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Affiliation:
Ghulam Sarwar
Assistant Professor, Noon Business School, University of Sargodha, Pakistan.
E-mail: sarwar41ss@uos.edu.pk
Maqbool H. Sial
Professor, School of Business and Economics, University of Management and Technology, Lahore, Pakistan. E-mail: maqbool.hussain@umt.edu.pk
Misbah Sher Muhammad
Department of Economics, The University of Lahore, Sargodha Campus, Pakistan.

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Determinants of Household Investment in Education in Pakistan

Ghulam Sarwar * Maqbool H. Sial † Misbah Sher Muhammad ‡

Abstract: *The purpose of this study is to examine the factors affecting investment in education at household level in Pakistan. The study utilizes household-level data from Pakistan Social and Living Standards Measurements survey. The findings show that household income, educational awareness, age and gender of household head, number of school going children, area and province of residence are the key determinants of household investment in education in Pakistan. There exists an inverted U-shaped relationship between investment in education and household total income confirming Engle's law for education expenditure in Pakistan. More importantly, household-level educational awareness has important implications for intergenerational educational mobility hence the income inequality.*

Keywords: Educational investment, household, Engle curve, tobit model, Pakistan.

Introduction

Human capital is a key determinant for growth and development that can be accumulated mostly through attaining higher level of education. The progress in human capital is the sole element of the economy, without it there is hardship, manual work and poverty (Schultz, 1961). Higher level of educational investment specifies more productive and skilled labors. Natural wealth is not the only source for the societal development, but the knowledge, experience and information are the core factors for it (Barro & Lee, 2001; Makasheva, Ischuk, Makasheva, & Kalashnikova, 2016). Moreover, the shortage of educated and skilled manpower seriously slows down the development process in developing economies as it is a necessity for healthy economy (Fields, 1973; Javed, 2018).

A significant proportion of Pakistan's population falls in schooling age category; 48% of the total population is between 05-24 years of age (LFS, 2013-14) having a population with a significant proportion of schooling age. This population can be translated into a demographic dividend by investing in education and skills formation. Moreover, Pakistan has a demographic dividend potential for economic development because the share of working age is on increase in its total population and is projected to continue this increase until 2040 (Bongaarts, Sathar, & Mahmood, 2013; Saad, 2016). It is very obvious that this pattern of demographic change has a potential to change the macroeconomic performance of Pakistan in the future. In addition, China-Pakistan Economic Corridor (CPEC)

* Assistant Professor, Noon Business School, University of Sargodha, Pakistan. E-mail: sarwar41ss@uos.edu.pk
† Professor, School of Business and Economics, University of Management and Technology, Lahore, Pakistan. E-mail: maqbool.hussain@umt.edu.pk
‡ Department of Economics, The University of Lahore, Sargodha Campus, Pakistan.

is going to be fully operational in near future. Therefore, to reap the demographic dividend calls for improvements in the education and skills of labor force through investment in education.

Society invests in education at two levels; government level and household level [1]. In case of Pakistan, there is reasonable information on government expenditures on education while knowledge about household expenditures on education is relatively limited. The expenditures by government and households are equally important. Both, government and household investments are interconnected and mutually dependent as absence or lack of either represents a sub-optimal allocation of resources. Thus, ignoring households' expenditures on education is costly because lack of information on these expenditures leads to imperfect suppositions about the willingness to pay for education by the households. These imperfect suppositions contribute toward ineffective design of the national educational policies. Therefore, it is imperative to study and analyze households' willingness to pay for education, or in general, demand for education in Pakistan.

The present study attempts to investigate effects of different socio-economic variables on investment in education at household level in Pakistan. To this end, study has employed a double logarithmic specification of Engel Curve to estimate the relationship between education expenditures and its determinants. Household's investment in education is measured by the household's expenditures on education. The study focuses on the determinants of expenditure on education at household level instead of determinants of educational attainment by the previous studies (Ahmed, Amjad, Habib, & Shah, 2013; Alderman, Orazem, & Paterno, 2001; Saqib, 2004). Expenditure on education directly reflects households' willingness to pay for education of their children whereas educational attainment is also a function of personal characteristics of the children along with the household characteristics and thus it partially explains the investment in/demand for education by households (Qian & Smyth, 2011). Secondly, we test the hypothesis that education is a necessary good in household budget and income elasticity of demand for education changes as level of income changes in Pakistan.

