schools and even if they attend school while the teacher is absent, it would not be very useful. Ghuman and Lloyd (2010) study gender-inequalities in children using data from government and private primary schools from rural Punjab and Khyber Pakhtunkhwa provinces of Pakistan. They find that teachers are absent more often in government schools compared to private schools. They also find that female government teachers teaching in girls' schools are usually more absent compared to male government teachers teaching in boys' schools. This finding is also found by other researchers such as Andrabi, Das, and Khwaja (2008). Given that the government schools are usually single-sex schools having teachers of the same gender, a higher absence rate of female government teachers mean that girls are affected more compared to boys by teachers' absence.

Another study by Jacoby and Mansuri (2014) also studies the increase in girls' enrollment in Punjab and Sindh during the period from 2001 to 2004. They use a time series panel data collected by Pakistan Rural Household Surveys (PRHS). They find an increase of about eight percentage points in the enrollment of girls aged 5-12. Contrary to the findings of Alderman, et al, (1996), they find that the major contributor in increasing girls' enrollment in schools was the household income, whereas the availability of new schools was just a minor factor. They find that the increase in household income explains about 60% of the increase in girls' enrollment. They use household expenditure data to come up with the measure used for household income. An interesting finding from this paper is that the increase in girls' enrollment takes place as the household income increases but it is conditional upon the availability of at least one primary school within the village i.e. in case there is no school within the village, the increase in household income does not result

in a significant increase in girls' enrollment. Given that the girls' usually face more mobility issues in Pakistan compared to boys, especially in the rural areas, the availability of a girls' school within their own village might work as a necessary condition for an increase in girls' enrollment as their household income increases.

Das, Pandey, and Zajonc (2006) study children's learning level in rural Pakistan. They find huge differences in children's learning based on their household and school characteristics. For instance, they find huge learning-gaps between children of literate and illiterate mothers. Likewise, they also find learning differences between children from poor and rich household. However, they find that the learning-gaps between children from government and private schools are much bigger than the gaps between children from poor and rich households i.e. the type of school a child is enrolled in is a bigger determinant of his/her learning level compared to his/her household's wealth. They determine that the differences between schools are responsible for about 50% differences in children's learning levels. While in India, the authors do not find any learning-differences in children from schools having better or poor infrastructure; in Pakistan, they find a marginal difference in children across schools based on school's infrastructure. However, they find strong association between teachers' absenteeism and children's learning level i.e. more than schools' physical infrastructure, the teachers' attendance and what they do while they are in school matters in determining children's learning level. However, the paper does not look into the effect of school's infrastructure from a gender-perspective given that availability of different facilities at school, such as washroom, can affect boys and girls differently.

To sum the discussion, it appears that there are lots of studies done that explore gender-based learning differences however, many of these studies are conducted in the western countries which has a different socio-cultural context compared to Pakistan. Those gender-based studies that are done so far in Pakistan are either based on very small scale datasets or focus mainly on differences in school enrollment. This paper uses a country-wide dataset on children's learning levels from

Pakistan to study gender-based learning differences. Given that we have a large dataset, we exploit our big sample size by dividing children into two distinct groups: one group of younger children where we do not find any significant gender-based learning difference, and the second group based on the older cohort of children within which we find significant learning differences across boys and girls.

Theory predictions / hypothesis

In the rural areas of Pakistan, communities are generally not very well sensitized about the importance of education. Boys are considered breadwinners of a family. Hence households may give relatively more importance to boys resulting in an allocation of more resources for boys. These socio-cultural norms can induce a difference in the learning level of girls.

Although boys would have a general preference, the fact that they are usually allowed to play outside their homes more often that girls, they may end-up spending more time on playing. On the other hand girls, who generally play within their houses or just nearby, may get more time for studies during their early age when they are not assigned household responsibilities.

In their young age, girls can be helping their elder sisters or mothers with household chores but they are usually not assigned independent responsibilities because they are very young at this point. So girls in this young-age get enough time to spend on their studies. Whereas boys who are socially allowed to go out of their houses, end up spending most of their times outside homes with friends such that they do not spend enough time on studies resulting in their lower learning levels compared to girls of the same age.

However, as children grow beyond the age of seven or eight, they start become physically strong. So around this age, they are usually assigned additional household responsibilities along their studies. In rural areas of Pakistan, social norms dictate higher number of household responsibilities to girls compared to boys due to patriarchal nature of society. Girls can be cleaning the household, cooking for the family, and/or taking care of younger siblings. So they will eventually find lesser time to spend on their studies as they become older. Hence, their learning level would decrease.

Hypothesis

The younger cohort of girls perform better in learning compared to boys. However as they grow past the age of seven to eight, their learning advantage goes away as the older cohort of boys fare better than girls.

Econometric equation

The following econometric equation will be used for data analysis:

$$\text{Learning level}_i = \beta_0 + \beta_1 * \text{Female} * \text{Young} + \beta_2 * \text{Male} * \text{Young} + \beta_3 * \text{Female} * \text{Old} +$$

District/Household Fixed Effects + Controls + Clustered SE at household level

Control variables

The following controls will be introduced in the econometric equation:

Children level controls: age of the child, school enrollment status of child, current grade of the child, type of school a child is enrolled in.

Household level controls: Size of a household i.e. total members of a household, type of the household construction (whether completely constructed of bricks, semi-constructed with bricks, or a mud-house), ownership of the house, availability of an electricity connection, availability of a television, availability of a mobile phone, educational level of mother and father.

Empirical Analysis

Data

This paper uses a countrywide dataset on children's learning levels collected by the Annual Status of Education Report (ASER) in Pakistan. ASER is a coalition of civil society organizations working to improve the quality of education through research, advocacy and partnerships with government education departments and other private actors across Pakistan. Since 2008, ASER conducts assessment of children's learning level on an annual basis. In terms of scale, the data is collected from all districts of Pakistan from across its four provinces (Punjab, Khyber Pakhtunkhwa, Sindh, and Balochistan) and federally administered regions (Gilgit Baltistan, Azad Jammu & Kashmir, and Federally Administered Tribal Areas). Within each district, thirty villages are randomly selected each year for conducting ASER survey. Within each village, a team of trained volunteers visit 20 houses to conduct assessment of children's learning level. A total of 20 houses within each village are selected. Depending upon the approximate count of the total number of houses within a village, it is determined how many houses will be skipped in between every two surveyed houses. So a total of 600 houses within each district gets surveyed during each wave of ASER survey.

Within each selected/surveyed house, ASER volunteers conduct learning assessment of each child aged 5 to 16. School enrollment status of all those children who are aged 3 to 16 is recorded. The survey is conducted on a Sunday to ensure the availability of maximum number of children within their houses, including those who are not enrolled in schools. A simple test, developed by ASER's psychometricians is used to assess children's learning level in linguistics, arithmetic, and English reading[1]. This paper uses data from ASER's 2016 survey. Table 1A in the appendix provides a quick regional summary of the scale of ASER 2016 survey. During the regression analysis, those observations were dropped where child's age was less than 5 because data on these children's

[1] The test used to conduct children's learning assessment are publicly available from ASER's website.

learning level was not recorded during ASER's survey. Those few observations also had to be dropped where learning level was missing due to data entry reasons.

After conducing children's learning assessment, ASER survey team assigns a learning level to each child. A learning level "1" means a child was not able to perform anything on the assessment or s/he is at a very beginner level. A learning level "2" in math means that a child could recognize numbers from 1 to 9. A learning level "3" in math means that a child could recognize numbers from 10 to 99. A learning level "4" in math means that a child could perform subtraction, whereas a learning level "5" in math means that a child could perform two digit long division. Similarly to math, a learning level "1" in English means that a child could not perform anything on the test or his/her learning level is that of a very beginner. A learning level "2" in English means the child can read alphabets, whereas "3" means s/he can read through words. A learning level of "4" in English means that the child was able to read complete sentences in English.

During a household survey, ASER team also records household characteristics such as the level of parental education, total number of household members (male and female). Though the survey does not directly record a household's wealth or income status, however it records various wealth characteristics such as (a) whether the household is constructed of bricks or mud, (b) the ownership status of house, (c) whether the household had an electricity connect, and (d) whether they owned household goods such as a television, a mobile phone etc. This paper uses these household characteristics to create a household wealth index using principle component analysis (PCA) technique.

