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School Quality and Parental Schooling Decisions for Their Children: Public and Private Schools in Rural Pakistan

MUHAMMAD JEHANGIR KHAN

This study uses the Pakistan Rural Household Survey 2004-5 (PRHS), a rich set of households and school data, to examine parents' schooling decision in rural Pakistan. Nested logit regressions are used to quantify the determinants of child school attendance. The analysis confirms that the greater the number of schools (public or private) in the local communities the higher is the attendance. Lower school attendance of boys seems to be the outcome of lower school quality more than it is for girls. A marginal increase in school quality correlates with increased school attendance in government schools more than in private schools. Nearly all school quality variables including control for number of schools in a community stand insignificant for girls. This shows that other factors might be of more importance than school quality of local schools for girl's low attendance in rural Pakistan. Besides, parental education, especially mother's education, and household income have strong positive impact on child school attendance. The greater the number of children in the household the lower is the child school attendance. Credit constraint seems not to be problematic as the estimated effect is statistically insignificant. The size of landholding seems to be important only in the case of girls schooling.

JEL Classification: I21, I25, D13, C25
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1. INTRODUCTION

Childhood in developed economies is a time for school learning, but the high level of dropout in poor countries suggests that children in these countries are deprived of learning opportunities. At the United Nations in 2000, almost 189 governments agreed to the Millennium Development Goal (MDG) that by 2015 every child (boy or girl) should complete primary schooling. This consensus substantiates the view of most economists and development agencies that schooling promotes individuals' wellbeing and economic development [Zhoa and Glewwe (2010)].

Pakistan's educational performance is poor relative to neighbouring countries as measured by Gross Enrolment Ratio (GER) and Net Enrolment Ratio (NER). In 2004-05 the country's adult literacy rate stood at 49.9 percent as compared to Sri Lanka (90.7 percent), India (61 percent), Iran (82.4 percent) and Indonesia (90.4 percent) [Pakistan (2009)]. The Human Development Index for Pakistan was 0.55, which is lower than that

Muhammad Jehangir Khan <jehnangir@pide.org.pk> is Assistant Professor, Pakistan Institute of Development Economics, Islamabad.

of some countries in the region but slightly better than that for Bangladesh and Nepal. Pakistan's performance is weaker on the Global Competitiveness Index (GCI) for health and education components than major competitors like India, China, Bangladesh, Malaysia and Sri Lanka. In terms of the quality of educational outcomes, Pakistani students are well below the international scaled mean of 495 in the Trends in International Mathematics and Science Study (TIMSS). This means that in Pakistani the performance of students is poorer than their counterparts in other countries in the region except Iran [Pakistan (2009)]. The current estimates show moderate improvement in adult literacy ratio (58 percent in 2015-2016) relative to the estimate of 49.9 percent in 2004-05. Low educational performance is always coupled with regional (rural and urban as well as provincial) and gender disparities in education provision. Adult literacy rate for males and females is 70 percent and 47 percent respectively. Literacy remains higher in urban areas (74 percent), while the rate for rural areas is 49 percent [Pakistan (2015-2016)]. With low level of literacy, it is most probable that they will have relatively low levels of income, social status and living conditions.

Research on the role of school quality in parental schooling decisions for their children from the perspective of public or private schooling is lacking in Pakistan. A few studies have used household survey data but these are usually confined to small population [e.g. Alderman, *et al.* (2001)]. Yet, no study has simultaneously considered the effects of household income, parental education and school quality in public or private schools. Moreover, due to limited data omitted variable bias may confound the true effect. This paper has tried to address, among the key questions, the relative importance of school quality on the one hand and family characteristics on the other. The investigation of these factors, and in particular school quality, will shed light on persistent low school attainment or enrolment; as it is plausible that low investment in children's human capital is the major cause of transition of poverty across generations.

This study uses the Pakistan Rural Household Survey (PRHS), a nationally representative dataset of rural households and schools, to investigate the role of school quality in child school attendance in rural Pakistan. The analysis estimates the impact of factors such as household income, parental education, land size and school quality, on school attendance.

The PRHS contain a comprehensive list of household and school level information in rural Pakistan, so the current study is less likely to suffer from omitted variable bias. In addition, it contributes to the literature on education in Pakistan in two ways. First, studies of the impact of school quality in rural Pakistan are extremely rare from the perspective of child school attendance in public or private schools. Secondly, it controls for the role of household income or wealth, credit constraint, other demographic indicators, along with school quality. School quality plays an important role in school attendance, learning and child stay at school for more years [Glewwe and Kremer (2006)]. This study analyses the effects of a comprehensive set of school-quality attributes on school attendance in public and private schools.

The results of studies carried out to date, which have focused on the relationship between school quality and student attendance/achievement, are inconsistent [Harbision and Hanushek (1992); Hanushek (1994); Greenwald, *et al.* (1996); Mora (1997); Behrman, *et al.* (1997); Alderman, *et al.* (2001)]. Robust results have been reported by a

very few studies from other countries with a lack of consensus on the effects of school quality even among these studies.

What is the role of school quality and other determinants? Two main approaches are used in the literature. In the first, cognitive functions are evaluated [Alderman, *et al.* (2001); Arif and Saqib 2003; Das, *et al.* (2006); Aslam (2009); Sandy and Duncan (2010)]. In the second, child school participation is modelled explicitly taking into account the schooling options. Alderman, *et al.* (2001) uses a nested logit framework to evaluate the child school participation in government versus private schools in Lahore, urban Pakistan. They employ an area-frame sampling methodology and included low-income areas, measuring household and school level characteristics. They incorporate controls for home background and school inputs into the nested logit framework. For rural Pakistan no similar exercise has been undertaken. This study provides one, focusing on quantifying child's school participation differences based on school quality provision in the two types of schools along with other important determinants. It is important to note that the studies of Arif and Saqib (2003), Das, *et al.* (2006) and Aslam (2009) looked for child achievement differences between state and private schools. But the research by Alderman, *et al.* (2001) is the only study that also evaluated child participation differences.

The nested logit framework has been widely used in the education economics literature for evaluating school choice decisions in other countries. Meschi, *et al.* (2011) investigates the relative importance of pupil attainment (test score), parental aspiration (whether the parent wants his child to stay at school) and local labour market conditions (unemployment rate) in post compulsory schooling decisions in England. They conclude that child's educational achievement and parental aspirations are the main drivers of the schooling rather than local market conditions. Checchi and Jappelli (2004) utilise a large cross-sectional data set on child's school attendance in private and public schools in Italy. They have information on household income, demographic characteristics, parental education and school quality. They control for school quality with an index of the subjective assessment of private and public schools by households. Their results show that school quality is the main factor in the choice between public and private schools in Italy. Private schools in the US are shown to have cream skimming effects;[1] that is, they skim off the most able and wealthiest students [Epple and Romano (2008)]. Also, in the United States, the private schooling decision depends on parental education, household income, racial composition of public schools, location, and crime rate in the area of residence [Lankford, *et al.* (1995)]. A proxy for school quality 'expenditure per student and tuition fee' does not affect parental school choice. Buddin, *et al.* (1998) establish that parental characteristics (age, income and education) are the main factors affecting private school choice. Proxies for school quality of public and private schools (teacher's salaries and expenditure per student) do not affect this decision. Overall the literature identifies a range of factors relevant to the private schooling choice but offers no consensus that school quality is the main driving factor affecting school choice decisions, perhaps partly because experience varies by country.

The paper is organised as follows. Section 2 presents an overview of schooling in Pakistan. Section 3 describes private-public school data. The nested logit framework is

[1]Epple and Romano (2008) did not utilise the nested logit framework.

presented in Section 4. In Section 5 results of the main econometric findings on child's school participation are discussed. Finally, Section 6 concludes.