This study contributes to literature in three ways. Firstly, the study proposes maximum level of education at household as a proxy of awareness about education instead of using parent's educational level or household head's education level. Secondly, it concentrates on the demand side factors rather than factors of supply of education that have attracted more researchers in recent literature. Thirdly, unlike employing OLS or Tobit regression models, this study utilized log-normal Tobit models that corrects for the likely left-censoring in log of expenditure on education at household level, given the fact that a number of households are characterized by zero expenditure on education.

Structure of Education in Pakistan

In Pakistan, the education system consists of three levels: five years of primary education (Grade 1 to Grade 5), seven years of secondary education (Grade 6 to Grade 12) and

[1] The terms investment in education, demand for education and expenditures on education are used interchangeably in this study.

tertiary education. Additionally, there is pre-primary schooling (play group, nursery and prep classes) for children that starts from age of 3 or above. Technical and vocational institutions are also offering three-year diplomas program after completion of ten years of schooling. Besides public and private schools, free religious education is also provided by Deeni Madrassas (Religious institutes) with free boarding and lodging. Usually these Madrassas are run by local communities and are funded through donations and charity.

Across Pakistan, the structure of education provided by both public and private institutions is almost similar. After pre-primary schooling, primary education takes 5 years of schooling (Grade I to Grade V). Secondary education consists of middle level (Grade VI to Grade VIII), matriculation or Secondary School Certificates (Grade IX-X) and intermediate level or Higher Secondary School Certificates (Grade XI-XII). For upper-middle classes international examination systems (O level and A level) are also offered by private schools. After secondary education, 2-year graduation programs i.e. BA/B.Sc/B.Com are offered by colleges while universities offer 4-year graduation programs. After 2 years of graduations, the students can pursue for 2-year masters degree. After the completion of 16 years of education (2-year master degree/4 year's graduation) the students can enroll in taught/research based post-graduation programs MS/M.Phil (minimum 2 years) in relevant field of study. After MS/M.Phil program, PhD (minimum 3 years) is research based degree program offered by the universities.

Empirical Model and Econometric Strategy

This study estimates a double logarithmic Engel curve linking investment in education with total household income and the household's demographic composition. The econometric specification of double logarithmic Engel curve is as followed:

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

Where,

lnE_i is natural log of expenditures on education of the i^{th} household [2];

lnX_i is natural log of the total income of the ith household;

Z_i is a vector of other variables that reflects household's demographic composition which includes household head's age and its square, educational awareness, number of school going children at household and dummies for household head's gender, area (rural, urban) and provinces [3].

ϵ_i is error term.

α and β are the parameters while δ is vector of parameters to be estimated.

In the above specification, the expenditure on education and total income of household both are in logarithmic forms. Thus, the estimated effects are the income elasticity

[2]Household's investment in education or demand for education is measured by household's expenditures on education as these expenditures directly reflect households' real intention to pay for education of their children. That is, these expenditures represent effective demand for education at household.

[3]Benchmark categories for household head's gender, area and provinces are male, rural and Punjab, respectively.

of demand for education. The interest in estimating the household income elasticity is whether they are negative or positive. Negative value of income elasticity tells that the good is inferior whereas positive value of income elasticity shows that the good is normal. If elasticity is positive and more than zero but less than one then good is a necessity. If elasticity is positive and greater than one, in that case the good is a luxury.

The study deals with the model where the dependent variable is continuous but at some point the range of the variable is constrained. This happens when the dependent variable is zero for some fraction of the population and positive for the rest. This is a problem which is particularly common in household expenditures surveys because some households spend no money on particular goods. While analyzing the microeconomic data, the existence of zero expenditure in the dependent variable causes complications. Using standard econometric regression, for instance the Ordinary Least Square (henceforth OLS) results in biased and inconsistent results because of non-normality of the dependent variable. In such case, usually Tobit Regression is quiet a convenient choice to deal with the problem of zero household expenditure in cross-section data. The main advantage to use the Tobit Regression Model as compared to an OLS regression for limited dependent variable is that, it provides the results that are unbiased and consistent. In standard specification of Tobit regression model, the observed dependent variable is expressed in terms of the latent variable y^* as follows;

$$y^* = x\beta + \mu, \;\; \mu|x \sim N(0, \sigma^2)$$

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

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

or

$$y = max(0, y^*)$$

where y^* is the latent variable describing level of household expenditures on education. y is the actual observed expenditures of household. x is the vector of explanatory variables and β is a corresponding vector of parameters to be estimated. μ is assumed to be a normally distributed error term with zero mean and constant variance (σ^2). y^* fulfills assumptions of linear regression model, particularly, normality of its distribution.