Descriptive Statistics

Since this paper looks at the gender-based learning differences, we will start off by looking at the difference in average learning levels of boys and girls in math and English. Taking a quick look at data on children's learning levels shows stark differences across the learning levels of boys and girls. On an overall level, the learning level of children across Pakistan shows that the average

learning level of boys is higher compared to that of girls. This gender-based difference holds true for children's scores in math as well as in English as shown by the two bar graphs in the figure 1 in appendix. Compared to English, the gender-based difference in the learning level is bigger in math's score.

Since Pakistan as a country is divided into different provinces/regions, it would be interesting to see how these gender-based differences are doing across different administrative regions of Pakistan. The figure 2 shows gender-based differences in learning levels in math and English across different provinces/regions of Pakistan. Across all the regions of Pakistan with an exception of its international capital territory, Islamabad, the average learning level of boys comes out to be higher than that of girls in math as well as in English.

For children based in Islamabad – the international capital territory of Pakistan – the average learning level of girls were found to be higher both in math and English compared to the average score of boys based in Islamabad region. For the region of Azad Jammu and Kashmir (AJK), the average learning level of boys comes out to be higher compared to the average learning level of girls, however these gender based differences are very small for scores in English as well as math. The regions of Gilgit Baltistan (GB) and Punjab follows just behind the AJK in gender-based learning gaps. For rest of the provinces, these gender-based learning differences show a sharp increase. The provinces of Khyber Pakhtunkhwa (KP) and Sindh lags behind GB and Punjab in gender-based learning differences. The survey data on children's learning levels shows biggest gender-based learning gaps coming from the regions of Balochistan and Federally Administered Tribal Areas (FATA). These two regions also happen to be the most under-developed regions of Pakistan.

Though it requires further empirical evidence and research but based on my field based working experience with different NGOs in Pakistan between 2012 and 2018 I can suggest that regions where we see a very small gender-based learning difference – for instance the ICT and AJK – also

happen to be those where I found female community members to be equally or more participatory within community meetings.

Since the data of children's learning level, as collected by ASER, is further divided into sub-learning levels, we can also compare these sub-learning levels across different regions of Pakistan to see the gender-based learning gaps. The figure 3 shows gender-based learning differences w.r.t these sub-learning levels across different regions of Pakistan. If we zoom-in on children who are at the "zero learning level" in math – as shown by the blue shade in the graph below – it comes out again that except for Islamabad region, on average there are more girls across all other regions of Pakistan who are at the "zero level" compared to boys in each of the respective regions. The region of AJK has almost similar number of boys and girls who are at the "zero level" in math. This is followed by the regions of GB, Punjab, KP and Sindh where there are substantially more girls compared to boys at the "zero learning" level in math. The region of FATA and Balochistan are performing worse across all regions having biggest gender-based differences w.r.t "zero learning" level in math.

The learning levels in English are also similarly divided in sub-learning levels If we focus on the "zero learning" level in English, the gender-based learning differences in English also show similar trends across different regions of Pakistan as showcased earlier by the "zero learning" level in math. Except for Islamabad, there are generally more girls compared to boys across all regions of Pakistan who are at "zero learning" level in English i.e. compared to boys there are generally more girls across all regions of Pakistan, except ICT, who cannot read simple letter in English. The biggest gender-based learning gap in English as assessed by the count of children who are at "zero learning" level is seen in the region of FATA where around 50% of the girls are at "zero learning" level compared to around 20% boys at "zero learning" level in English.

As a next step, we explore the gender-based learning differences across different age-groups. Comparing gender-based learning difference in math across age-groups shows that on average the learning level of boys in math is higher compared to that of girls across all the age-groups from

age 5 to 16. This is shown in the figure 4 (left). Starting at the age of 5, the gender-based learning differences continue to grow bigger with age. At the age 5 and 6, the gender-based learning differences are very small in math, however as children grow, beyond the age of 7, the learning differences starts becoming bigger.

The figure on the right compares the average learning level in math across age-groups but only for those boys and girls who are enrolled in any school, whether a government or a private school or non-formal / religious school. Children on average have a higher learning level across all age-groups if they are enrolled in a school. Comparing these two graphs below also makes it evident that the gender-based learning gaps in math become relatively very small across almost all the age-groups if children are enrolled in a school. It looks like that up to the age of 8, girls are either performing better on their math score or almost equal compared to boys when we make a comparison only between enrolled children. After the age of 12, we can see very small gender-based learning difference in math score and the gap do not seem to be growing with age.

Comparing the average scores in English also confirms the same gender-based pattern in learning levels across different age-groups as seen in math. A comparison of learning level in English of all children shows that boys on average perform better compared to girls across all age-groups. However, if we run this same comparison only across those children who are enrolled in a school, the pattern is reversed. We see that the girls on average perform better or almost equal compared to boys up to the age of 12. After the age of 12, the average learning level of boys comes out to slightly better than the girls in English. These comparisons are shown in the figure 5 in appendix.

Given that enrollment in schools matters in reducing gender-based learning differences in children in Pakistan, we now explore whether there are any differences in enrollment across boys and girls. The data suggests that on average, about 82% children from across Pakistan during ASER 2016 household survey were found to be enrolled in a school. This percentage was higher for boys compared to girls. On an overall level, around 86% boys were found to be enrolled in schools

compared to about 76% girls' enrollment. So there appears to be an overall gap of about 10% points within the enrollment of boys and girls. These gender-based differences in school enrollment were evident across children of all age-groups. The figure 6 shows these differences across gender and age-groups.

It appears that gender-based differences in school enrollment grow with age. The differences are comparably small in the young age and bigger in the later parts of the age. At the age of 5, about 73% boys were enrolled in schools compared to only 66% girls i.e. there was a gender-gap of about 6% at the age of 5. At the age of 16, about 78% boys were enrolled in schools compared to about 61% girls' enrollment. So girls were lagging behind boys by 17% percentage points in school enrollment at the age of 16. The figure 7 shows the growth of age-based gender-gap in the school enrollment. The table 2 in appendix shows these gender-based differences across all age-groups from 5 to 16.

Figure 8 presents a set of graphs showcasing gender-based differences in school enrollment across different regions of Pakistan and by age. As it is the case in learning levels, the differences in school enrollment across genders are small in the regions of Punjab, AJK, and Islamabad. However, there are big differences in the regions of Balochistan and FATA. Except for AJK where gender-based differences in school enrollment are almost non-existent, the gender-based differences in school enrollment rises across all regions with age i.e. in the young-age, there is a less difference in school enrollment between boys and girls, however the difference becomes big as children grow. The biggest gender-based difference in school enrollment comes with age across the regions of Balochistan and FATA. There are relatively small gender-based differences in school differences in the regions of Gilgit Baltistan, Sindh, and Khyber Pakhtunkhwa however these differences grow with the age.

A table listing different summary statistics across boys and girls and age group is also given in appendix (table 3). The descriptive table shows differences between boys and girls. The average

age of boys within our sample is 9.85 years where this is slightly less, 9.59 years, for girls. The age-based gender difference significant. We also see that average math score for boys is 3.08 points whereas this is 2.74 for girls. We separately compare the math score of boys and girls across the age-groups of less than 7 and more. We find that across both of these age-groups, the average math score of girls come out to be less than that of boys. Likewise, the average score of girls in English is also less than boys across our complete sample, as well as across the age-groups of children aged less than 7, and those who are seven or more. We find that the average level of parental education is higher for girls. The proportion of boys enrolled in schools is also higher, and a higher proportion of boys take extra help from a tutor than girls. We also compare the average number of male and female household members across genders. We find that on average, there are usually more male household members for male children, and more female household members for female children. All of these gender-based differences are statistically significant as also shown in the table.

