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Regional Disparities in Demand for Education: A Microeconometric Analysis for Pakistan

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Abstract: *This study identifies the determinants of household expenditures on education in four provinces of Pakistan. The household survey data are used to identify the factors that affect household's decision to spend on education. Lognormal hurdle model is employed which suggests that household income, gender and age of household head, awareness about education, school going children and rural urban residence affect household expenditures on education. Household expenditures on education are income inelastic implying that households consider education as an importance and necessary budget item. This elasticity is different in magnitude for Punjab, Sindh, KPK and Balochistan. The concavity of relationship between household expenditures and age of household head is evident. Female heads spend more on education than their male counterpart. Rural households invest less than urban households in education. Moreover, educational awareness, number of school going children also have positive effect on household expenditures on education.*

Keywords: Households, educational expenditures, double hurdle model, regional disparity.

Introduction

Education, as a driver of sustainable change, has received considerable attention in the literature and policy circles. Education is recognized as one of the most significant investments in human capital that improves mental ability of people and increases productivity (Romer, 1986; Barro & Lee, 2001). Sustainable development goal 4 is to ensure the inclusive and equitable quality education and promote lifelong learning opportunities for all, irrespective of economic status, age, region and gender. It is generally understood that education has a positive effect on other dimensions of sustainable development. Therefore, education has a central role to play for meeting other sustainable development goals (Kioupi & Voulvoulis, 2019).

A major part of population falls in schooling going age, 6-16 years, in Pakistan. The current literacy rate is 62.3 percent while 6.5 percent children of schooling going age are out of school in urban areas and 17 percent children of same age group are out of school

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in rural areas (Annual Status of Education Report, 2018). Considering the central role of education, households and government invest in education. During the last decade, government spending on education fluctuate between 2.1% to 2.5 % that is lowest in South Asia. Because of lower expenditures on education by the government, households are required to spend on education of children. It has implications for significant differential in expenditures on education at household level. High level dropout of children from schools demands for study of determinants of spending on education at household level in Pakistan. Moreover, overlooking the spending on education at household level may result in poor suppositions about household demand for education and hence, educational policy will remain fruitless.

There are enormous regional differences in geography, culture and preferences of households across provinces of Pakistan. Moreover, after the 18th amendment, provinces are responsible for the provision and system of education. Therefore, the study of household expenditures on education at provincial level is imperative for the educational policies in provinces. Therefore, this study tries to estimate impact of socio-economic variables on household demand for education in four provinces of Pakistan . In doing so, study utilized a double hurdle model for estimation of empirically specified model of household demand for education. We focus on the determinants of expenditure on education as these expenditures directly reflects willingness of households to pay for education of their children (Qian & Smyth, 2011).

Literature Review

Economists are interested in economics of education since the (Schultz, 1961), who developed human capital investment model. Whereas, specific literature on household educational expenditure suggests that socio-economic characteristics of households are leading factors that affect spending on education. Household income elasticity of demand for education is studied by Acar, Günalp, and Cilasun (2016) for Turkey; Ogundari and Abdulai (2014) for Nigeria; Himaz (2010) for Sri Lanka; Acerenza and Gandelman (2019) for Latin America and the Caribbean; Chi and Qian (2016) for China; Rizk and Abou-Ali for Arab Countries, among others.

Differences in household educational expenditures for boys and girls are reported by Aslam and Kingdon (2008) for Pakistan; Chowdhury, Nath, and Choudhury (2002) and Shafiq (2009) for Bangladesh; Masterson (2012) for Paraguay; Azam and Kingdon (2013) for India; Kenayathulla (2016) for Malaysia; Majumder and Mitra (2016) for West Bangal; Wongmonta and Glewwe (2017) for Thailand; Khanal (2018) for Nepal. Household head education as determinant of household educational expenditures has been discussed by Qian and Smyth (2011) for China; Andreou et al. (2012) for Cyprus. Gender of household head is also a significant determinant. Jenkins, Amala Anyabolu, and Bahramian (2019) for Nigeria; Iddrisu, Danquah & Quartey (2017) for Ghana reported that female heads spend more than male household head on education. Other factors that affect educational expenditures are household size, age of household head, rural urban residence

In this study, the term demand for education is used interchangeably with expenditures on education.

of household, number of schooling going children and regional factors etc.

Another series of studies also focus on determinants of household spending on private tutoring/shadow education. These studies include Tansel and Bircan (2006) for Turkey; Dang (2007) for Vietnam; Kim and Lee (2010) for South Korea; Pallegedara (2012) for Sri Lanka; Kenayathulla (2013) for Malaysia; Azam (2016) for India; Choi and Choi (2016) for Korea; Liu and Bray (2017) for China; Pallegedara and Mottaleb (2018) for Bangladesh. The results suggest that household characteristics are the main determinants of private tutoring.