2. EDUCATION IN PAKISTAN: AN OVERVIEW

Investment in education is a pre-requisite for sustained improvement in the wellbeing of individuals and societies. But Pakistan's social indicators are low in comparison to countries at the same level of development. Pakistan lies at the low end of Education Development Index (EDI) in the region [NEP (2017)].

Every child is entitled to free and compulsory education under article 25(A) of the Constitution which states that "The state shall provide free and compulsory education to all children of the age of 5-16 years in such manner as may be determined by law". Detailed laws and rules have been framed to enforce the said constitutional provision in the country but much needs to be done to execute it in true letter and spirit.

According to Pakistan Education Statistics (PEC) (2015-16) total education institutions in the country (from pre-primary to university level) are 303,446, comprising 191,065 public and 112,381 private institutions. Total enrolment, in both sectors, is 47.49 million, out of which 27.69 million is in public sector and remaining 19.80 million is in private sector institutions. Further disaggregation at the gender level shows that 56 percent of the total enrolled children are male while 44 percent are female students. At the pre-primary level total enrolment is 8.745 million (public 4.532 million (52 percent) and private 4.212 million (48 percent)). The primary level (I-V) of education in Pakistan accommodates 18.75 million children (public 11.461 million (61percent); private 7.290 million (39 percent)). The middle (VI-VIII) level of education enrols 6.445 million children (public 4.039 million (63 percent); private 2.403 million (37 percent)). The enrolment at secondary (IX-X) school level is 3.437 million (public 2.227 million (65 percent); private 1.209 million (35 percent)). Whereas total enrolment at higher secondary school level is 1.697 million (public 1.325 million (78 percent); private 0.372 million (22 percent).

In Pakistan there are almost 51.17 million children between the ages of 5 and 16 [PEC (2015-16)]. Out of these, about 28.53 million children go to any educational institution (government or private), and the rest (22.64 million children) are out of school. According to the available statistics, Pakistan stood 2nd in terms of out of school children in the world [NEP (2017)]. The out of school estimate for primary school going age children is nearly 5.03 million, while estimates for middle, high and higher secondary level are 6.40 million, 4.88 million and 6.33 million, respectively. Not surprisingly, more girls are out of school than boys. The under financing of education implies more illiterates, low enrolment, high dropout rate and low learning outcomes.

Spending on education has remained static at around 2 percent (of GDP) for the past couple of years, with about 92 percent being spent on salaries (recurrent head), only a meagre amount is spent on quality improvements (about 8 percent as development head) such as provision of school infrastructure, curriculum development, teachers' training, monitoring and supervision. More than half (64 percent) public sector primary schools have electricity. About 60 percent schools have drinking water, 54 percent have latrines, and 65 percent are with boundary wall. Nearly 80 percent of private sector primary schools are electrified. About 85 percent schools have drinking water facility, 84 percent

have latrines, and 81 percent have boundary wall [ASER (2015-16)]. This shows that education provision in public sector schools is not satisfactory. Barely 40 percent children, in public sector schools, have required competency in mathematics, science and languages [NEP (2017)]. Furthermore, public sector education provision also faces the problems of gender disparities, inequitable access and high dropouts. In this situation, considerable presence of private sector education provision is imperative. Accordingly, private sector is supporting the education in Pakistan by accommodating more than 41.69 percent of the total enrolment in the country, while providing quality education.

Expenditure on education (percent of GDP) in other countries of the region is greater than that in Pakistan. According to Pakistan Economic Survey (2015-16), expenditure as percent of GDP is 3.8 percent in India, 6 percent in Bhutan, 4.6 percent in Afghanistan and 5.2 percent in Maldives. The low level of education expenditures, as percentage of GDP, in Pakistan reveals a big gap in policy and practice.

3. DATA SOURCE AND SCHOOL CHOICE

The empirical analysis of this study is based on the Pakistani Rural Household Survey, second wave, of 2004-5 (PRHS-II). This data source offers a unique combination of child level data and a wide range of school quality indicators, essential for the present study. The PRHS-II, was restricted to Punjab and Sindh due to security concern, and is comprised of 1614 households. The PRHS-II also interviewed 293 split households[2] leading to a sample of 1907 households. The child age range of the present study is 5-15 years. Some of the PRHS-II households had no children less than 15 years of age. Therefore, the final sample is reduced to 1427[3] households (with 3918 children) spread over 94 rural communities (villages).

The PRHS-II survey collected information on agricultural-related activities, credit, employment, and several demographic events as well as households' consumption information for the month preceding the survey.

PRHS-II is a representative household survey data which combines information from a village and school census. The school census contains comprehensive information on all schools within each village and schools lying within a 2 km walk of the border of each settlement of the village. GPS coordinates were available, so the distance between each household and school could be calculated. The school census contains information on 1326 schools of which 1112 (84 percent) have classes at the primary level (up to grade 5). About 63 percent of these schools are solely primary/elementary schools, while the rest primary schools were attached to a middle or high school. Government school provision is central in determining access to education as nearly three-fourths of primary schools are public (90 percent in Sindh province).

The descriptive statistics based on Pakistan Rural Household Survey (PRHS) reported in Table 1 shows that more than half of school age children (51 percent) are not

[2]A split household is defined as a new household where at least one member of the previous panel household has established a new household permanently. The movement of the member from the panel household is due to the marriage of a female member or to a son or brother deciding to live separately from the panel household. In PRHS, households split only within a sampled village (PSU) were interviewed. Those households who split or moved out of the sampled villages were not followed due to high cost involved in this process [Arif and Farooq (2012)].

[3]667 households in Sindh and 760 households in Punjab.

in school. The relevant proportion of enrolled children is 49 percent. Besides, it is shown that there are two main school types in Pakistan, government and private. The relevant proportion of government school children in the survey is 88.96 percent. Whereas the same figure for private schools is 11.04 percent. Private schools are for profit in Pakistan.

The breakup of enrolled children over the provinces in Table 1 shows that out of 1708 (88.96 percent) enrolled children in government schools, 901 children are in Punjab and 807 children in Sindh. Total number of children enrolled in private schools is 212 (11.04 percent), of which 199 are in Punjab Province and the remaining 13 children are from Sindh. These figures support the FBS (2000) claims/estimates that much of the mushrooming of private institutions has happened in Punjab than anywhere else in the country in the last two decades.

Table 1

Enrolment by Province

School Type		Enrolment by Province								
		No			Yes			Total		
		Sindh	Punjab	Total	Sindh	Punjab	Total	Sindh	Punjab	Total
No-schooling	Count	1,124	874	1,998	–	–	–	1,124	874	1,998
	Percent	100	100	100	–	–	–	57.82	44.28	51.00
Government	Count	–	–	–	807	901	1708	807	901	1,708
	Percent	–	–	–	98.41	81.91	88.96	41.51	45.64	43.59
Private	Count	–	–	–	13	199	212	13	199	212
	Percent	–	–	–	1.59	18.09	11.04	0.67	10.08	5.41
Total	Count	1,124	874	1,998	820	1,100	1,920	1,944	1,974	3,918
	Percent	100	100	100	100	100	100	100	100	100

Source: Calculated from PRHS-II.

4. ESTIMATION STRATEGY

4.1. The Nested Logit Model

For modelling the outcome variable on child's school participation, unordered nested logit is preferred over other discrete choice models (multinomial or conditional logit models) because it relaxes the strong assumption of independence of irrelevant alternatives (i.i.a).[4] The nested logit model is interpreted with the underlying principles of utility-based choice theory, the random utility maximisation (RUM) model. Utility[5] in an indicator of value to the decision maker—here the parents—and is derived from the attributes of alternatives. The utility maximisation rules state that the decision maker will choose the alternative from the available set of alternatives that maximises his/her utility.