In Tobit models, the marginal effects are base on two different expectations of the dependent variable: $E(y_i|x)$ which is the unconditional expectation on all values of dependent variable y_i, and $E(y_i|y_i > 0, x)$ is conditional expectation which tells the expected value of y_i for given values of explanatory variables, if $y_i > 0$. Conditional expectation can be found as follows (Wooldridge, 2013:598)

$$E(y|y > 0, x) = x\beta + \sigma\lambda\left(\frac{x\beta}{\sigma}\right)$$

While the unconditional expectation is obtained as follows:

$$E(y|x) = \Phi\left(\frac{x\beta}{\sigma}\right)\left[x\beta + \sigma\phi\left(\frac{x\beta}{\sigma}\right)\right]$$

Where $\lambda(\bullet) = \phi(\bullet)\Phi(\bullet)$ is the inverse Mills ratio; (ϕ) the ratio of the standard normal p.d.f (Φ) to standard normal c.d.f (Φ), evaluated at $\left(\frac{x\beta}{\sigma}\right)$.

The marginal effects are obtained from above conditional and unconditional expectations. If x_j is continuous variable (for example, total household income), its conditional marginal effect on y is obtained as follows:

$$\frac{\partial E(y|y>0,x)}{\partial x_j} = \beta_j\left\{1 - \lambda\left(\frac{x\beta}{\sigma}\right)\left[\frac{x_j\beta}{\sigma} + \lambda\left(\frac{x\beta}{\sigma}\right)\right]\right\}$$

The sign of these marginal effects will be same as β_j, but their magnitude depends on values of all X_s, β_s and σ. In case, when x_j is a dummy variable (for example, gender of household head), partial effect is difference of $E(y|y > 0, x)$ at $x_j = 1$ and $x_j = 0$. Similarly, partial effect of discrete variable (for example, number of school going children at household level), can be estimated [4]. Given x_j is continuous variable, the unconditional marginal effect of $x_j(y_i \geq 0)$ is calculated as:

$$\frac{\partial E(y|x)}{\partial x_j} = \beta_j\Phi\left(\frac{x\beta}{\sigma}\right)$$

This shows for example in case that household having zero expenditure on education may choose/start expenditure on education $(y > 0)$ if x_j changes. Moreover, these marginal effects allow comparison of Tobit estimates with OLS estimates.

The Tobit model discussed above is based on the assumption of normality. But data on expenditure (educational expenditure) are often not normally distributed. Therefore, these data are modeled as lognormal by transforming data on expenditures in log form. Tobit model for log normal involves a non-zero threshold and log normality of y. This model introduces log-normality as follows:

$$y^* = exp(x_\beta + \mu), \quad \mu N(0 - \sigma^2)$$

where,

$$y = 0 \quad if \quad lny^* \leq \gamma$$

$$y = y^* \quad if \quad lny^* > \gamma$$

Here $y = 0$ at data censoring point i.e. $\gamma \neq 0$, in general, this threshold (γ) equals lowest uncensored value of lny. In this model unconditional and conditional expectations respectively are obtained as:

[4] To take a partial derivative, must be a continuous variable. That's why, in case of dummy variables or other discrete variables marginal effects are estimated in this way.

$$E(y|x) = exp\left(x'\beta + \frac{\sigma^2}{2}\right)\left\{1 - \Phi\left(\frac{\gamma - x'\beta - \sigma^2}{\sigma}\right)\right\}$$

and

$$E(y|x, y > 0) = \frac{E(y|x)}{1 - \Phi\left(\frac{\gamma - x'\beta}{\sigma}\right)}$$

The partial derivatives of these expectations with respect to x_j, provide unconditional and conditional marginal effect of .