Estimation and Analysis

There are two parts to our hypothesis. The first part of the hypothesis is to test the learning differences between boys and girls at a younger age. Tables 4 and 5 focus on this part of the analysis. The second part of the hypothesis is to test if there is a difference in learning outcomes across genders as age increases. Table 6 focuses on this part of the analysis. The variables of interest are the gender binary variable, its interaction with age, and household size variables. An insignificant coefficient of the gender variable means there is no difference in learning outcomes across genders. However, a negative significant coefficient of 'female*age' interaction term would mean that girls perform poorly on test scores as their age increases. Likewise, a negative significant coefficient of 'female*household size' would mean that the test score of girls deteriorates with an increase in household size. We look at different factors that could explain the variation in test scores and argue that the interaction terms remain significant despite controlling for all other variables. So, after having controlled for factors that affect the learning outcomes, a significant

gender interaction term implies that the burden of household work on girls results in a drop in their learning outcomes when compared to boys of similar age. Our primary variable of learning outcome is the math test score. To strengthen our analysis, we also repeat the same regression specifications for English test scores. We perform other robustness tests by varying the sample size, adding more control variables and fixed effects in table-7.

For the first part, we consider the sample below the age of seven. This selection is based both on cultural norms as well as data. Rural Pakistan is a deeply conservative Islamic society. Age of seven is considered as first major milestone in life. According to the edicts of the Prophet Muhammad (called *hadith*), children should start to learn to pray from the age of seven (e.g. see *hadith* from *at-Tirmizi* No. 407). Similarly, it is recommended that siblings should sleep in separate beds from this age (see *hadith* from *al-Albaani* in *Saheeh al-Jaami'*, No. 418). Moreover, our data shows that the gender and age interaction term becomes significant in regression analysis once children of age seven or older are included in the sample. This interaction term is insignificant for children below the age of seven. Analysis that shows comparison between regression results for different ages is given in table 8.

The regression results presented in column 1 of table 4 regress the math test score of children on a gender binary variable. The sample is limited to 41,393 observations of children aged five and six. The co-efficient of the female binary variable is negative and significant. It implies that on average girls lag behind boys in math score. However, this regression is too simplistic and we need to control for other variables. Age of children is strongly correlated with their ability. In column 2 we control for age of children and to check for gender specific age effects in our sample, we also add a gender interaction term with age. A significant coefficient on 'female*age' interaction term would mean that the test scores differ across genders with age. Column 2 of table 4 reports these regressions results. The age variable is positive and significant implying that with an increase in age, children's score on math test also improves. The female variable is insignificant implying that

there is no gender specific difference in math scores. The coefficient of 'female*age' interaction variable is also positive but insignificant showing that there are no gender specific age effects in our sample. Though this variable is insignificant we will still retain it in our further regressions (columns 3-10 of table 4) to ensure that our findings are stable as we add more controls.

Household characteristics like household wealth and household size could also impact a child's learning outcomes. A wealthier family will have better facilities (e.g., bigger house, access to electricity, better transport) and thus we expect that household wealth would have a positive impact on children's learning outcomes. The household size on the other hand could have either a negative or positive impact. A larger household means more availability of help in studying, for example an elder sibling or a cousin thus a positive impact on learning outcomes. On the other hand, a larger household may also mean more opportunities for distraction, a greater burden of household chores and less per capita resources thus a negative impact on learning outcomes. We add both household level variables in column 3. The sample size drops from 41,393 to 37,866 due to missing values in the wealth variable. The coefficient of wealth is positive and significant as expected. The coefficient of household size is negative and significant at 1%. This means that for household size the negative effect dominates. Coefficients of other variables are not affected by the addition of these two variables.

Given the patriarchal nature of rural society in Pakistan, we can expect that a bigger household size would have a more negative effect on girls. To test this, we add an interaction term of gender with household size in column 4. The coefficient of 'female*household size' is negative however insignificant. This shows that within our restricted sample of children aged less than seven, the household size does not affect boys and girls differently. Coefficients of other variables are not affected by the addition of 'female*household size'.

There are other factors that could affect the learning outcomes for example, enrollment in a school. There are 10,330 children in our restricted sample that do not go to school. In our sample, there

is a higher incidence of girls not being enrolled into schools as compared to boys (28% versus 22%). This is in line with the social norms of the Pakistani society. There is a strong preference for boys over girls in Pakistan. Parents tend to spend more resources on boys than on girls, especially in the rural areas (Qadir et al. 2011). It is expected that those who go to school will have a higher score on the math test. We therefore add a binary variable that shows if the child is not enrolled in any school ('not enrolled'). The expected sign on this variable is negative. Column 5 shows the results for this regression. The 'not enrolled' variable is negative and highly significant as expected. The age variable is also significant and still positive. The female binary variable and its interaction with age and household size however are still insignificant implying that once age, enrollment status, household wealth and size has been controlled for, there is no difference in learning outcomes of girls and boys.

Note that we would get the same results if the 'not-enrolled' variable was formulated as a child being 'enrolled'. The results would be the same but the sign on 'enrolled' variable would be positive. School enrollment can be further broken down into type of schools. There is a wide body of literature that focuses on the differences in learning outcomes between government run and private run schools in Pakistan (see Das, Pandey, and Zajonc 2006). It is expected that children who attend private schools will have better learning outcomes on average. We replace the 'not enrolled' variable with three binary variables in column 6 to capture this effect. The variables 'enrolled private school', 'enrolled government', and 'enrolled non-formal' capture the different types of education systems available to the rural population of Pakistan. The base category here is 'not enrolled'. Column 6 shows that those who are enrolled in non-formal, government and private schools do progressively better than those that are not enrolled. All three variables are positive and significant at 1% level of significance. The gender binary variable is still insignificant. Furthermore, breaking the enrollment variable into three categories has not resulted in any significant difference between columns 5 and 6 in the magnitude of other variables.

A child's learning outcomes are also impacted by his/her parents' education. For example, Das, Pandey, and Zajonc (2006) report huge differences between the learning outcomes of children based on their parental education. To capture this effect, column 7 includes two variables that capture the number of years of education of father and mother. Both variables are positive and highly significant. Interestingly, mother's education seems to have a larger impact than father's education. This could be because in Pakistan mothers traditionally take the role of homemakers and spend more time with the children. The impact at 0.02 points for each year of mother's education is small. This implies that on average a mother with a bachelor's degree (16 years of education) would lead to a 0.32-point increase in the test scores compared to an illiterate mother. After controlling for parental education, the positive significant effect of household wealth drops from 0.033 to 0.012, and the coefficient of household size while still negative becomes insignificant. This implies that having educated parents reduces the gaps in children's learning based upon household wealth and household size. Interestingly the addition of parent's education results in a drop in the coefficients of all three types of school enrollment. This shows contribution of parents towards the learning of their children alongside what they could learn in schools.

Another key variable to control is whether the child is getting tutoring help. There is a very strong culture of getting regular tutoring help after school hours in urban and rural Pakistan alike. Column 8 reports the results with an indicator variable for tutoring help. Our sample size drops from 37,866 to 34,029 because of missing observations in this variable. The tutoring help variable is positive and highly significant. Interestingly, the variable results in a marginal drop in the magnitude of the coefficients of private and government school enrollment. This could be because the enrollment variables had previously captured the positive effect of tutoring help and thus dropped in magnitude when we controlled for tutoring. At the same time, the coefficient of enrollment in non-formal education increases in magnitude. This shows that there is a negative correlation between these two variables. Households that send their children to non-formal education systems

are likely to be poorer and/or do not put a high value on the education of their children. In our sample the average wealth index score of households that send their children to non-formal school systems is much lower than those who send their children to government or private schools. Such households are also less likely to invest in extra tutoring help.

There could be regional differences in the quality of education being imparted. This could be controlled by adding district level fixed effects. Moreover, we control for heteroskedasticity by clustering the standard errors at household level. The results are given in column 9. The district level fixed effects and clustered standard errors do not change the significance of any coefficient. The magnitude of enrollment variables and mother education drop significantly. The drop in the coefficients of enrollment variables is expected as there is lesser variation in the quality of education imparted by schools within a district as compared to across districts. The drop in the coefficient of mother's education could be because some districts have higher levels of female education than others. Thus, the within effects are smaller in magnitude. The household wealth variable is now significant at 10 % level of significance.