Suppose 'U_{ij}' is the true utility to the decision maker 'i' from alternative 'j'. Utility 'U_{ij}' is the sum of a deterministic (observable) part 'V_{ij}' and an unobserved stochastic part 'ε_{ij}';

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

[4]The conditional logit model takes into account alternative-specific regressors; however, like the simple multinomial logit model it assumes the independence of irrelevant alternatives. The independence of irrelevant alternatives (i.i.a) implies that the relative odds between two alternatives are the same no matter what other alternatives are available.

[5]The utility, here, is referred to the expected utility of the returns to investment in child schooling.

The estimated probability 'P_{ij}' that decision maker *'i'* selects alternative *'j'* is equal to the probability of 'U_{ij}' being the highest of all '$U_{i1},\ldots U_{ij}$'. The alternative that the decision maker *'i'* chooses is denoted by $y_i \in [1....J]$. Hence the probability is

$$P_{ij} = pro(y_i = j) = pro(U_{ij} > U_{ik} \qquad \forall j = 1,..k...,J : k \neq j)$$

$$P_{ij} = pro(y_i = j) = pro(\varepsilon_{ik} - \varepsilon_{ij} \leq V_{ij} - V_{ik} \ \forall j = 1,..k...,J : k \neq j) \qquad \ldots \quad (2)$$

Different assumptions regarding the distribution of the random error terms 'ε_{ij}' associated with the utility of each alternative, given the observable portion of the utility 'V_{ij}', result in different model representations and predicated choice probabilities [Koppelman and Bhat (2006); Cameron and Trivedi (2009)]. The observable portion of the utility 'V_{ij}' is specified as;

$$V_{ij} = X_{ij}^{'} \beta_j + Z_j^{'} \gamma_j \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Where 'X_{ij}' are alternative-specific regressors and 'Z' are individual specific regressors. Alternative-specific regressors vary over individual as well as alternatives. These variables include school quality characteristics of government and private schools available to the household. School quality variables have been made to vary by alternative, as these inputs may have different productivities in government and private schools and important for assessing parental choices between these schools. Similarly, for no-school choice the vector of school quality characteristics is a null vector. Alternative-specific variables accounted for in this study include:

X_{ij} = (number of schools in the community, student-teacher ratio, toilet facility for children, school boundary wall, electrified schools, furniture for students, textbooks for students, teacher experience, teacher qualification, schools with a playground, schools with a library).

Whereas, individual-specific regressors describe the characteristics of the decision maker. Specifically, individual specific variables accounted for in this study include:

Z_t = (Child sex, child age, own farm animals, own non-farm animals, household expenditure, fertility, mother's level of education, father's level of education, land owned, land owned squared, land ownership dummy, credit constraint, province).

The nested logit model requires that a nesting structure (D_n; n=1, ..., N) be specified that partitions the alternatives into groups. Errors are correlated within group but uncorrelated across groups. In the present context, the schooling decision is partitioned into two nests. Sending children to school modes (Government and Private) share the nest D_{Yes} = {*government, private*} and the other mode not sending children to school (no-schooling) belong to nest D_{No} = {*no-schooling*}. Further details about parental decision of child schooling decision are given in Appendix A.

Specifically, subscripts (j,k) denote the alternatives, where j denotes the upper level (limb) and k denotes the branch (lower level) within the limb (see Appendix A, Figure A1). For instance, $(1,2)$ denotes the second alternative in the first limb.

$$V_{jk} + \varepsilon_{jk} = Z_j^{'} \gamma + X_{jk}^{'} \beta_j + \varepsilon_{jk}, \quad j = 1, \ldots., J, \;\; k = 1, \ldots., K_j \quad \ldots \quad \ldots \quad (4)$$

Here $'Z_j'$ varies over the limbs and $'X_{jk}'$ varies over both branches and limbs. The subscript '*i*' for individual is suppressed, for ease of explanation. In nested logit model $(\varepsilon_{j1}, \ldots. \varepsilon_{jK})$ are distributed as Gumbel's multivariate extreme-value distribution. The probability that alternative (j,k) is selected is equal to;

$$p_{jk} = p_j \times p_{k/j} = \frac{\exp(Z_j^{'} \gamma + \theta_j I_j)}{\sum_{m=1}^{J} \exp(Z_m^{'} \gamma + \theta_m I_m)} \times \frac{\exp\left(X_{jk}^{'} \beta_j / \theta_j\right)}{\sum_{l=1}^{K_j} \exp(X_{jl}^{'} \beta_j / \theta_j)} \quad \ldots \quad \ldots \quad (5)$$

Here, $I_j = \ln \sum_{l=1}^{K_j} \exp(X_{jl}^{'} \beta_j / \theta_j)$ is called log sum and $'\theta_j'$ called the dissimilarity parameters.

The 'θ_j' characterises the degree of substitutability between government and private alternatives, and represents correlation between the unobserved (error) components for these two alternatives in the same nest. Its value is bounded by zero and one $(0 < \theta_j < 1)$ to ensure consistency with the random utility maximisation principles. The values outside this range mean that the model is inconsistent with random utility theory. Smaller value of 'θ_j' indicates greater substitution between government and private school alternative in the nest. The probability of private school is equal to the probability of choosing child schooling times the conditional probability of choosing private schooling given that child schooling mode is chosen. Similar interpretation could be undertaken for the government school option.

Estimation involves specifying the alternative-specific regressors 'X_{jk}' and individual-specific variables 'Z_j' (Equation 4) and inserting them into Equation 5. The log likelihood for Full Information Maximum Likelihood (FIML) estimation of the model [Green (1997)] is as follows:

$$LnL = \sum_{i=1}^{n} Ln(prob(j \setminus D) \times prob(D))_i$$

Where *'j'* represent alternative in each nest and *'D'* denotes the relevant branch/s or nest/s.

4.2. Coefficient Interpretation of Alternative Specific Variables

Mathematically, the marginal effect of a change in characteristic *'r'* of alternative *'j'* on the likelihood that individual *'i'* would select alternative *'k'* (where alternative *'k'* may or may not be equal alternative *'j'*) is given as;

$$\partial prob\,[y_i = k] / \partial X_i(r \mid j) = [1(j = k) - P_{ij}] P_{ik} \beta_r \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

For example, a positive coefficient in the main utility function on one of the alternative-specific variables means that if the regressor increases for one category, then that category is chosen more and the choice for other categories decreases or chosen less. A positive coefficient on the variable 'Proportion of schools with a textbook for students' means that if the textbook proportion of one of the school options (government or private)

increases, then demand for that option increases and demand for other options decreases, and vice versa for a negative coefficient. The coefficients of case-specific variables (e.g. household expenditure and other socio-economic variables) are interpreted as the parameters of a binary logit model against the reference category.

There are two common ways to estimate the partial effect of a continuous variable on the response probability; Average Marginal Effects (AMEs) and Marginal Effects at sample Mean (MEMs).[6] Greene (2003) shows that the estimates from both AMEs and MEMs would be the same in large samples but may not be in moderate and small samples. But current practice favours AMEs, when possible, because econometric software packages were not supporting or able to calculate AME until recently. Therefore, AMEs has also been estimated in this study.

The definitions of the vector of alternative-specific variables (school quality) and vector of case-specific variables (child and household level controls) are given in the following.

4.3. Variable Definitions

The vector of school quality-related variables includes: number of schools in the community, student-teacher ratio, toilet facility for children, school boundary wall, electrified schools, furniture for students, textbooks for students, teacher experience, teacher qualification, proportion of schools having playground, and proportion of schools having library. School availability and accessibility in the community entails significant opportunity cost to the parents in terms of child's time going to and from school to home, as well as, if a particular school is not available in the community or nearby community with implied characteristics. Greater disutility associated with child's school farther from home and most importantly, travelling to and from school is not productive [Alderman, *et al.* (2001)]. Previous research in the area [as in Alderman, *et al.* (2001); Ersado (2005)] focussed on number of schools to proxy school accessibility/availability. However, even if schools are available to individual households in the local area, such schools do not have the appropriate quality attributes. Then number of schools alone would not be able to proxy school accessibility/availability. In such circumstances, the nearest school would have much more disutility to parents than the one a bit farther in the community. Therefore, we also control for the aforementioned school quality attributes/capacity variables along with the number of schools in the community. These capacity variables reflect the educational infrastructure available to all households in the community and could be an important determinant in the explanation of child's school participation. However, to distinguish school capacity/infrastructure effect from school crowding effect, we also control for the number of pupils per teacher. For instance, few schools might be available in a particular community having the implied school quality characteristics but might be over crowded due to greater parental evaluation/child participation.