In the econometric analysis that follows, the study reports (i) Estimates of log-normal Tobit regression of expenditures on education at household (ii) Unconditional marginal effects (iii) Conditional marginal effects (iv) Estimates of OLS Regression of log expenditures on education at household.

Data and Descriptive Statistics

This study uses data from Pakistan Social and Living Standards Measurements (henceforth PSLM) survey of Pakistan for the year 2013-14, collected by Pakistan Bureau of Statistics. The PSLM survey is the most comprehensive household survey that comprises of rich information on households' income and expenditure patterns. The PSLM survey (2013-14) data give information on 17989 household from all regions of Pakistan. This analysis is limited to Punjab, Sindh, KPK and Baluchistan province that lessen the sample to 16482 households.

The expenditures on education are defined as the amount of money in rupees spent by a household on education. These expenditures include admission, examination or registration fees and expenditures on uniform, books, stationery, transport and hostel etc.

Table 1 provides the detailed summary of dependent variable i.e. household educational expenditures. Values in column show that amongst all households, 10343 households make investment in education (third column) while the rest spend no money on education in Pakistan.

Table 1
Summary Statistics of Dependent Variable

Statistics	Education Expenditures	Positive Education Expenditures	Log of Positive Education Expenditures
Mean	14923.38	23781.03	9.108
Medium	2600	9440	9.153
Minimum	0	20	2.996
Maximum	1204000	1204000	14.001
Standard Deviation	40839.97	49470.24	1.428
Skewness	9.978	8.42	-0.0511
Kurtosis	174.991	123.303	2.772
No. of Obs.	16482	10343	10343

The variable is positively skewed and has non-normal kurtosis (second column) if all the households are considered. When only households having positive education expen-

ditures are considered, there is a slight decline in skewness and kurtosis from 9.9 to 8.4 and 174.9 to 123.3, respectively. This shows that the dependent variable is not normally distributed. In general, for normality of the variable, which is positively skewed, it is transformed into logged form.

Last column of the table shows that distribution of log of dependent variable, if $lny > 0$, is approximately normal as mean and median are almost equal and standard deviation is very small. Moreover, coefficients of skewness and kurtosis are -0.051 and 2.8 respectively. That is, dependent variable has zero skewness i.e. it is symmetric and it may be considered normally distributed with confidence. Given the distribution of log of positive education expenditure, lognormal Tobit model becomes a proper choice for the estimation of proposed model of the study.

Table 2 presents summary statistics of the independent variables for the households with positive education expenditure and the households with zero education expenditure. The average of log of total household income for the households with positive education expenditures is 12.36 that is higher than the average of the households with zero education expenditures i.e., 11.95. On average the household head's age is 46 which indicate that the household head with upper middle age making education expenditures.

Table 2
Summary Statistics of Independent Variables

Variable	Obs	Mean	SD	Min	Max
Households with positive education expenditures					
Ln (Total HH income)	10343	12.36	0.73	7.78	17.75
HH head's age	10343	46.45	12.08	16	99
HH head's age square	10343	2303.31	1216.59	256	9801
HH head's gender:					
Male	9807	9.11	1.43	2.99	14
Female	536	9.12	1.35	5.48	13.12
Highest level of education at a HH	10343	8.13	4.99	0	19
Number of school going children	10343	2.51	1.47	1	15
Area:					
Rural	6232	8.68	1.35	2.99	13.54
Urban	4111	9.76	1.29	3.91	14
Provinces:					
Punjab	4612	9.39	1.34	2.99	14
KPK	2189	9.36	1.32	3.91	13.78
Sindh	2677	8.64	1.45	3.91	12.99
Balochistan	865	8.42	1.48	4.38	12.78
Households with zero education expenditures					
Ln (Total HH income)	6139	11.95	0.72	7.11	15.54
HH head's age	6139	43.63	15.35	16	99
HH head's age square	6139	2139.37	1461.68	256	9801
Highest level of education at a HH	6139	5.58	5.23	0	19
Number of school going children	6139	0	0	0	0

Notes:
(i) HH stands for household in this table and in the next tables.
(ii) Values against categories of dummy variables are the averages, standard deviations, minimum and maximum of expenditures on education for each category.
(iii) The average of expenditures on education for categories of dummy variables with zero education expenditures has not been reported in table because of their zero values.