There could be other unobserved features at household level that could impact a child's learning outcome. For example, the general preference of a family for good education, presence of role models or other relatives who help or hinder educational activities. We control for these unobserved variables adding household level fixed effects in column 10. Our sample increases to 35,200. This is because the wealth variable had a few missing values and it is not relevant anymore. Total number of households with children under the age of seven is 31,242. After adding these household level fixed effects, there is no change in the significance of any variable, however there is a substantial drop in the coefficients of enrollment in private or government school. This implies that these variables were capturing the positive impact of some household level unobserved variable. The unobserved variable could be preference for a school of particular quality or in a particular locality. Furthermore, we see that the coefficient of 'age' becomes even more positive

however the interaction variable 'female*age' is still insignificant showing that there are no gender-based learning differences at a younger age.

In table-5, we repeat the analysis for English test scores. The results are similar to those in columns 8 to 10 of table-4. The magnitude of each coefficient is different, but the sign and significance remain the same. Table 4 and 5 show that at young age (5 and 6 years), there is no significant difference in the math and English test scores of boys and girls. The results are stable across different specifications and estimation techniques.

We turn to second part of our hypothesis in the table 6 by extending the sample to all children (age 5 and more) to test if there is a difference in the learning outcomes across gender at a higher age. The sample size is 167,429. We are unable to use the full sample of 203,000 children because of missing values in wealth and tutoring help variables. We use the specifications given in column 9 and 10 of table 4. In column1 of table 6, district fixed effects are included, and standard errors are clustered at household level. The results show that on average girls fare better than boys on test scores, however, there is a drop in the test score of girls with age. Both 'female*age' and 'female*household size' variables that were insignificant in the restricted sample in table 4 are negative significant. This shows that there are gender related differences due to age and household size. The results imply that on average a seven-year-old girl living in a household of average size (7 people) will score 0.02 points less in math score than a seven-year-old boy and a ten-year-old girl will score 0.16 points less than a ten-year-old boy. This lends credibility to our hypothesis that as age increases, there is more household responsibility on girls and consequently their learning outcomes suffer. In the column 2, we add household fixed effects along with clustering standard errors at household level. The count of households used is 68,800. The significance and sign of coefficients stay similar to that in the column 1. Our variables of interest, 'female*age' and 'female*household size' are still negative significant and of the same magnitude.

In columns 3 and 4 of table 6, we make a direct comparison of the learning level of girls aged seven or more with boys of the same age. To make this direct comparison, we divide the sample into four categories i.e. (a) female under seven, (b) male under seven, (c) female aged seven or more and (d) male aged seven or more. Instead of using the interaction term between female and age variables, we include three binary variables in regression with 'male who are seven or more' serving as the base case. We would expect younger girls and boys to fare worse than the base category on the test scores due to difference in age. Our hypothesis and earlier analysis from columns 1 and2 implies that older girls will also fare worse than older boys. As in the columns 1and 2, we cluster the standard errors at household level and also add district and household level fixed effects in columns 3 and 4 respectively. The results in columns 3 and 4 confirm our expectations. The coefficient on older females is negative and significant. The coefficient on 'female*household size' continues to stay negative significant. The significance and sign of the coefficients of the rest of the variables also remain the same. However, there is a marginal difference in the magnitude of the coefficients.

Columns 5-8 of table 6 repeat the same analysis using English test scores as the dependent variable. The results are similar to that from math scores (columns 1-4). Columns 5-6 shows that as age increases, girls do worse on English tests than boys. Column 7-8 also shows that girls aged seven or older fare worse than boys of similar age.

Robustness checks

We check for the robustness of our results in table 7. We perform three different regressions, each for math and English by varying the sample size and adding more control variables to our regression equation. In all robustness checks, we have added household level fixed effects and clustered the standard errors at household level.

In column 1 of table 7, we restrict our sample to only those children who are aged 7 or more. Our sample size reduces to 138,197. The significance and signs of all variables remain similar to our

previous analysis. The coefficients of 'female*age' and 'female*household size' are still negative and significant. In the column 2, we add a new interaction term of gender binary with household wealth. The number of observations drop to 167,429 due to missing observations in household wealth variable. The coefficient of 'female*household wealth' is positive and significant at 1% implying that the learning level of girls goes up as the household wealth increases. The coefficient of 'female*age' and 'female*household size' continues to stay negative and significant..

Lastly, we check for mobility constraints faced by females in the conservative society of Pakistan. It is especially difficult for girls who have to travel long distances to go to school. We do not have data on mobility or distance from the school. We, however, can use the design of the ASER survey to our advantage. The project surveys one government and one private school from each sampled village. In case there is no government school in the village, it surveys just the private school. The questionnaire asks households if the children in their family go to one of the surveyed schools. While there can be multiple private schools in a village, there can only be one government school. This is the way public education is structured. Children who belong to a village with no government school or if the government school has no space for new students, can go to a government school in a neighboring village. This adds to their commute and poses special problems for girls. We limit our sample to those students who go to government school and create a binary variable that shows if the student does not go to a government school within his/her village. The expected sign on this variable is negative. The sample drops to 79,023 observations. The new variable is negative and significant implying that a longer commute impacts children's learning outcomes. 'Female*age' is still negative significant but drops in magnitude implying that it was capturing some of the impact of the commute. 'Female*household size' is still negative significant and of comparable magnitude as before. In a separate regression (not shown), we add an interaction term 'female*not enrolled in village government school'. The interaction term is insignificant. This analysis shows that there is evidence of adverse impact on girls' learning

outcomes due to household responsibility after controlling for mobility constraints. The sample has many restrictions and better data is needed to test this further.

Our analysis shows that as age increases girls do worse on learning outcomes. We have controlled for several factors that could explain this difference including household wealth, household size, school enrollment and type, parent's education, tutoring help, geographic and household fixed effects. We also carried out several robustness checks. Our variable of interest is negative and significant despite controlling for all the above. The effect of household size is also negative and significant for older girls. This leads credence to our hypothesis that girls fare worse on test scores because of added household responsibility. There are, however, other factors for which we do not have data that could explain the difference. For instance, given the general preference for boys in rural areas, the household may give more nutrition to boys. This could translate into poor health outcomes of girls which in turn could affect their learning outcomes. Number of days of school attendance could also impact test scores. It can be argued that girls could be skipping school more because of additional household responsibility. We do not have data to test it. Mobility constraints is another factor that could indirectly affect learning outcomes. Women in general have more restrictions on their mobility and access issues due to the conservative nature of the rural Pakistani society. If the school is located farther from home, girls will have more problems reaching the school and thus either drop out or skip more school days. Part of this is captured by the enrollment variable. A girl who drops out of school due to mobility issues is therefore accounted for. We tried to control for mobility constraints in a restricted sample but more data is needed to test this further.

In a nutshell, our analysis gives a very strong indication that there is a difference in learning outcomes across genders due to unequal household responsibilities, social and cultural norms around genders. The analysis has its limitations and requires richer data for a more robust conclusion.

Discussion of results

Based upon the data findings and literature review presented in this study, following set of policy recommendations are proposed to improve the situation of quality education and gender-based learning differences in Pakistan.

Sensitization of gender-roles in society

Rural areas of Pakistan are very patriarchal in nature where women are generally responsible for most of the household chores. Though it requires further investigation to establish a causal relation, however, lowering of female's learning level beyond the age of 7 might have to do with the fact that they are involved in a higher set of responsibilities at their homes – not finding enough time for their studies. Using media and other advocacy channels, the importance of girls' education needs to be emphasized within rural communities. It is true that gender-based roles are not easy to change however with some effort, we can at least ensure that girls get enough time to focus on their studies so that their learning do not suffer.

Housing interventions for poor

Our data analysis shows that the learning level of girls has a negative correlation with household size i.e. the learning level goes down as the household size increases. While some families may have a strong preferences for living in a joint family system, many might be facing resource constraints to get a separate house for their neutral family. Govt. can introduce housing interventions in rural areas assisting each family to have a house of their own. Such interventions can be helpful in improving the learning levels of girls.

Enrollment in schools helps in improving the learning ability

The data findings tell there are big learning differences between those children who are enrolled in any type of school and those who are not-enrolled. The government must continue its focus on enrolling out of school children in schools while also making an effort to improve the quality of schooling. Even the very low cost non-formal or religious schooling has positive returns to learning as shown by our regression analysis. In the cases where it is not possible for the

government to set up formal government or private schools in an area, it can collaborate with local stakeholders to set up non-formal or religious schools in the short-run while working on setting up formal schools in the long-run.