A variety of variables are used in the literature for capturing school quality, including average expenditure per pupil and the student-teacher ratio. Hanushek (1994)

[6]For computing marginal effects, one usually evaluates Equation (6) at the sample mean of the data (Marginal Effect at Sample Means, MEMs). Alternatively, the marginal effects may be evaluated at every observation and then these individual marginal effects are averaged across the sample (Average Marginal Effects, AMEs).

concluded that increase in spending has no positive effects on student achievement/ attendance. However, Greenwald, *et al.* (1996) found that increased spending did significantly enhance student performance.

On the student-teacher ratio, Betts (1996) argues that a reduction in class size increases the length of stay of children in school. Reviewing evidence on school quality indicators for studies in the United States, especially the student-teacher ratio, Harbision and Hanushek (1992), found that out of 152 studies using the student-teacher ratio as a school quality indicator, 59 obtained positive effects (coefficients), 48 inferred negative effects and results from other 45 studies were undetermined. Mora (1997) has attached some other interpretation to the positive and negative coefficient on the student teacher ratio. He argues that secondary schools with relatively large student-teacher ratios have higher quality as secondary school teachers are more specialised; he refers to it as a school scale effect, whereas primary schools with bigger student-teacher ratios have lower school quality because teachers are unable to impart basic skills to primary school students due to lower interaction. A recent study from urban Lahore in Pakistan by Alderman, *et al. (*2001) found that the student-teacher ratio has positive coefficients in both the school attendance and cognitive achievement equations.

Teacher experience and teacher quality (qualification) have been employed to capture the school quality effect on attendance/student achievement as well e.g. see Behrman, *et al.* (1997) for a review. Furthermore, the size of the school has appeared as an indicator of school quality.

In their study for rural Pakistan Behrman, *et al.* (1997, p. 127) gave a summary of the evidence on school quality indicators, citing a survey of 96 studies for developing countries [Harbison and Hanushek (1992)]; none of six common input measures had statistically significant positive effects for more than two thirds of the studies and only half of them—facilities, teacher education, and expenditure per student (with the last of these based on relatively few studies)—had significantly positive effects in half of the studies. The student-teacher ratio had significant coefficients in half of the studies, but the sign was the opposite of that presumed in half of these significant cases.

All school quality related variables[7] are community-level averages/expected values of school quality inputs (by school type) used by households in the community (apart from number of schools in the community).

Community-level school quality variables/expected values of school quality inputs are used on the ground that these do not reflect the characteristics of the specific school a child attends [Alderman, *et al.* (2001)]. The characteristics of the specific school a child attends are determined jointly with the schooling decision, hence are endogenous to schooling [Deaton (1988); Alderman, *et al.* (2001)]. But community-level school quality variables/expected values of school quality inputs are not endogenous to household-level child schooling decisions [Alderman, *et al.* (2001); Ersado (2005)].

Alderman, *et al.* (1996) and Behrman, *et al.* (2008) assumed the availability and quality of local schools as exogenous for their estimates. The availability and quality of

[7]Our school quality correlates are village/community level averages of schools in a village and village level school quality regressors do not vary within a village. A small error correlation for children in each village would lead to a great downward bias in the default standard errors, as well as in heteroskedasticity-robust standard errors. Hence, given the importance of cluster standard errors we estimated cluster standard errors of the regression estimators over the villages.

local schools are determined by district and higher level decisions and are not in direct response to village characteristics and household demands.

The vector of family attributes contains different household level and child level characteristics. Other possible determinants of child schooling include child sex (gender), child age, household head age and sex, parental educational level and ownership of productive assets such as land and animals [Bhalotra (2003)]. The effect of age on child schooling has been reported from many empirical studies as negative and quadratic. Child schooling is decreasing in age if child labour productivity is increasing in age. The other view is that child labour may get social acceptability or viewed as less harmful as the child age advances [Bhalotra (2003)]. A gender differential in child schooling participation is measured because of variation in returns to education or remittance propensities between boys and girls.

Parental levels of education of both mothers and fathers are included to allow for their possible impact on child schooling and employment [Strauss and Thomas (1995); Bhalotra (2007)]. Educated mothers have a greater say in household decision making and may increase the efficiency of household resource allocation towards child schooling [Bhalotra (2007)]. Also, they may be more altruistic towards their children [Strauss and Thomas (1995)].

Parental income or wealth is measured by household level income (also known as 'household income net of child earnings') as calculated by Bhalotra (2007). This excludes income from child employment to measure household poverty more accurately and to avoid endogeneity with child labour, but includes non-labour earnings and savings income. The variable has been made consistent over households using the OECD (1982) Equivalence Scale [also called Oxford scale,[8] see Jenkins and Cowell (1994)]. It is desirable to utilise more than one indicator. Bhalotra and Heady (2003) reported that the children of households having *more* land are *less* likely to be in school than work.[9] Transaction costs for child labour (family and hired labour are not perfect substitutes) mean that a household with more land has an incentive to employ more of its children [Alderman, *et al.* (1996)]. Farm animals typically supply milk and milk products for their owners' consumption and also are a source of income from sale of the surplus. Non-farm animals usually provide power for agricultural operations.[10] The two categories of animals have different implications for child activity; child schooling is decreasing in farm animals and increasing in non-farm animals [Hou (2010)]. Hence, livestock ownership and possession of land variables are included as possible explanatory variables for schooling.

[8]Equivalence scales correct for the fact that the needs of the each household grow with each additional member but not proportionally. Needs for space, electricity and so on are not twice as high for a household with two members as for a single individual. With equivalence scales each household member is assigned a value in proportion to their needs. The OECD equivalence scale or the Oxford scale assigns a value of 1 to the first member of the household and of 0.7, 0.5 to each additional adult and child, respectively, in the household. Specifically the formula is; $H = 1 + \alpha(n_A - 1) + \beta n_C$, where $\alpha = 0.7$ and $\beta = 0.5$ and, n_A and n_c are the number of adults and children in the household.

[9]Bhalotra and Heady recognise that wealth is often stored as land/other productive assets. Wealth buys leisure but it also demands labour; given imperfect labour markets. So in interlocked and imperfect agrarian markets; there may be perverse or non-linear relationship of schooling/child labour and wealth.

[10]Farm animals include the cow, buffalo, goat and sheep, whereas non-farm animals include the horse, donkey, camel and bullock.

Income smoothing, from year to year, may matter [Jacoby (1994) and Fuwa, *et al.* (2009)]. But measurement of credit access is problematic [Ersado (2005)]. Distance from a commercial bank at the community level is used as proxy for access to the formal credit market - while recognising that it may be a poor indicator. A provincial (regional) dummy is included to capture spatial variation in labour demand, price and productivity, as well as in culture.

Table 2 shows that 47 percent of the children are female. Majority of the households (76 percent) own farm animals. Household income net of child earnings is Rs 15886 for all children. Average number of children born to a couple is 4.54. Parental education is quite low as evident from Table 2. About 44 percent of the households are land owners. The average plot size is nearly 4.52 acres.