The average of log of total education expenditure is 9.12 if a female is household head that is to some extent higher than if a male is household head. The average of highest level of education at the household with positive education expenditures (8.13) is greater than the average for the household with zero education expenditures (5.58). The average number of school going children in a household with positive education expenditure is 2.51. On average educational expenditures by the households living in urban area are greater than the households who reside in rural area. The average of the household's spending on education is 9.39 for Punjab followed by KPK (9.36), Sindh (8.64) and Balochistan (8.42).

Empirical Results

The maximum likelihood estimates for log-normal Tobit regression are given in the first column of Table 3. As the Tobit model estimates are not directly interpreted, we compute the unconditional marginal effects as well as conditional marginal effects that are reported

Table 3
Lognormal Tobit Maximum Likelihood and OLS Estimates

Variables	Tobit Estimates	ME (Unconditional)	ME (Conditional)	OLS Estimates
Ln (Total HH income)	0.443***	0.387***	0.299***	0.395***
	-11.72	-11.72	-11.7	-10.92
HH head's age	0.159***	0.139***	0.107***	0.142***
	-15.58	-15.61	-15.61	-15.08
HH head's age square	-0.002***	-0. 001***	-0. 001***	-0.001***
	(-15.24)	(-15.27)	(-15.27)	(-14.80)
HH head's gender	0.522***	0.466***	0.366***	0.461***
	-5.08	-4.99	-4.9	-4.61
Highest level of education at a HH	0.080***	0.070***	0.0543***	0.072***
	-15.47	-15.48	-15.45	-14.39
Number of school going children	1.728***	1.512***	1.165***	1.916***
	-118.59	-123.4	-112.09	-140.4
Urban	0.500***	0.441***	0.342***	0.457***
	-10.06	-10.01	-9.93	-9.36
KPK	-0.1096*	-0.096*	-0. 074*	-0.094
	(-1.81)	(-1.81)	(-1.82)	(-1.57)
Sindh	-0.687***	-0.594***	-0.454***	-0.607***
	(-12.73)	(-12.92)	(-13.02)	(-11.79)
Balochistan	-1.299***	-1.073***	-0.799***	-1.148***
	(-15.53)	(-16.67)	(-17.15)	(-14.65)
Constant	-6.234***	-	-	-5.771***
	(-13.20)			(-12.98)
Sigma	2.616874			
Log likelihood	-33200.392			
LR Chi-square (10)	14251.56			
Pseudo R^2	0.1767			
Total observations	16482			

Dependent Variable: Natural Logarithm of Expenditures on Education by Households.
Notes:
(i) *Significant at 10%; **Significant at 5%; ***Significant at 1%.
(ii) t-statistics are in parentheses.
(iii) Number of left-censored observations at ln (expenditures on education) are 6140 and number of uncensored observations are 10342.

in the column 2 and 3 respectively [5]. The unconditional marginal effect shows the effect of independent variable on expected value of households with zero and positive education expenditures, whereas the conditional marginal effect indicates the effect of independent variable on positive education expenditures. For comparison, OLS estimates are also reported in the last column of the Table 3. The marginal effects indicate that all estimates are with expected signs and are highly significant except the coefficient of the dummy variable for KPK that is statistically significant at 10 percent.

Income of household has a significant impact on investment in education. Other thing being equal, the expenditures on education will be higher for households with higher income irrespective of estimation methods. The coefficient of total household income is positive and significant and income elasticity is 0.299. This implies, holding other things constant, a 1% increase in total income of household increases educational expenditures by 0.3 percent suggesting that the education is a necessary good for households in Pakistan.

In general, income elasticity is not independent of changes in household income, thus income elasticity does not remain constant as income changes. This implies that share of expenditures on education tends to decline as total income of households increases which clearly indicates that richer households spend a smaller fraction of their incomes on education of their children in Pakistan. Bayar and İlhan (2016) found similar evidence for Turkey and reports that at lower quintiles households are more sensitive to change in their income. Whereas, Acar, Günalp, and Cilasun (2016) show that income elasticities for top and bottom income quartiles are lower than the middle income quartiles, that is, education is luxury good for middle income households while for upper and lower income households education is necessary good in Turkey. Kim and Lee (2010) showed that private tutoring is necessary good in South Korea. Similarly, Chi and Qian (2016) reported that education is necessary good in China and low income households spend a larger fraction of their income on the education of children.