Methodology

Empirical Specification

The study specifies an empirical model that relates expenditure on education (demand for education) with socioeconomic status and demographics of the household . Thus, the specification of demand for education is as follows:

$$lnE_i = Z_i\delta + \epsilon_i \tag{1}$$

In above specification; lnE_i is natural log of expenditures on education of the ith household ; Z_i is a vector of regressors, these variables are described in Table 1. δ is vector of parameters to be estimated and ϵ_i is error term.

In empirical model, dependent variable is expenditures on education. Conceptually, it is a corner solution model as dependent variable is truncated and piles up at zero but it has a continuous distribution for strictly positive values.

Table 1
Description of Variables

Ln (Total household income)	Total household income is measured in rupees and used in logarithmic form
HH head's age	Age of the household head
HH head's age square	Square of age of the household head
HH head's gender	"=1 if Household Head is female 0 otherwise"
Maximum level of education in a HH	Maximum level of education at household level is used as proxy variable for educational awareness at household.
Number of school going children	"Total members of a household who are currently attending the school, college or university"
Area	"=1 if Household lives in urban area 0 otherwise"

In a corner solution model, the observed dependent variable is expressed in terms of the latent variable y* as follows;

$$y* = x_i\beta + \epsilon_i \tag{2}$$

$$y = y* = if\ y* \geq 0$$

This empirical relationship is known as Engle Curve in the literature.

Since, these expenditures reflect real intention to pay for education by the households. Therefore, it is effective demand for education.

$$y = 0 = if\ y < 0$$

where y* is the latent variable while y is the actual observed value of y.

Econometric Methodology

In such cases, usually Tobit model is utilized but the assumptions of homoscedasticity and normality are usually not fulfilled that has serious consequences for the estimates. Moreover, it assumes the same probability mechanism which generates zero and positive values of dependent variables. Cragg (1971) proposed an alternative to Tobit model, a two parts/hurdle model that allows for different mechanisms for the generation of zero and positive values of dependent variables.

Hurdle model specifies a model for censoring mechanism and a model for the outcome conditional on the outcome being positive. Hurdle models have two parts; the first part is the participation decision to choice a positive y or not (y=0 versus y>0) while the second part is the amount decision; how much to expend given that expenditures are positive amount (y|y > 0). Two tiers are assumed independent of each other and are estimated separately. A double Hurdle model for household expenditures on education- a corner solution variable- can be specified as follows:

$$P(w = 1|x) = \sigma(x\gamma) \tag{3}$$

$$log(y)|(x, y > 0)\ N(x\beta, \sigma^2) \tag{4}$$

where y is household educational expenditures. x is the vector of regressors , γ and β are corresponding vectors of parameters to be estimated while Φ is the standard deviation of y. First equation is a binary outcome equation indicating that w follows probit model and second equation shows that conditional on $y > 0, y|x$ follows a lognormal distribution. This hurdle model is also known as lognormal hurdle model. The log transformation of y minimizes the problem of homoscedasticity and its distribution looks like the normal distribution. Using the properties of lognormal distribution, the conditional $E(y|x, y > 0)$ and unconditional expectations $E(y|x)$ can be estimated given $\hat{\beta}$, $\hat{\sigma^2}$ and $\hat{\gamma}$:

$$E(y|x, y > 0) = exp(x\beta + \sigma^2/2) \tag{5}$$

$$E(y|x) = \Phi(x\gamma)exp(x\beta + \sigma^2/2) \tag{6}$$

Estimation of parameters is proceed in two steps. First, maximum likelihood estimation (MLE) of γ is the probit estimator using a binary indicator w such that w=1 if $y > 0$ and w=0 if y=0. Secondly, β is estimated through OLS, which is attained from the regression of log(y) on x using only those observations where $y > 0$ i.e. education expenditures

Generally same regressors are used in two parts of the model but they may be different if exclusion restriction are apparent

are observed. The estimate of σ is usual standard error of regression of second equation estimated by OLS.

Demand for education involves two part decision making on the part of households. First, households' decision to enroll the children for the education, this is participation decision. Second, if having enrolled the children for education, then household determines how much to spend on education given their circumstances, this is expenditure decision. Therefore, the study employs lognormal hurdle model for separate estimation of empirical model for each province of Pakistan.