Public Private Partnerships (PPPs) to set up private schools

The regression results show that on average the highest learning levels are of those students who are enrolled in a private school. In the past decade or so, there has been mushrooming of private schools even in far off villages. However, these private schools can only operate in those villages where they can find a supply of female teachers (Andrabi, Das, and Khwaja 2008). In case there is no school at all in a village or its surroundings, the village is less likely have any supply of female teachers making it non-feasible for private players to operate a school because hiring teachers from distant villages will increase the cost of school.

The government can incentivize private players to set-up schools in such remote locations to overcome the shortage of schools in the short-run. However, in the long run, the government should ensure that 100% villages have access to at least one government female school as it is legally the responsibility of state.

Hiring more female teachers – especially for single-teacher government schools

Given that the rate of absenteeism of government female teachers is usually higher compared to male government teachers or teachers in private schools, there is a need for the government to improve its monitoring efforts to ensure a higher teacher attendance. While the government works on improving teachers' attendance rate in schools, placing more female teachers in government schools can also help with the availability of teachers.

Converting government primary schools into coeducational learning spaces

A high demand for private schools across Pakistan which happen to be coeducational shows a feasibility for converting government primary schools into coeducational schools (Ghuman and Lloyd 2010). If implemented, this can also help with teacher absence in the short-run as the government takes other measures to improve the challenge of teachers' shortage in the long-run

by hiring more female government. Hiring more teachers would, however, need lots of financial resources and logistical planning and hence cannot be done in the short-run.

Improved incentives for poor households

Given that the learning outcomes are positively linked with household wealth and the learning is relatively low in children belonging to those families having more household members i.e. less per-capita resources, there is a need for the government to pay extra attention to these poor households. The teachers can be trained such that they are sensitized to be more vigilant and helpful to such disadvantaged students – especially girls.

Conclusion

This paper studies the gender-based learning differences using a countrywide dataset from rural Pakistan. Our dependent variable is test scores of children in math and English. These tests were conducted by Annual Status of Education Report (ASER) through a household level district representative survey across 144 rural districts of Pakistan. Given that a big majority of children in Pakistan is still out of school, using a household level survey data allows us to include out of school children in our analysis.

In our regression analysis, we add control variables that can affect the learning of children. Our control variables include age of child, household size, household wealth, enrollment status of child and type of school a child is enrolled in, educational level of parents, and a binary variable indicating whether a child is taking extra tutoring help or not. We also add interaction of female binary variables with age, household size, and household wealth to see the gender-specific effects of these variables. In our estimates, we cluster the standard errors at household level and also control for fixed effects at a district level and separately at a household level also.

We find no gender-specific learning differences in children at a young age. However, for children aged 7 or above, we start seeing gender-specific learning differences. We find a significant negative correlation between the learning level of older girls and age i.e. the learning level of girls goes down with their age. This result holds true even after we have controlled for the age of the child, their enrollment in a school, extra tutoring assistance, as well as household level characteristics such as wealth and total members within a household, and the level of parental education. Our analysis strongly indicates that these differences in learning outcomes across genders exist due to unequal household responsibilities and socio-cultural norms/constraints around genders. However, the analysis has its limitations and requires richer data to establish a robust conclusion.

Appendix

Tables

Table 1: Sample distribution of ASER Survey 2016

Regions	Districts	Boys	Girls	Total
Punjab	35	21,504	48,833	27,329
Sindh	25	15,050	36,065	21,015
Balochistan	32	15,958	43,617	27,659
Khyber Pakhtunkhwa	25	13,687	32,980	19,293
Gilgit-Baltistan	7	5,110	11,067	5,957
Azad Jammu and Kashmir	10	7,332	15,468	8,136
Islamabad - ICT	1	215	509	294
Federal Tribal Areas (FATA)	9	5,552	14,631	9,079
Total	**144**	**118,762**	**84,408**	**203,170**

Table 2: Descriptive Statistics

Characteristics	Boys	Girls	(Boys - Girls)
Average age	9.85	9.59	0.26***
	(3.31)	(3.30)	(0.01)
Average math score	3.08	2.74	0.34***
	(1.54)	(1.58)	(0.01)
Average math score (age <7)	1.79	1.74	0.04***
	(0.96)	(0.95)	(0.00)
Average math score (age ≥ 7)	3.39	3.02	0.37***
	(1.49)	(1.61)	(0.00)
Average English score	2.39	2.16	0.23***
	(1.15)	(1.16)	(0.01)
Average English score (age <7)	1.50	1.46	0.04***
	(0.63)	(0.62)	(0.00)
Average English score (age ≥ 7)	2.60	2.36	0.24***
	(1.15)	(1.20)	(0.00)
Average Mother Education Level	2.24	2.55	-0.31***
	(3.94)	(4.14)	(0.2)
Average Father Education Level	4.68	5.00	-0.33***
	(5.13)	(5.18)	(0.02)
Proportion of School Enrollment	0.86	0.76	0.10***
	(0.34)	(0.43)	(0.00)
Proportion of School Enrollment (age <7)	0.78	0.72	0.06***
	(0.42)	(0.45)	(0.01)
Proportion School Enrollment (age ≥ 7)	0.88	0.77	0.11***
	(0.32)	(0.42)	(0.00)
Proportion taking a tutor's help	0.11	0.10	0.01***
	(0.31)	(0.30)	(0.00)
Average male household members	3.86	3.23	0.63***
	(1.75)	(1.73)	(0.01)
Average female household members	3.00	3.71	-0.70***
	(1.89)	(1.84)	(0.01)

Standard deviation and errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3. Explanation of regression variables

Regression Variables	Explanation
Female	A dummy variable which takes the value of "1" for females and "0"
Age	It is a continuous variable representing the age of a child
Female*Age	An interactive variable of female dummy with age. It takes the value of "0" for all males and will be equal to "age" variable for females.
Female (age < 7)	A dummy variable which takes the value of "1" for females who are less than seven years old, and "0" otherwise
Male (age < 7)	A dummy variable which takes the value of "1" for males who are less than seven years old, and "0" otherwise
Female (age ≥ 7)	A dummy variable which takes the value of "1" for females who are aged seven or more, and "0" otherwise.
Household wealth	This variable has been created using Principal Component Analysis (PCA) techniques. The following variables were used to create the wealth variable: - The household construction material i.e. whether the household is brick constructed or not. - The household ownership status - The availability of electricity, TV, and mobile phone at the household
Female*household wealth	An interactive variable of female dummy with household wealth
Household size	The total members, male & female, within a household
Female*household size	An interactive variable of female dummy with household size
Enrolled Pvt. School	It takes the value of "1" if the child was enrolled in a private school, and "0" otherwise
Enrolled Govt.	It takes the value of "1" if the child was enrolled in a government school, and "0" otherwise
Enrolled non-formal	It takes the value of "1" if the child was enrolled in a non-formal or a religious school, and "0" otherwise
Education Mother	A continuous variable showing the level of child's mother's education
Education Father	A continuous variable showing the level of child's father's education
Tutoring help	It takes the value of "1" if the child is taking tutoring help and "0" otherwise
Enrolled in village govt. school	It takes a value of "1" if the child is enrolled in the govt. school of the same village

Table 4: Regression Results. Dependent variable: learning level in math for children aged < 7