The household head's age has a positive effect on education expenditures at decreasing rate, because coefficients of age of household head and its squared are statistically significant with positive and negative signs, respectively. This indicates that the household heads with upper middle age spend more on education of their children. This result is similar to (Tansel & Bircan, 2006).

It is very interesting that coefficient of the gender dummy shows that female household's head spend more on their children's education as compared to male heads. The conditional marginal effect indicates that the females head relatively spend 37 percent more than males head. This result may be due to the possibility that females are more concern about their children's education as compare to males. In case of Pakistan, Aslam and Kingdon (2008) using OLS and Hurdle models found the similar results.

Educational awareness at household is one of the most important factors which affect demand for education in Pakistan. The maximum level of education at household,

[5]For log-normal Tobit estimation, setting of lower limit of dependent variable is mandatory. Thus, setting of zero (i.e. zero education expenditures) as lower limit creates problem because the STATA mistakenly treats these observations to missing observations. To avoid this problem, we set 2.996 (the minimum positive value of dependent variable) as the lower limit.

a proxy variable for awareness about education, has a positive impact on education expenditures. By controlling the other variables, one year increase in maximum level of education at household increases the education expenditures by 5 percent for the sample households with positive education expenditures. This result indicates that the household with higher awareness of education spend more on education which is aligned with Arif, Raza, Friemann, and Suleman (2019). Aslam and Kingdon (2008) found a similar result that households' head having higher education spend more on education compare to heads with lower level of education in Pakistan. This finding has important implications for intergenerational educational mobility that leads to intergenerational income mobility.

The variable number of school going children is statistically significant with a positive effect on education expenditure. An increase in school going children increases the total education expenditures. An explanation is that the larger number of children is more likely to be in larger households given the joint family system in Pakistan. The members of larger households share many goods which reduce their per capita expenditures; therefore, they spend a larger amount on education of their children.

The rural urban disparity in expenditures on education is evident in Pakistan. The households living in urban areas are found to spend 34 percent more than those who live in rural areas. It is interesting that a large fraction of population in Pakistan lives in rural areas but the people who reside in urban areas have higher spending on education. This result may be because of the high costs of education in urban areas as the households in urban areas are expected to enroll their children in private institutions. While, in rural areas, there are either a few or no private educational institutions and principal provider of education are public schools in rural areas that is almost free in Pakistan. Similar result was reported by Kim and Lee (2010) and they pointed that the parents in big cities spend larger amount on their children's education.

Another difference in expenditures on education based on residing in different provinces is also obvious. The results show that the households who are residents of Punjab spend on average more on education of children as compare to the household that live in other provinces i.e. KPK, Sindh and Balochistan. This finding is consistent with descriptive analysis; average of the households spending on education is highest for Punjab followed by KPK, Sindh and Balochistan. The higher awareness about education, better facilities of education with a number of good educational institutions and universities in Punjab as compared to other provinces are the potential explanations for this phenomenon.

Conclusion

The objective of this study is to identify the factors that affect investment in education at household level in Pakistan. Investment in education is measured by expenditures on education at household. The empirical evidence suggests that investment in education is positively related to total income of household. This positive relationship implies that a reduction in cost of schooling may increase willingness to pay for education by the households in Pakistan. Moreover, a public policy just relying on an increase in pur-

chasing power to encourage more expenditure on education will not work successfully for the poor households, because they spend a larger share of their income on education. Therefore, more public resources should be devoted to ensure the equality of educational opportunity for the poor. In addition to this, distribution of laptops and scholarships to the students, despite on merit basis, have an alarming implication on equity ground. These resources should be used for children of poor households. Government should also design and encourage financial aid and loan programs for poor students through public as well as private banks to eradicate credit constraints for human capital investments.

Households, where level of education is higher, are likely to investment more for the education of their children. This finding has serious implications for intergenerational educational mobility hence the intergenerational income mobility, given a positive relationship of human capital and labor productivity. The hurdles to educational mobility can be removed by promoting the equality of educational opportunities. Moreover, the disparities in demand for education based on residence in rural-urban or in a province are evident in Pakistan. Therefore, it is essential to design and implement an inclusive education system.

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