Moreover, the decision of spending on education could be nonrandom outcome as it may possibly an outcome of utility maximizing behavior of household. Thus, it could introduce the problem of selection bias in above empirical specified function. To test/correct for selection bias, Heckman two steps procedure is utilized. We employed this procedure and found no selection bias.

The analysis that follows, we present (i) Distribution of dependent variable (ii) Descriptive analysis of variables used (iii) Estimates of first part of double hurdle model; Probit estimates (iv) Estimates of second part of double hurdle model.

Data and Descriptive Statistics

Pakistan Social and Living Standards Measurements (henceforth PSLM) survey 2013-14 data are used. The PSLM survey covers the information on demographic characteristics, employment, education, health, household assets, population welfare, water supply & sanitation and household income and expenditures at national, provincial and regional level. The study utilizes on data for Punjab, Sindh, KPK and Baluchistan province.

To investigate the determinants of demand for education at household, the study used data on three sections of PSLM survey. These include demographic characteristics, household income and employment section and education section. The study dropped those observations where the data is missing or incorrect. For instance, those households who do not report their total income, who report their education expenditures more than their total income and who does not report their education expenditures but their children are currently attending school.

Summary statistics of dependent variable i.e. log of expenditures on education for each province are given in Table 2. On average, households in Punjab and KPK have higher spending on education than Sindh and Balochistan. Without logarithm of positive expenditures on education were not normally distributed for all provinces while distribution of positive logged expenditures on education show that mean and medium is almost identical and has a small standard deviation. Moreover, the skewness and kurtosis indicate dependent variable is normally distributed for all provinces. That is, dependent variable is symmetric and is considered normally distributed. Therefore, data fulfill requirement of log normality of dependent variable and lognormal hurdle model can be utilized safely for estimation of empirically specified model.

Summary statistics of the variables at provincial level representing Punjab, KPK, Sindh and Balochistan are reported in Table 3. It reports summary statistics for households

who spend on education in upper panel and those do not spend on education in lower panel. The average total income in Balochistan is slightly higher than other provinces for households with positive education expenditure while the average total income of Punjab, KPK and Sindh is nearly same. The average of total household income is lower for the households who do not spend on education in all the provinces of Pakistan.

Table 2
Summary of Dependent Variable: Log of HH Expenditures on Education

Statistics	Punjab	Sindh	KPK	Balochitan
Mean	9.385	8.641	9.364	8.422
Median	9.405	8.683	9.356	8.434
Minimum	2.996	3.912	3.912	4.382
Maximum	14.00	12.98	13.77	12.78
Standard Deviation	1.34	1.449	1.320	1.481
Skewness	-0.008	0.043	0.040	0.122
Kurtosis	2.960	2.352	3.003	2.573
NO. of Obs.	4612	2677	2189	875

The average age of household head is around 47 years for all provinces except Balochistan where it is 45.7 years. The average of expenditures on education of male household head in Punjab and KPK is greater than female household head while, in Sindh and Balochistan the situation is reverse. The highest average expenditures on education by male headed household are in Punjab whereas the highest average expenditures on education by female headed household are in Balochistan.

Table 3
Summary Statistics of Independent Variables

Variable	Punjab		Sindh		KPK		Balochistan	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Households with positive education expenditures								
Ln (Total household income)	12.37	0.780	12.30	0.598	12.36	0.820	12.50	0.560
HH head's age	47.18	12.08	47.41	11.77	47.65	12.14	45.73	12.13
HH head's age square	2372.6	1244.08	2111.04	1148.06	2418.32	1226.38	2237.88	1177.97
HH head's gender:								
Male	9.400	1.340	8.630	1.450	9.380	1.320	8.420	1.480
Female	9.160	1.390	8.910	1.250	9.150	1.300	9.190	1.850
Maximum level of education in a HH	8.380	4.610	7.790	5.270	8.310	5.210	7.380	5.410
Number of school going children	2.440	1.380	2.320	1.390	2.740	1.570	2.790	1.750
Area:								
Rural	8.990	1.280	8.160	1.290	9.030	1.220	8.080	1.350
Urban	9.870	1.250	9.62	1.240	9.840	1.310	9.160	1.490
Households with zero education expenditures								
Ln (Total household income)	11.985	0.896	11.85	0.540	11.98	0.896	12.10	0.570
HH head's age	46.39	15.69	40.68	14.53	46.196	15.69	41.79	13.59
HH head's age square	2404.2	1520.93	1866.19	1346.74	2380.1	1520.93	1930.58	1266.14
Maximum level of education in a HH	6.77	5.170	4.740	4.990	6.220	5.440	3.740	4.970
Number of school going children	0	0	0	0	0	0	0	0