Summary statistics for local school quality over the 94 villages are reported in Table 3. Public schools are higher in number than private schools. School quality variables show a wide variation between communities. Student-teacher ratio is higher in public schools than in private schools. Private schools compared favourably with government schools on the available school quality indicators except for playgrounds, textbook provision and average teacher experience. Provision of toilet facility, libraries, furniture availability for students, potable drinking water facility, black board/chalk, electricity in the schools, school boundary wall, is higher in private schools than in the public schools.

Table 2

Mean and Standard Deviation of Child and Household Characteristics

	All (N=3918)		Boys (N=2072)		Girls (N=1846)	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Child Sex (Female)	0.47	0.50				
Child Age	9.68	3.18	9.73	3.24	9.63	3.10
Child Age Squared	103.86	63.49	105.24	65.06	102.31	61.66
Own Farm Animals (Yes)	0.76	0.43	0.76	0.43	0.76	0.43
Own Non -Farm Animals (Yes)	0.27	0.44	0.27	0.45	0.26	0.44
Household Income net of Child Earnings	15886.31	11780.65	16182.68	12141.96	15553.66	11355.50
Fertility	4.54	1.95	4.45	1.95	4.64	1.94
Mother's Level of Education						
Primary	0.07	0.25	0.07	0.25	0.07	0.26
Middle	0.01	0.09	0.01	0.09	0.01	0.08
Secondary	0.01	0.10	0.01	0.10	0.01	0.11
Higher Secondary	0.01	0.07	0.00	0.07	0.01	0.08
Tertiary	0.00	0.04	0.00	0.05	0.00	0.02
Father's Level of Education						
Primary	0.24	0.43	0.24	0.42	0.24	0.43
Middle	0.06	0.23	0.06	0.24	0.05	0.22
Secondary	0.07	0.25	0.07	0.25	0.07	0.25
Higher Secondary	0.03	0.16	0.02	0.15	0.03	0.17
Tertiary	0.02	0.13	0.01	0.12	0.02	0.14
Land Owned in Kharif 2004	4.52	12.82	4.85	14.30	4.16	10.91
Land Ownership Kharif (Yes)	0.44	0.50	0.43	0.50	0.45	0.50
Distance to Nearest Bank	8.82	6.93	8.85	6.77	8.78	7.12
Province (Punjab)	0.50	0.50	0.52	0.50	0.48	0.50

Source: Calculated from PRHS-II.

Table 3

Mean and Standard Deviation of School Quality Attributes

	All Schools(N=94)		Public (N=93)		Private (N=37)	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Percentage of schools with a toilet facility	61.50	28.31	55.17	29.01	98.65	8.22
Percentage of schools with a furniture for students	73.33	27.20	69.57	30.07	70.90	36.95
Percentage of schools with a blackboard/chalk	90.16	19.03	87.64	20.82	90.99	25.34
Percentage of schools with a playground	40.51	29.84	41.89	32.17	38.29	34.32
Percentage of schools with a potable drinking water facility	65.46	32.20	61.37	33.38	94.73	18.63
Percentage of schools with a boundary wall	61.45	30.17	57.74	29.38	88.51	26.74
Percentage of schools with a library	21.63	21.55	20.66	22.27	35.99	37.08
Percentage of schools with textbooks for students	74.33	26.89	79.08	25.43	45.95	49.13
Percentage of electrified schools	51.05	31.23	45.49	31.15	87.75	31.60
Number of schools in a village	6.65	3.02	4.69	2.61	2.16	1.21
Student-teacher ratio	34.10	13.08	35.45	13.40	23.52	9.12
Average no. of teachers with primary qualification	0.07	0.20	0.06	0.21	0.14	0.39
Average no. of teachers with secondary qualification	1.24	0.98	1.23	1.02	1.43	1.28
Average no. of teachers with bachelor qualification	4.35	3.83	4.21	4.02	5.65	3.62
Average no. of teachers with master qualification	3.01	4.43	3.13	4.60	2.93	8.10
Average teacher experience (years)	11.23	7.22	12.46	4.51	5.64	4.19
Average no. of classrooms per school	2.56	2.42	5.39	3.83	7.94	5.34

Source: Calculated from PRHS-II.

5. SCHOOL CHOICE RESULTS AND DISCUSSION

This section presents results on nested logit multinomial model of child school participation in rural Pakistan. Important policy correlates are controlled for in the nested model estimation. The model notably identified many variables significantly affecting the child schooling decision. It shows the appropriateness of the nesting structure adopted that government and private schools are closer substitutes for each other than for the no-schooling option. (The estimate of 'θ_{Yes}' is in the range of $0 < \text{'}\theta_{Yes} < 1$).

Results on variables (case-specific variables) that are held constant across all three choices are reported in the first stage (top part of Table 4). The parameter signs of case-specific regressors indicate the relative utility from choosing the no-schooling option versus the schooling option. Results that allow differential utility across the three alternatives, parameter estimates of alternative specific variable, are presented in the second stage (bottom part of Table 4). A joint parameter has been estimated for each school quality attribute as school quality attributes vary over both alternatives as well as individuals. The direct and cross average marginal effects (AMEs) of statistically significant alternative specific variable (school quality indicators of government and private schools) are also calculated and interpreted subsequently (Tables 5-9). Tables 5 and 6 present AMEs for all children, Tables 7 and 8 present results for boys, and Table 9 presents results for girls.

Table 4

Nested Multinomial Logit Model for School Choice in Rural Pakistan (All Children, Boys and Girls)

	Column (1) All Children	Column (2) Boys	Column (3) Girls
No School versus School Option			
Child Sex (Female)	–0.845*		
	(–7.38)		
Child Age	1.126*	1.365*	0.867*
	(14.58)	(11.98)	(6.15)
Child Age Squared	–0.0577*	–0.0679*	–0.0472*
	(–14.76)	(–12.11)	(–6.53)
Own Farm Animals (Yes)	0.0809	0.0909	0.0553
	(0.56)	(0.58)	(0.30)
Own Non Farm Animals (Yes)	0.0531	–0.0263	0.146
	(0.41)	(–0.16)	(0.92)
Household Income net of Child Earnings [(a)]	3.825*	3.792*	4.761*
	(4.27)	(3.18)	(3.17)
Household Income net of Child Earnings Square[(a)]	–2.779*	–1.531	–5.499*
	(–2.99)	(–1.17)	(–2.23)
Fertility	–0.0908*	–0.0510+	–0.128*
	(–3.44)	(–1.72)	(–3.22)
Mother's Level of Education	0.611*	0.507*	0.656*
	(4.46)	(2.75)	(3.98)
Father's Level of Education	0.251*	0.254*	0.255*
	(5.22)	(4.15)	(4.38)
Land owned in Kharif 2004	0.0148	0.000660	0.0805*
	(1.63)	(0.03)	(2.22)
Land owned in Kharif Squared 2004	–0.0000713	0.000108	–0.00121
	(–1.22)	(0.50)	(–1.52)
Land Ownership Kharif (Yes)	0.252*	0.377*	–0.104
	(1.99)	(2.39)	(–0.43)
Distance to Nearest Bank	–0.0159	–0.0109	–0.0220
	(–1.12)	(–0.62)	(–1.34)
Province (Punjab)	–0.160	–0.231	0.0562
	(–0.65)	(–0.92)	(0.15)
Choice of School Mode (Public, Private or No-schooling	School-Mode Choice	School-Mode Choice	School-Mode Choice
Average no. of classrooms per school	0.0220	0.0455+	0.0000985
	(1.15)	(1.91)	(0.01)
Percentage of schools with a toilet facility	–0.000783	–0.000310	0.0000865
	(–0.26)	(–0.11)	(0.03)
Percentage of schools with a furniture for students	0.0000325	0.00179	–0.00210
	(0.01)	(0.69)	(–1.11)
Percentage of schools with a blackboard/chalk	0.00529	0.00356	0.00630
	(1.23)	(0.85)	(0.99)
Percentage of schools with a playground	0.000794	0.00249	–0.00170
	(0.37)	(1.24)	(–0.67)