Independent variables	(1) Math	(2) Math	(3) Math	(4) Math	(5) Math	(6) Math	(7) Math	(8) Math	(9) Math	(10) Math
Female < 7	-0.045***	0.044	-0.014	0.007	0.078	0.087	0.072	0.059	0.071	-0.026
	(0.01)	(0.10)	(0.10)	(0.11)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.22)
Age		0.378***	0.376***	0.375***	0.289***	0.296***	0.301***	0.300***	0.312***	0.382***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)
Female*Age		-0.016	-0.006	-0.006	-0.011	-0.014	-0.012	-0.010	-0.012	0.003
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)
Household wealth			0.091***	0.090***	0.049***	0.033***	0.012***	0.010***	0.008*	
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Household size			-0.016***	-0.014***	-0.006***	-0.005**	-0.001	-0.002	0.001	
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Female * household size				-0.003	-0.002	-0.002	-0.001	-0.000	-0.001	0.001
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Not enrolled					-0.808***					
					(0.01)					
Enrolled Pvt. School						0.988***	0.916***	0.888***	0.744***	0.388***
						(0.01)	(0.01)	(0.01)	(0.02)	(0.06)
Enrolled Govt.						0.744***	0.732***	0.726***	0.717***	0.518***
						(0.01)	(0.01)	(0.01)	(0.01)	(0.04)
Enrolled non-formal						0.518***	0.508***	0.552***	0.492***	0.473***
						(0.04)	(0.04)	(0.04)	(0.05)	(0.13)
Education Mother							0.020***	0.019***	0.007***	
							(0.00)	(0.00)	(0.00)	
Education Father							0.004***	0.004***	0.003***	
							(0.00)	(0.00)	(0.00)	
Tutoring help								0.209***	0.220***	0.315***
								(0.02)	(0.02)	(0.10)
Observations	41,393	41,393	37,866	37,866	37,866	37,866	37,866	34,029	34,029	35,200
Adjusted R2	0.001	0.038	0.059	0.059	0.188	0.200	0.208	0.233	0.289	0.199
F-stat > P	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
District FE									Yes	
Household FE										Yes
Clustered SE									Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Dependent variable: learning level in English for children aged < 7

Independent Variables	(1) English	(2) English	(3) English
Female < 7	0.002	0.009	0.179
	(0.07)	(0.06)	(0.15)
Age	0.165***	0.173***	0.227***
	(0.01)	(0.01)	(0.02)
Female*Age	-0.001	-0.002	-0.036
	(0.01)	(0.01)	(0.03)
Household wealth	0.008***	0.005*	
	(0.00)	(0.00)	
Household size	-0.002	-0.000	
	(0.00)	(0.00)	
Female*household size	-0.000	-0.001	0.001
	(0.00)	(0.00)	(0.00)
Enrolled Pvt. School	0.613***	0.517***	0.404***
	(0.01)	(0.01)	(0.04)
Enrolled Govt.	0.469***	0.466***	0.388***
	(0.01)	(0.01)	(0.03)
Enrolled non-formal	0.449***	0.398***	0.443***
	(0.03)	(0.03)	(0.11)
Education Mother	0.012***	0.005***	
	(0.00)	(0.00)	
Education Father	0.002***	0.001*	
	(0.00)	(0.00)	
Tutoring help	0.147***	0.144***	0.168**
	(0.01)	(0.01)	(0.07)
Observations	33,995	33,995	35,166
Adjusted R-squared	0.234	0.300	0.190
F-stat > P	0.000	0.000	0.000
District FE		Yes	
Household FE			Yes
Clustered SE		Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Dependent variable: learning level in Math & English

Independent variables	(1) Math	(2) Math	(3) Math	(4) Math	(5) English	(6) English	(7) English	(8) English
Female	0.401***	0.429***			0.318***	0.356***		
	(0.02)	(0.03)			(0.02)	(0.02)		
Age	0.209***	0.208***	0.150***	0.147***	0.159***	0.160***	0.127***	0.126***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Female*Age	-0.047***	-0.048***			-0.036***	-0.039***		
	(0.00)	(0.00)			(0.00)	(0.00)		
Female (age < 7)			-0.445***	-0.455***			-0.178***	-0.176***
			(0.02)	(0.02)			(0.01)	(0.02)
Male (age < 7)			-0.599***	-0.631***			-0.281***	-0.303***
			(0.01)	(0.01)			(0.01)	(0.01)
Female (age ≥ 7)			-0.093***	-0.090***			-0.053***	-0.051***
			(0.02)	(0.02)			(0.01)	(0.01)
Household wealth	0.032***		0.033***		0.029***		0.030***	
	(0.00)		(0.00)		(0.00)		(0.00)	
Household size	-0.001		-0.001		-0.004***		-0.003**	
	(0.00)		(0.00)		(0.00)		(0.00)	
Female * household size	-0.013***	-0.014***	-0.016***	-0.016***	-0.009***	-0.011***	-0.011***	-0.012***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Enrolled Pvt. School	1.708***	1.616***	1.653***	1.524***	1.206***	1.103***	1.184***	1.067***
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Enrolled Govt.	1.724***	1.685***	1.663***	1.585***	1.188***	1.138***	1.164***	1.097***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Enrolled non-formal	1.084***	1.024***	1.022***	0.930***	0.742***	0.675***	0.718***	0.638***
	(0.04)	(0.05)	(0.04)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
Education Mother	0.005***		0.005***		0.004***		0.004***	
	(0.00)		(0.00)		(0.00)		(0.00)	
Education Father	0.009***		0.010***		0.007***		0.007***	
	(0.00)		(0.00)		(0.00)		(0.00)	
Tutoring help	0.186***	0.181***	0.186***	0.184***	0.143***	0.162***	0.143***	0.163***
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
Observations	167,429	173,397	167,429	173,397	167,282	173,243	167,282	173,243
Adjusted R-squared	0.486	0.379	0.494	0.393	0.495	0.376	0.496	0.379
F-stat > P	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
District FE	Yes		Yes		Yes		Yes	
Household FE		Yes		Yes		Yes		Yes
Clustered SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Robustness checks: Dependent variable: learning level in Math & English

Independent variables	(1) Math	(2) Math	(3) Math	(4) English	(5) English	(6) English
Sample restrictions	Age ≥ 7	-	Govt. School only	Age ≥ 7	-	Govt. School only
Female	0.511***	0.436***	0.206***	0.441***	0.358***	0.185***
	(0.04)	(0.03)	(0.05)	(0.03)	(0.02)	(0.03)
Age	0.177***	0.209***	0.245***	0.151***	0.160***	0.188***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Female*Age	-0.051***	-0.050***	-0.018***	-0.043***	-0.039***	-0.016***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Female * household size	-0.015***	-0.014***	-0.018***	-0.010***	-0.010***	-0.014***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Female * household wealth		0.028***			0.014***	
		(0.01)			(0.00)	
Enrolled Pvt. School	2.020***	1.616***		1.428***	1.104***	
	(0.02)	(0.02)		(0.02)	(0.01)	
Enrolled Govt.	1.972***	1.684***		1.386***	1.136***	
	(0.02)	(0.01)		(0.01)	(0.01)	
Enrolled non-formal	1.213***	1.023***		0.843***	0.675***	
	(0.05)	(0.05)		(0.04)	(0.03)	
Tutoring help	0.101***	0.182***	-0.026	0.108***	0.164***	0.033
	(0.03)	(0.02)	(0.05)	(0.02)	(0.02)	(0.04)
Not-enrolled in village govt. school			-0.177***			-0.102***
			(0.02)			(0.01)
Observations	138,197	167,429	79,023	138,077	167,282	79,023
Adjusted R-squared	0.322	0.381	0.305	0.330	0.377	0.331
F-stat > P	0.000	0.000	0.000	0.000	0.000	0.000
Household FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Learning level in math – using different sample restrictions

Independent variables	(1)	(2)	(3)	(4)
Sample restriction	age<6	age<7	age<8	age<12
Female	-0.020	0.071	0.215***	0.328***
	(0.03)	(0.10)	(0.06)	(0.03)
Age		0.312***	0.362***	0.324***
		(0.01)	(0.01)	(0.00)
Female*Age		-0.012	-0.037***	-0.045***
		(0.02)	(0.01)	(0.00)
Household wealth	0.004	0.008*	0.015***	0.027***
	(0.01)	(0.00)	(0.00)	(0.00)
Household size	0.003	0.001	0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)
Female * household size	0.003	-0.001	-0.003	-0.009***
	(0.00)	(0.00)	(0.00)	(0.00)
Enrolled Pvt. School	0.659***	0.744***	0.823***	1.239***
	(0.02)	(0.02)	(0.01)	(0.01)
Enrolled Govt.	0.626***	0.717***	0.813***	1.240***
	(0.01)	(0.01)	(0.01)	(0.01)
Enrolled non-formal	0.429***	0.492***	0.504***	0.804***
	(0.06)	(0.05)	(0.04)	(0.03)
Education Mother	0.003	0.007***	0.006***	0.006***
	(0.00)	(0.00)	(0.00)	(0.00)
Education Father	0.001	0.003***	0.005***	0.009***
	(0.00)	(0.00)	(0.00)	(0.00)
Tutoring help	0.172***	0.220***	0.228***	0.219***
	(0.03)	(0.02)	(0.02)	(0.01)
Observations	17,827	34,029	51,055	113,225
Adjusted R-squared	0.272	0.289	0.342	0.474
F-Stat > P	0.000	0.000	0.000	0.000
District FE	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