Notes:
(i) HH denotes for household.
(ii) Statistics against each category of dummy variables are summary statistics of log of expenditures on education for that category

The highest average of maximum level of education in a household is 8.38 for Punjab and lowest average is 7.38 for Balochistan. Mean maximum level of education with positive expenditures on education is higher than those with zero expenditure on education in all provinces. At provincial level, the average number of school going children in a household is similar in KPK and Balochistan that it is about 2.75 and this average is lowest for Sindh preceded Punjab. The average of expenditures on education in urban areas is higher than rural areas for all the provinces. This difference is the largest in Sindh while KPK has the least difference.

Empirical Results

Table 4 presents first part of hurdle model; the maximum likelihood estimates for probit model for four provinces of Pakistan. These estimates show that household income has positive effect on decision to spend on education of children by households in Pakistan. This finding is consistent with the study of Ogundari and Abdulai (2014). Age of head of household has a positive and significant impact on decision to spend on education in four provinces. Age raises the likelihood of spending on education at a decreasing rate.

Table 4
First Part of Hurdle Model (Probit Estimates)

Variables	Punjab	Sindh	KPK	Balochistan
Ln (Total household income)	0.300***	0.587***	0.183***	0.418***
	-11.74	-14.28	-4.97	-5.71
HH head's age	0.110***	0.117***	0.115***	0.0819***
	-16.22	-14.11	-10.42	-5.22
HH head's age square	-0.00113***	-0.00120***	-0.00116***	-0.000760***
	(-16.73)	(-13.78)	(-10.49)	(-4.62)
HH head's gender	0.159*	-0.0621	-0.0798	0.418
	-2.39	(-0.51)	(-0.85)	-0.93
Maximum level of education in a HH	0.0161***	0.0368***	0.0295***	0.0541***
	-4	-8.66	-5.26	-7.16
Area	-0.00675	0.02	-0.0215	0.249**
	(-0.19)	-0.41	(-0.38)	-2.89
Constant	-5.836***	-9.853***	-4.402***	-7.317***
	(-18.18)	(-20.40)	(-9.28)	(-8.24)
N	6912	5092	2963	1515

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Gender of household head has significant effect on decision to spend on education in case of Punjab province while in other provinces gender does not matter. It suggests that female household heads tends to expend more on education as compared to male household heads in Punjab province. This finding is in line with Jenkins et. al., in case of Nigeria. Educational awareness at household level increases the probability of spending on education of children in all provinces of Pakistan. The coefficients of maximum level of education in a household are positive and highly significant. Educational awareness increase inducement about the value of education and households do not hesitate to spend more on education from their income. Living in rural or urban area does not significantly affect the probability of spending on education in provinces except Balochistan province.

That is, households residing in urban Balochistan have a higher probability of spending on education.

Table 5 provides the estimates of second part of hurdle model for four provinces; Punjab, KPK, Sindh and Balochistan. These estimates indicate the effect of regressors on positive education expenditures. The signs of coefficients are as expected and the coefficients are highly significant. Only the coefficient of gender is significant at 10% in case of Balochistan.

Household total income has a significant impact on demand for education in Pakistan. Its coefficient is positive and statistically significant for all provinces. That is; all else being equal, households with higher income spend more on education. Since, both household total income and expenditure on education, are in logarithmic forms. Therefore, these coefficients are the income elasticities of demand for education. These elasticities are positive but less than one. This implies that education is a necessity for household in four provinces of the Pakistan. Moreover, this elasticity is highest for Sindh and lowest for KPK. This finding appears similar to the findings of Acar et al. (2016) for Turkey, Chi and Qian (2016) for China and Ogundari and Abdulai (2014) for rural Nigeria. However, it does not support the findings of Himaz (2010) for Sri Lanka, Jenkins et al. (2019) for Nigeria and Acerenza and Gandelman (2019) for Latin America and the Caribbean who reported the income elasticity is greater than one, meaning that education is a luxury good for households.