Continued—

Table 4—(*Continued*)

Percentage of schools with a potable drinking water facility	0.00154	0.00144	0.00185
	(0.63)	(0.63)	(0.68)
Percentage of schools with a boundary wall	0.00139	–0.000336	0.00237
	(0.48)	(–0.12)	(0.68)
Percentage of schools with a library	0.00220	0.000518	0.00276
	(0.89)	(0.21)	(0.77)
Percentage of schools with textbooks for students	0.00364^{+}	0.00450*	0.00216
	(1.93)	(2.42)	(1.06)
Percentage of electrified schools	0.00314	0.00241	0.00392
	(1.05)	(0.76)	(1.14)
Number of schools in a village	0.0751*	0.104*	0.0448
	(2.56)	(3.31)	(1.44)
Student-teacher ratio	0.0124*	0.0116*	0.0121^{+}
	(2.52)	(2.49)	(1.69)
Average no. of teachers with primary qualification	0.332	0.285	0.292
	(1.24)	(1.05)	(0.69)
Average no. of teachers with secondary qualification	0.152^{+}	0.117	0.148
	(1.69)	(1.48)	(0.90)
Average no. of teachers with bachelor qualification	0.0273	0.0208	0.0342
	(1.62)	(1.11)	(1.47)
Average no. of teachers with master qualification	–0.0187^{+}	–0.0181^{+}	–0.0246^{+}
	(–1.86)	(–1.79)	(–1.81)
Average teacher experience (years)	–0.0624*	–0.0564*	–0.0631^{+}
	(–2.65)	(–2.61)	(–1.75)
Government			
_cons	–7.334*	–8.912*	–6.326*
	(–9.95)	(–10.15)	(–6.35)
Private			
_cons	–8.255*	–9.736*	–7.251*
	(–9.28)	(–10.08)	(–5.15)
yes_tau			
_cons	0.498*	0.534*	0.358
	(2.77)	(3.06)	(1.14)
no_tau			
_cons	1	1	1
Wald chi2	573.0	502.9	242.3
d.f	32	31	31
P	0.000	0.000	0.000
No of observations	11754	6216	5538
No of cases	3918	2072	1846
Alts per case			
Min	3	3	3
Avg	3	3	3
max	3	3	3
Log pseodolikelihood	–2753.22	–1474.17	–1238.24

t-statistics in parentheses (Std. Err. adjusted for 94 clusters in villages).

$^{+}p< 0.10$, $^{*}p< 0.05$

[a]Variable divided by 100000 for estimation.

Table 5

Nested Logit Average Marginal Analysis for Alternative Specific Variables (All Children): Government Alternative

Variables	Summary of d(P_j)/d(Government)				
		School-mode	Mean	Std. Dev.	Freq.
Number of schools in a community or village	Direct effect	Government	0.018	0.006	3918
	Cross effect	Private	–0.005	0.007	3918
	Cross effect	No-schooling	–0.014	0.004	3918
Student-teacher ratio	Direct effect	Government	0.0030	0.0010	3918
	Cross effect	Private	–0.0008	0.0012	3918
	Cross effect	No-schooling	–0.0022	0.0007	3918
Percentage of schools with textbooks for students	Direct effect	Government	0.0009	0.0003	3918
	Cross effect	Private	–0.0002	0.0003	3918
	Cross effect	No-schooling	–0.0007	0.0002	3918
Average no. of teachers with secondary qualification	Direct effect	Government	0.036	0.012	3918
	Cross effect	Private	–0.009	0.014	3918
	Cross effect	No-schooling	–0.027	0.009	3918
Average no. of teachers with master qualification	Direct effect	Government	–0.0045	0.0015	3918
	Cross effect	Private	0.0011	0.0018	3918
	Cross effect	No-schooling	0.0034	0.0011	3918
Average teacher experience (years)	Direct effect	Government	–0.0150	0.0050	3918
	Cross effect	Private	0.0038	0.0059	3918
	Cross effect	No-schooling	0.0112	0.0037	3918

Note: Calculation based on column 1, Table 4.

Note: d (P_j)/d (Government) stands for change in the probability of each alternative with respect to a given change in the attributes of government school.

Table 6

Nested Logit Average Marginal Analysis for Alternative Specific Variables (All Children): Private Alternative

Variables	Summary of d(P_j)/d(Private)				
		School-mode	Mean	Std. Dev.	Freq.
Number of schools in a community or village	Direct effect	Private	0.0060	0.0086	3918
	Cross effect	Government	–0.0045	0.0071	3918
	Cross effect	No-schooling	–0.0015	0.0024	3918
Student-teacher ratio	Direct effect	Private	0.0010	0.0014	3918
	Cross effect	Government	–0.0008	0.0012	3918
	Cross effect	No-schooling	–0.0002	0.0004	3918
Percentage of schools with textbooks for students	Direct effect	Private	0.0003	0.0004	3918
	Cross effect	Government	–0.0002	0.0003	3918
	Cross effect	No-schooling	–0.0001	0.0001	3918
Average no. of teachers with secondary qualification	Direct effect	Private	0.012	0.017	3918
	Cross effect	Government	–0.009	0.014	3918
	Cross effect	No-schooling	–0.003	0.005	3918
Average no. of teachers with master qualification	Direct effect	Private	–0.001	0.002	3918
	Cross effect	Government	0.001	0.002	3918
	Cross effect	No-schooling	0.0004	0.001	3918
Average teacher experience (years)	Direct effect	Private	–0.0050	0.0071	3918
	Cross effect	Government	0.0038	0.0059	3918
	Cross effect	No-schooling	0.0012	0.0020	3918

Note: Calculation based on column 1, Table 4.

Note: d (P_j)/d (Private) stands for change in the probability of each alternative with respect to a given change in the attributes of private school.

Table 7

Nested Logit Average Marginal Analysis for Alternative Specific Variables (Boys): Government Alternative

	Summary of d(P_j)/d(Government)				
Variables		School-mode	Mean	Std. Dev.	Freq.
Number of schools in a community or village	Direct effect	Government	0.025	0.008	3918
	Cross effect	Private	–0.006	0.010	3918
	Cross effect	No-schooling	–0.019	0.006	3918
Student-teacher ratio	Direct effect	Government	0.0028	0.0008	3918
	Cross effect	Private	–0.0007	0.0011	3918
	Cross effect	No-schooling	–0.0021	0.0007	3918
Percentage of schools with textbooks for students	Direct effect	Government	0.00109	0.00033	3918
	Cross effect	Private	–0.00028	0.00041	3918
	Cross effect	No-schooling	–0.00081	0.00027	3918
Average no. of classrooms per school	Direct effect	Government	0.0110	0.0033	3918
	Cross effect	Private	–0.0028	0.0042	3918
	Cross effect	No-schooling	–0.0082	0.0027	3918
Average no. of teachers with master qualification	Direct effect	Government	–0.0044	0.0013	3918
	Cross effect	Private	0.0011	0.0017	3918
	Cross effect	No-schooling	0.0033	0.0011	3918
Average teacher experience (years)	Direct effect	Government	–0.014	0.004	3918
	Cross effect	Private	0.003	0.005	3918
	Cross effect	No-schooling	0.010	0.003	3918

Note: Calculation based on column 2, Table 4.