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

Figures

Figure 1: Gender-based learning differences in math and English

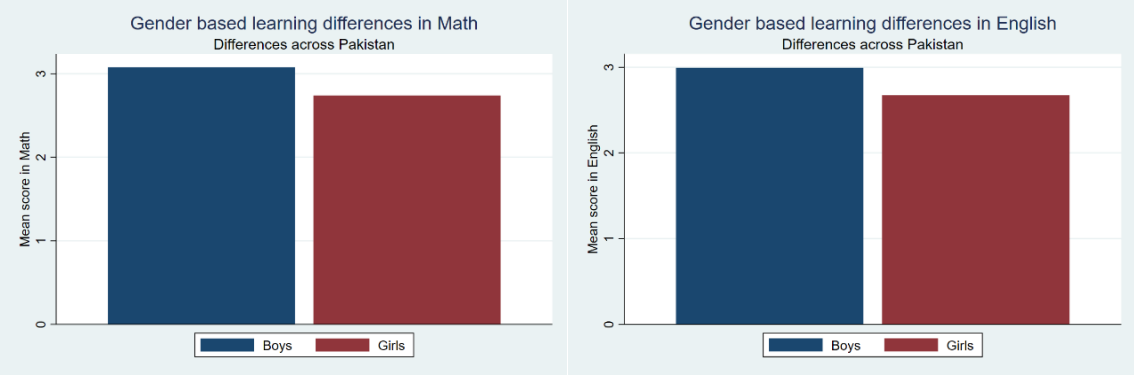


Figure 2: Gender-based differences across different regions of Pakistan

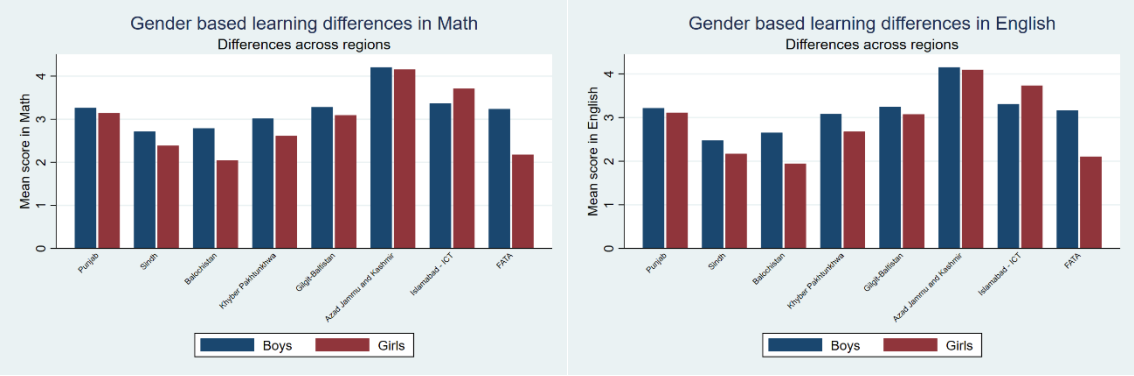


Figure 3: Gender-based differences across different regions of Pakistan

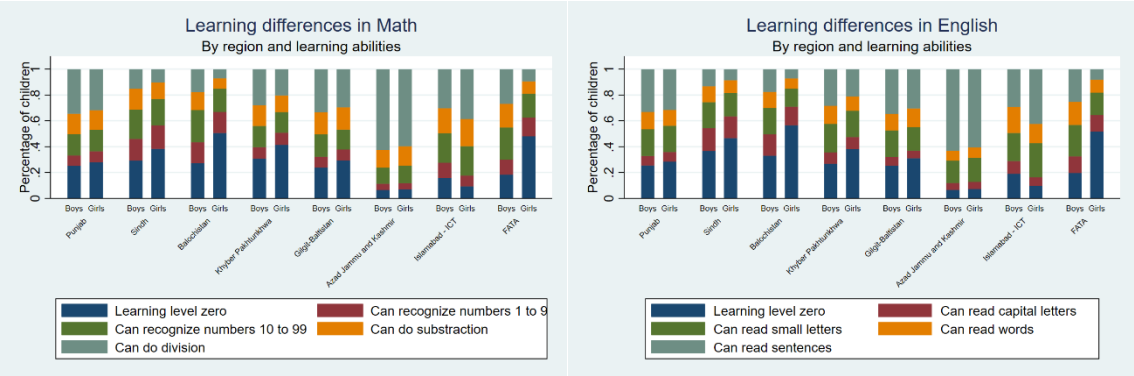


Figure 4: Gender-based learning differences across age-groups in math

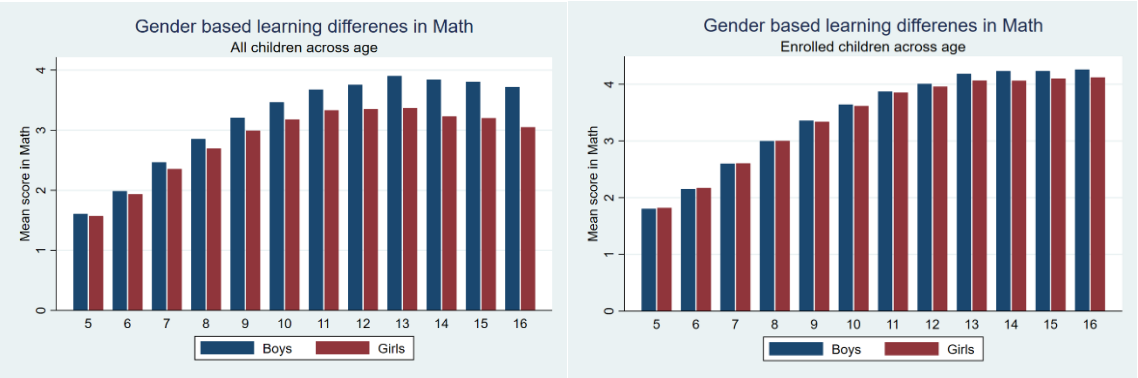


Figure 5: Gender-based learning differences across age-groups in English

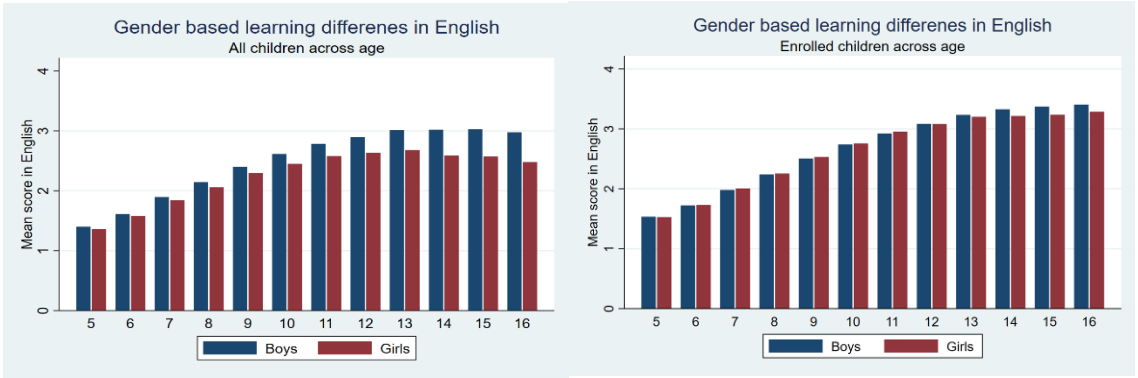