Table 5
Second Part of Hurdle Model
Dependent Variable: Log of HH Expenditures on Education

Variables	Punjab	Sindh	KPK	Balochistan
Ln (Total household income)	0.547***	0.659***	0.374***	0.418***
	-24.26	-16.91	-12.10	-4.790
HH head's age	0.0221**	0.0219*	0.0368***	0.0704***
	-3.230	-2.420	-3.620	-3.730
HH head's age square	-0.000199**	-0.000190*	-0.000317**	-0.000708***
	(-3.020)	(-2.060)	(-3.170)	(-3.670)
HH head's gender	0.483***	0.362**	0.380***	0.746
	-8.180	-3.000	-4.740	-1.760
Maximum level of education in a HH	0.0747***	0.0529***	0.0711***	0.0391***
	-20.62	-12.57	-15.62	-4.590
Number of school going children	0.366***	0.373***	0.330***	0.355***
	-36.11	-27.09	-25.17	-15.24
Area	0.384***	0.895***	0.378***	0.664***
	-12.96	-20.80	-8.740	-7.820
Constant	0.324	-1.616***	2.075***	0.0669
	-1.100	(-3.410)	-5.060	-0.060
R-Square	0.520	0.580	0.490	0.440
N	4612	2677	2189	865

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

For all the provinces, the estimates of household head's age and age squared are statistically significant effect on spending on education. Signs of the coefficients of household head's age and its square are positive and negative, respectively. This shows the concavity of the relationship between the household head's age and demand for education at household level. This implies that the household heads with lower middle age spend more on education of their children while older household heads spend a smaller fraction

on schooling in Pakistan. This is consistent with the notion that the most of household heads have school going children at lower middle age. This finding is in line with (Tansel & Bircan, 2006; Wongmonta & Glewwe, 2017).

The coefficient estimates of gender of household head are statistically significant except for Balochistan. These results show that household head's gender matter in allocating budget for education in Pakistan. Positive coefficients show that female heads spend 48%, 36% and 38% more on education than male heads in Punjab, Sindh and KPK, respectively. Females are usually more concern about their children's education than the males and being head of household, female has greater decision power in household matters. Therefore, females allocate more budget for education. This is consistent with findings of Ogundari and Abdulai (2014); Jenkins et al. (2019) for Nigeria. In contrast, Kenayathulla (2016) for Malaysia; Bayar and İlhan (2016) for Turkey reported that male heads spend more on education of children.

Educational awareness at household level significantly affects the education expenditures in all provinces of Pakistan. The maximum level of education at household, a proxy variable for educational awareness, positively affects the spending on education. This implies that the higher educational awareness, the higher is spending on education at household. Himaz (2010); Shafiq (2009); Aslam and Kingdon (2008) reported similar findings using households' head education as proxy variable for educational awareness. It has important repercussions for intergenerational educational inequalities, hence the income inequality in Pakistan.

Having more school going children has a positive effect on educational expenditures in all the provinces; higher number of school going children, higher is the expenditures on education. This may be due to relationship of economies of scale and household size (Deaton & Paxson, 1998). The larger number of children are more likely to be in the households which are large in size. The members of larger households are able to share many goods which reduce their per capita expenditures. Therefore, they are able to spend a larger amount on education.

Finally, as far as urban vs rural residence is concerned, urban households spend more on education than rural households in Pakistan. This is evident as the coefficient of dummy variable area is highly significant for all the provinces. The expenditure differential of urban vs rural is lower in KPK and Punjab because the rural areas of KPK and Punjab are more develop as compare to Sindh and Balochistan and have better education facilities at primary and secondary level. In urban areas, costs of education is higher as many households send their children in private institutions to acquire human capital for a successful life in a competitive urban settings. Moreover, households, having higher preferences for education, migrate to urban areas and allocate more for education. Whereas, in rural areas, main provider of education are government schools that cost much less than private educational institutions. This finding is consistent with Andreou et al. (2012) for Cyprus; Wongmonta and Glewwe (2017) for Thailand; Khanal (2018) for Nepal; Jenkins et al. (2019) for Nigeria; Acerenza and Gandelman (2019) for Latin America and the Caribbean and, among other.

Conclusion

In this study, we identify the factors that affect the household expenditure on education in four provinces of Pakistan. The empirical evidence suggests that there are various explanatory factors of household expenditure on education. It shows a diverse picture in the provinces in terms of expenditures. Households in Punjab and KPK have higher spending on education than Sindh and Balochistan. Estimation of Engel curve suggests that education is a normal good and income inelasticity is less than one indicating that education is necessity item in household's budget in all the provinces of Pakistan. We report inverted-U shaped relationship of household head's age and demand for education. This implies that the household heads with lower middle age spend more on education of their children while older household heads spend a smaller fraction on schooling.

Gender of household head also has an impact on household allocation decision regarding education of household members. Female heads spend more on education than male heads in Punjab, Sindh and KPK province. Educational awareness at household affects the education expenditures in all provinces. Having more school going children has a positive effect on educational expenditures in all the provinces. Finally, urban households spend more on education than rural households in Pakistan.

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