Table 8

Nested Logit Average Marginal Analysis for Alternative Specific Variables (Boys): Private Alternative

	Summary of d(P_j)/d(Private)				
Variables		School-mode	Mean	Std. Dev.	Freq.
Number of schools in a community or village	Direct effect	Private	0.008	0.012	3918
	Cross effect	Government	–0.006	0.010	3918
	Cross effect	No-schooling	–0.002	0.003	3918
Student-teacher ratio	Direct effect	Private	0.0009	0.0013	3918
	Cross effect	Government	–0.0007	0.0011	3918
	Cross effect	No-schooling	–0.0002	0.0004	3918
Percentage of schools with textbooks for students	Direct effect	Private	0.00036	0.00050	3918
	Cross effect	Government	–0.00028	0.00041	3918
	Cross effect	No-schooling	–0.00008	0.00014	3918
Average no. of classrooms per school	Direct effect	Private	0.0037	0.0050	3918
	Cross effect	Government	–0.0028	0.0042	3918
	Cross effect	No-schooling	–0.0008	0.0014	3918
Average no. of teachers with master qualification	Direct effect	Private	–0.0015	0.0020	3918
	Cross effect	Government	0.0011	0.0017	3918
	Cross effect	No-schooling	0.0003	0.0006	3918
Average teacher experience (years)	Direct effect	Private	–0.0045	0.0062	3918
	Cross effect	Government	0.0035	0.0052	3918
	Cross effect	No-schooling	0.0010	0.0018	3918

Note: Calculation based on column 2, Table 4.

Table 9

Nested Logit Average Marginal Analysis for Alternative Specific Variables (Girls): Government and Private Alternative

Variables	Summary of d(P_j)/d(Private)	School-mode	Mean	Std. Dev.	Freq.
Student-teacher ratio	Direct effect	Government	0.003	0.001	3918
	Cross effect	Private	–0.001	0.002	3918
	Cross effect	No-schooling	–0.002	0.001	3918
Average no. of teachers with master qualification	Direct effect	Government	–0.0061	0.0028	3918
	Cross effect	Private	0.0018	0.0031	3918
	Cross effect	No-schooling	0.0042	0.0015	3918
Average teacher experience (years)	Direct effect	Government	–0.016	0.007	3918
	Cross effect	Private	0.005	0.008	3918
	Cross effect	No-schooling	0.011	0.004	3918
	Summary of d(P_j)/d(Private)				
Student-teacher ratio	Direct effect	Private	0.0012	0.0018	3918
	Cross effect	Government	–0.0009	0.0015	3918
	Cross effect	No-schooling	–0.0003	0.0005	3918
Average no. of teachers with master qualification	Direct effect	Private	–0.0024	0.0036	3918
	Cross effect	Government	0.0018	0.0030	3918
	Cross effect	No-schooling	0.0005	0.0009	3918
Average teacher experience (years)	Direct effect	Private	–0.0061	0.0093	3918
	Cross effect	Government	0.0047	0.0078	3918
	Cross effect	No-schooling	0.0013	0.0024	3918

Note: Calculation based on column 3, Table 4.

School Choice (All Children, Boys and Girls)

Table 4 column (1) reports estimates on school choice while controlling for family background and correlates on school quality.

In Table 4, school-mode choice[11] is a dependant dummy variable coded 0/1 and is important for modelling differential utility across the nested alternatives; namely government, private and no schooling. One parameter estimate is identified for each alternative-specific variable as these vary across individuals as well as alternatives. However, direct and cross-marginal effects of the reported parameters are calculated henceforth for a detailed explanation.

The dissimilarity parameter 'θ_{Yes}' is within the unit interval and corresponds to a correlation of about 0.49 between the error terms of government and private school alternatives (Table 4, column 1).

Girls are less likely to be in school than boys (Table 4, column 1). Schooling increases in child age but non-linearly. Relative to the probability of no-schooling, an increase in income leads to an increase in the probability of child schooling. However, the relationship holds non-linearly. The probability of child schooling decreases with

[11]It is also possible to estimate school-mode equation. Variable school-mode model the relative utility of case-specific variables from selecting the no school option versus the government and private school options. School quality variables could either go to the school-mode choice equation as alternative specific variables or as case specific variables to the school-mode equation but not both. Modelling school quality though school-mode choice equation permits estimating differential utility across the nested alternatives.

couple level fertility. Parental education is important for child schooling. Relative to the probability of no-schooling, an increase in parental education leads to an increase in child education. The effect of household plot size on child schooling, relative to no-schooling, is significant only in the case of girls (column 3). Girls' schooling increases in household plot size unlike boys. Households having more land are able or willing to finance their daughter's education. The variable measuring access to credit (distance to the nearest bank) has no effect on child schooling. The estimated coefficient has the implied sign (negative) but insignificant.

The coefficients on control for number of schools and school quality variable, percentage of schools with textbooks for students, is positive and significant for all children and boys only sample. When the percentage of free textbooks in private schools increases, then demand for private schooling increases and demand for government and no-schooling decreases. The coefficient on student teacher-ratio is positive and significant for the whole sample as well as for boys and girls. Similarly, when student teacher-ratio in private schools increases, then private schooling is chosen more than government and no-schooling options. The parameter estimate of variable (average number of teachers with secondary qualification) is significant only in the case of all children regression. The coefficients on variables average number of teachers with masters degree and average teacher experience per school are negative and significantly different from zero in all three equations.

Average Marginal Effects of Alternative Specific Variables (All Children)

Average marginal effects (AMEs) of alternative specific variables (school quality attributes) and control for number of schools are presented in Tables 5 and 6 for government and private schooling alternative, respectively. All own (direct) effects are positive and all cross effects are negative. Referring to Table 5, the probability of government schooling marginally increases (by 0.0009 percent)[12] with a small rise in the textbook provision percentage in government schools, while keeping all other variables at the sample mean. Similarly, the cross-derivative shows that with the same small rise in textbook percentage in government schools, the probability of private schooling and no-schooling falls by 0.0002 and 0.0007 percent, respectively. The interpretation of parameter estimates of direct and cross derivatives for average number of teachers with secondary qualification remains the same as for textbook percentage; however, the small increase in number of teacher with secondary qualification have bigger marginal impact than the same small increase in textbook percentage. Similarly, the probability of government schooling marginally increases (by 0.018 percent) with a small rise in the number of government schools in a community, while keeping all other variables at the sample mean. Similarly, the cross-derivative shows that with a small increase in government schools, the probability of private schooling and no-schooling falls by 0.05 and 0.14 percent, respectively. Table 6 reports average marginal effects (AMEs) with respect to private school attributes. The probability of private schooling marginally increases (by 0.0003 percent) with a small rise in the textbook

[12] As X (e.g. a school quality indicator) is in percent and Y is enrolment probability. Changing X by 100 percent means that the enrolment changes by 0.09 percent.

percentage in private schools, while keeping all other variables at the sample mean. Similarly, the cross-derivative shows that with the same small rise in textbook percentage in private schools, the probability of government schooling and no-schooling falls by 0.0002 and 0.0001 percent, respectively. The parameter estimates of average number of teachers per school with secondary qualification (direct and cross marginal effects) are interpreted similarly as for textbook percentage. However, a small rise in the number of teachers with secondary qualification has a bigger marginal impact than the same small rise in textbook percentage (Table 6). Also, the probability of private schooling marginally increases by (0.006 percent) with a small rise in the number of private schools in a community, while keeping all other variables at the sample mean. Similarly, the cross-derivative shows that with a small increase in private schools, the probability of government schooling and no-schooling decreases by 0.0045 and 0.0015 percent, respectively. An important observation follows from these direct and cross marginal effects for government and private school's quality attributes. Marginal improvements in quality of either private or government schools are equally likely to displace each other's children. However, a marginal increase in school quality correlates with increased *school attendance* in government schools more than in private schools.

Average Marginal Effects of Alternative-Specific Variables (Boys)

Average marginal effects (AMEs) of school quality attributes are presented in Tables 7 and 8 for government and private schools, respectively. All direct effects are positive and cross effects are negative. Referring to Table 7, the probability of government schooling marginally increases (by 0.0011 percent) with a small rise in the textbook provision percentage in government schools, while keeping all other variables at the sample mean. Similarly, the cross-derivative shows that with the same small rise in textbook percentage in government schools, the probability of private schooling and no-schooling falls by 0.00028 and 0.00081 percent, respectively. The interpretation of parameter estimates of direct and cross derivatives for student teacher-ratio, average number of classrooms per school in the community and control for number of government schools in a community remain the same as in the case of whole sample analysis.