Figure 6: Gender differences in school enrollment

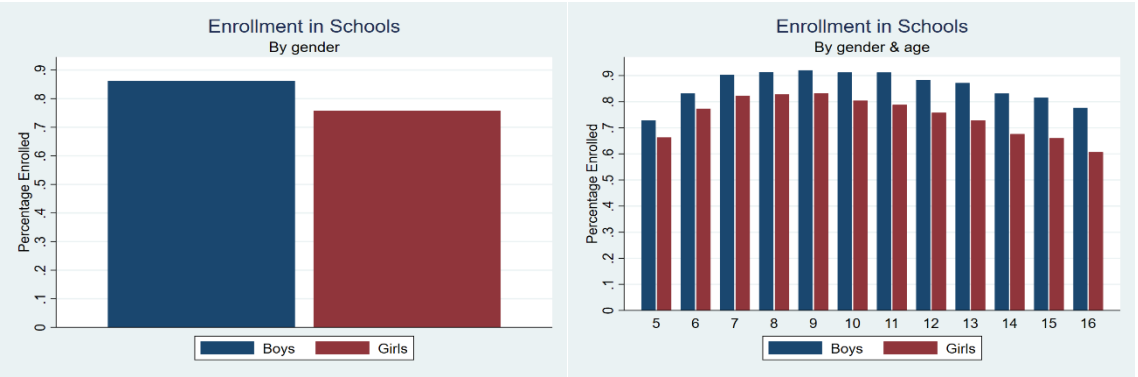


Figure 7: Size of gender based differences in school enrollment

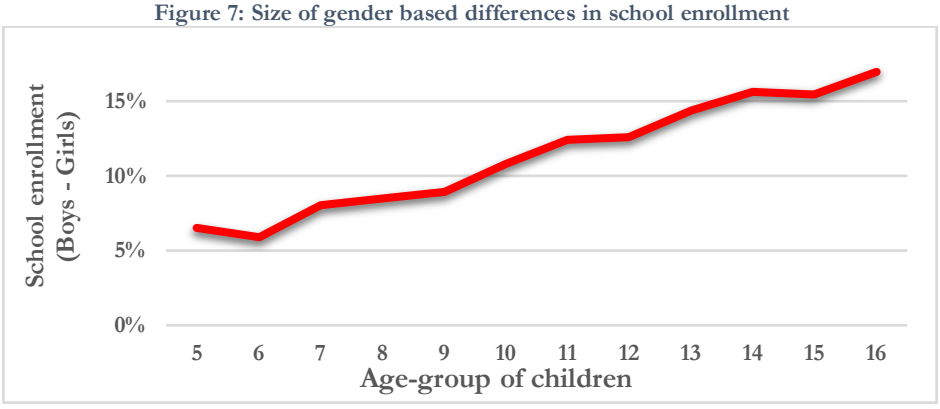
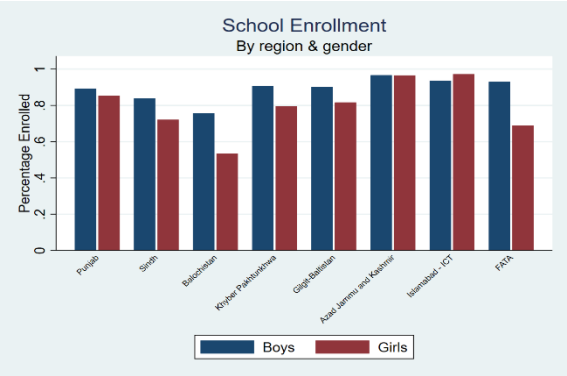
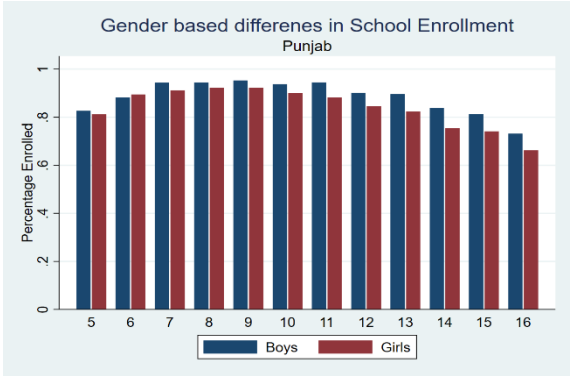
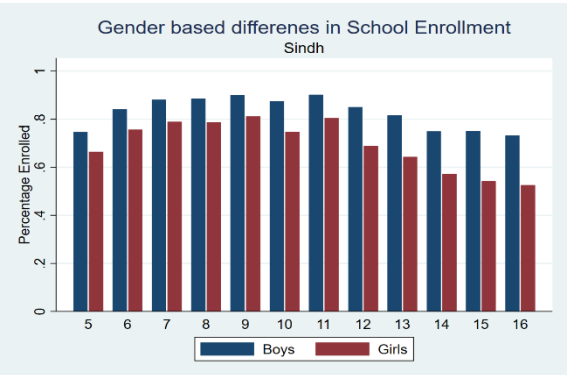
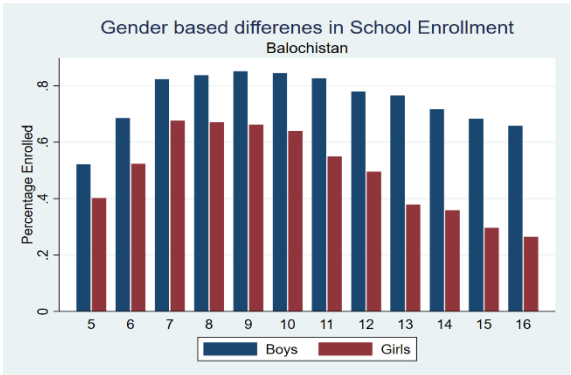


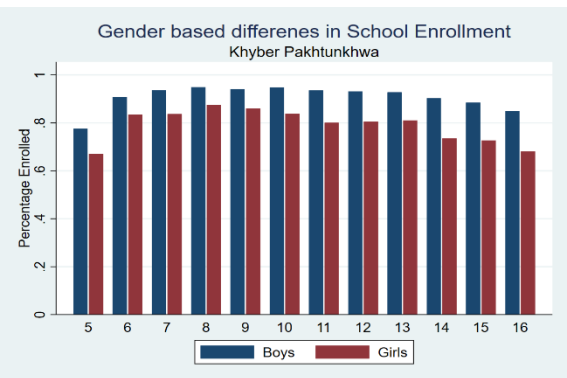
Figure 8: School enrollment trends across regions, age and gender

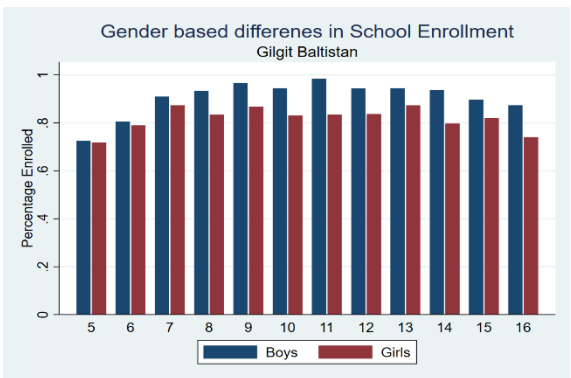


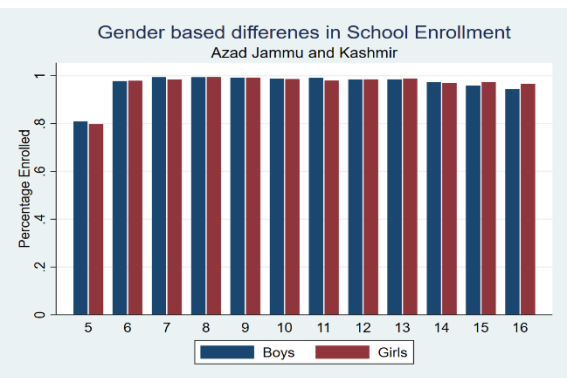


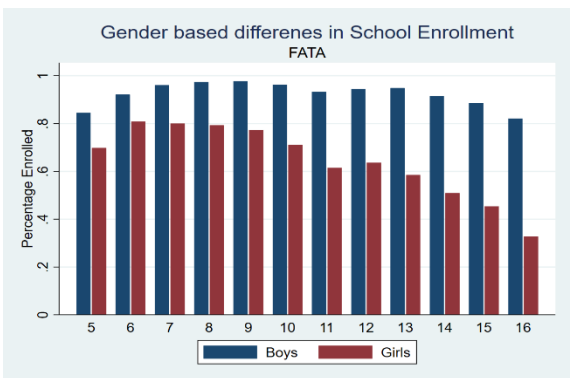












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