Table 8 reports average marginal effects (AMEs) with respect to private school attributes. The probability of private schooling marginally increases (by 0.00036 percent) with a small rise in the textbook percentage in private schools, while keeping all other variables at the sample mean. Similarly, the cross-derivative shows that with the same small rise in textbook percentage in private schools, the probability of government schooling and no-schooling falls by 0.00028 and 0.00008 percent, respectively. Overall the AMEs for boys display similar behaviour as is the case of whole sample estimates; a marginal increase in school quality correlates with increased school attendance for boys in government schools more than in private schools.

Average Marginal Effects of Alternative Specific Variables (Girls)

Nearly all school quality variables including control for number of schools in a community are statistically not different from zero in the case of girls. Student

teacher-ratio is significant, while average number of teachers with masters degree and average teacher experience (years) are significant only at 10 percent level of significance. This shows that other factors might be of more importance than school quality of local schools for low attendance of girls in rural Pakistan. Average marginal effects (AMEs) for student teacher-ratio, average number of teachers with masters degree and average teacher experience (years) are presented in Table 9 for government and private schools respectively. All the direct effects are positive and cross effects are negative. In Table 9, the probability of government schooling marginally increases (by 0.003 percent) with a small rise in student teacher-ratio in government schools, while keeping all other variables at the sample mean. Similarly, the cross-derivative shows that with the same small rise in student teacher ratio in government schools, the probability of private schooling and no-schooling falls by 0.001 and 0.002 percent, respectively.

Average marginal effects (AMEs) with respect to private school attributes are provided in the same Table. The probability of private schooling marginally increases (by 0.0012 percent) with a small rise in student teacher-ratio in private schools, while keeping all other variables at the sample mean. Similarly, the cross-derivative shows that with the same small rise in student teacher-ratio in private schools, the probability of government schooling and no-schooling falls by 0.0009 and 0.0003 percent, respectively.

6. CONCLUSION

The aim of this paper has been to investigate the role of school quality in parental schooling decisions for their children in Rural Pakistan. Research from the perspective of public and private school phenomenon is lacking in rural Pakistan. This study uses a rich set of households and school data (nationally representative data of rural Pakistan) to conduct a comprehensive investigation of the factors that have been ignored in previous research. The analysis confirms that lower school attendance of boys seems to be the outcome of lower school quality than girls. The greater the number of schools (public or private) in the local communities the higher is the attendance. Class size also seems to be important for raising school attendance in rural Pakistan; however, the estimated coefficient is positive. Free textbooks provision to students is also important for improving school attendance in either public or private school. Teacher qualification also positively impacts all children attendance. Nearly all school quality variables including control for number of schools in a community are insignificant for girls. This shows that other factors might be more important than school quality in explaining low attendance of girls in rural Pakistan.

Furthermore, the result also shows substitution in enrolment, whereby increase in enrolments of one sector (public or private) leads to a decline in the share of the other. Both sectors are equally likely to displace each other's child enrolment. The magnitude of the coefficients on public school quality indicators is larger than the magnitude of the coefficients on private school quality indicators for the choice of enrolment in school. A marginal increase in school quality correlates with increased school attendance in government schools more than in private schools. The incremental benefits from improving state schools are much higher because the initial average quality is so low.

Improving the quality of public schools would require several considerations. First, research is needed on how best to improve school quality in rural Pakistan. Second, the role of school inputs provision needs to be investigated further to check whether school inputs really make a school more attractive; the most effectivee way to do this is to administer a randomised trial that provides school inputs to randomly selected schools. Third, the competence and willingness of the state authorities to improve state school quality are important. Fourth, there is a need to assess the balance of costs and benefits of raising school quality in state schools versus alternative programmes such as distributing subsidies to low income families to pay private school fees. The distributional consequences of this particular alternative are likely to be unacceptable to children who continue to be educated in state schools and continue to receive poor quality education. Fifth, the feasibility of public-private partnerships in schooling needs to be checked. Finally, once children are in school they must get the skills important for their life when they finish their schooling, therefore, more needs to be learned on how to make schools more effective in imparting important skills to children.

As far as individual and household factors are concerned, parental education, especially mother's education and household income have strong positive impact on child school attendance. Most recently, Andrabi, Das, and Khwaja (2012) also found in the case of Pakistan that educated mothers spend more time with their children and make certain that their children devote more time on homework when at home. In addition, the greater the number of children in the household the lower is the child school attendance. Credit constraint seems to be not problematic as the estimated effect is statistically insignificant. Size of landholding seems to be important only in the case of girls' schooling.

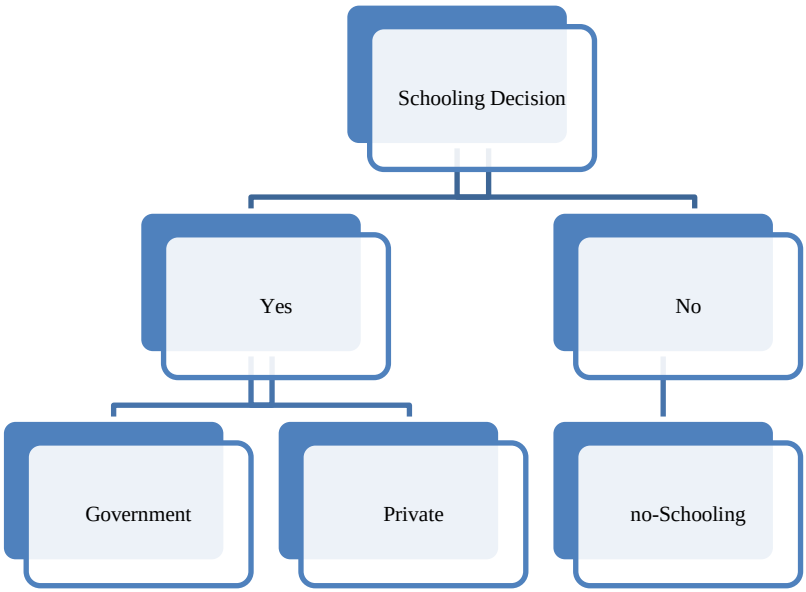
APPENDIX A

Generally the choice set is partitioned into '*N*' subsets (nests) 'D_n', *n=1,....., N*. The present case involves only one nesting level. Each available alternative in the choice set belong to exactly one nest. Nest '$D(j)$' to which alternative *j=1,.....,J* belongs is denoted as;

$$D(j) = \{D_n : j \in D_n, n = 1,.....N\} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

In the context of the present study, parental decision of child school participation is depicted in Figure 1. The schooling decision is partitioned into two nests *(N=2)*. Sending children to school modes (Government and Private) share the nest $D_{Yes} = \{government, private\}$ and the other mode not sending children to school (no-schooling) belong to nest $D_{No} = \{no - schooling\}$. Private and government schooling alternatives are more similar to each other than no-schooling alternative. Usually it is viewed convenient to interpret the choice as if there are two levels of decision; however, the derivation of nested logit model does not make such an assumption. The decision tree (Figure 1) and the hierarchy of choice are purely analytical devices and do not imply that a decision maker makes decision in certain order [Borsch-Supan (1987), cited in Koppelman and Bhat (2006), p.160]. Figure 1 shows an upper level (marginal) choice between going to school and not going to school and a lower level (conditional) choice between government and private schooling, given that going to school is chosen.

Fig. A1: Parental Child Schooling Decision (Decision Tree)



This representation is based on the assumption that some of the alternatives share common components in the error terms. The error term in the nested logit model is decomposed into a portion associated with each alternative and a portion associated with the group of alternatives in the same nest.

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