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The level of Girls Education in Rural Areas of Pakistan Subject to Socio-Economic, Demographic and Schooling Characteristics: Count Data Models Approach

Zeeshan Rasheed, M.Phil. Scholar, Pakistan Institute of Development Economics Islamabad, Department of Economics and Econometrics Email: malikzee834@gmail.com
Dr. Babar Hussain, Assistant Professor, International Islamic University Islamabad, International Institute of Islamic Economics Email:Babar.Hussain@iiu.edu.pk
Aniqa Ijaz, Lecturer, University of Okara, Department of Economics Email:Aniqa.ijaz@uo.edu.pk
Muhammad Hashim M.Phil. Scholar, Quaid e Azam University Islamabad, School of Economics
Email: Dearshani22@gmail.com

Abstract- An important determinant of sustainable social and economic development is the education. The objective of this study is to diagnose the determinants of girls' level of education at household level in rural areas of Pakistan. In this study, the dataset of 941 girls aged 5-18 years has been obtained from Pakistan Rural Household Panel Survey 2014. The Generalized Poisson regression model has been utilized and its findings illustrate that household saving, household income, household assets, parent education, age and employment of household head have positive and significant effects on the girls' level of education. On the other side, head count poverty, farm work status, school joining age, family size, household debt, household expenditures, Govt. type school, repetition of last class and domestic work have negative impact on the girls' level of education. Furthermore, the girls who reside in or near to school and whose school distance is less are more likely to enroll in higher class than the girls who reside far away from school. The government should alleviate poverty and provide employment opportunities in rural areas. There is need to construct schools nearer to rural areas and improve the preschool facilities and functioning of public schools.

Keywords: Determinants, Household, Generalized, Education, Poverty, Education
JEL Codes: I21, I24, I25, I22, P36

I. INTRODUCTION

The education is an important tool to tackle the issues of income distribution and poverty along with facets of demographic, political and social developments. The human capital is relatively important in developing countries as compared to developed countries because education is core need for political, social and economic transformation of institutions. The role of the education in economic development is well recognized except the criticism of Chicago view which concludes, the productive role of education is negligible (Arrow & Spence, 1973). Some studies on Africa in 1970's concluded that the gender role was ignored in the development process and ignorance of gender role may have the adverse effects. This conclusion results in emergence of women in development approach which states women exclusion as problem of development. The roots of subordination of the women were seen in their ignored role in the market place and their control over resources. The solution of this subordination was to legislatively include the role of women 'in' development by overcoming the gender discrimination and by encouraging the women by providing the opportunities in employment and education. The Women in Development approach emphasizes on bringing women into development process to improve efficiency. However, this approach had some flaws like social injustice, exploitation and subordination. This approach also has an objective of fulfilling the needs of gender like the better access to water, so that women could save their time for domestic chores and could utilized their time for education and employment. At that time, the questions were not raised about the responsibility of collecting water by only women and improved access to water as essence for women. Contrary to Women in Development approach, Gender and development approach emerged in 1980s aimed to focus on the women and the effects of macroeconomic policies on their lives. Recently, the desire to recognize how gender traverses with some characteristics like sexuality, ethnicity and age has been renowned. The approach of Gender and Development identifies that it will be insufficient to include girls and women into prevailing development processes but it is also required to ask the question about why women remained excluded, supporting that the emphasis ought to be on demonstrating the imbalances of supremacy on the basis of this exclusion. The Gender and Development approach also defines the concept of 'development' and its gentle nature, indicating that there is need to transform narrow understanding of development as economic growth into social development. The Gender and development approach seeks the relationship between the economic and social roles of men and

women to gain the better environment for both gender (Aikman & Unterhalter, 2005). The development of a country largely depends on the education of residents without any hindrance. The Human development index representing the development of an economy consists of education, health and Per capita income. It means education is the fair determinant of economic development. The education not only contributes positively in the economic growth in terms of monetary benefits but it also has some real effects such as productivity of labor and farm's efficiency. In developing countries, Herz & Sperling (2004) provided extensive evidences about the four categories of returns to women education by following different circumstances across countries. The first category of returns shows the relationship between women empowerment and women education, a strong evidence supports that education improves women's bargaining power in the family and society (Barro, 1999; Sen, 2000). The second category of returns is that women education encourages themselves for a smaller, better-educated and healthier families (World bank, 2001; Hill & King, 1993). The third category of returns shows that women education prepares women for the best defense against HIV or AIDS, because well-being of family, empowerment, earning capacity of women and discouragement of risky health behavior increase due to HIV based education programs and other education programs (UNESCO, 2002). The fourth category is related to the positive effects of women education on the growth of individual and nation's income as whole. The structural transformation and growth of an economy is only possible by providing the equal opportunities of education to men and women. A woman utilizes the education as an instrument to reduce fertility rate and population growth. She engages herself in healthier activities so that she could bring her children up in healthier way (Chaaban & Cunningham, 2011). In developing countries, Pakistan is ranked as sixth most populous country in the world with 207.77 million population. Out of total population, 63.61 percent population belongs to rural areas and female contribution in rural population is 49.08 percent (Pakistan economic survey, 2018-19). The reason behind rapid increase in population is that the women proportion in rural areas is higher. The major portion of the population in Pakistan is young so younger females can be treated as resource which needs to be embedded with human capital to play a significant role in the economy of Pakistan (Mustafa et al., 2016). In 2006, Pakistan has been ranked at 134th in Human development index and quoted as an example among those countries where female education is less (OCSD, 2007).

The rural female gross enrollment ratio from primary to tertiary education in Pakistan is significantly lower than rural male (PSLM, 2014-15). The females belong to households adopting farming as profession from these rural areas are ignored and less preferred over males (Farid et al., 2014). In Pakistan, there are many constraints that affect the rural female enrollment in at different level of education. These constraints are generally classified in social, economic and regional constraints. The disparities in rural areas of all provinces are greater than urban like high poverty, lack of education institution and poor quality of education. In rural areas, these deficiencies result in schooling as a bad alternative for parents so that they could prefer schooling over the chores done by rural girl at homes (PESRP, 2012). The figure 1.1 shows the literacy rate of all provinces and graphs depicts the lower literacy rate of female as compared to male in all provinces.

Figure 1.1

Literacy Rate in Rural Areas of Provinces

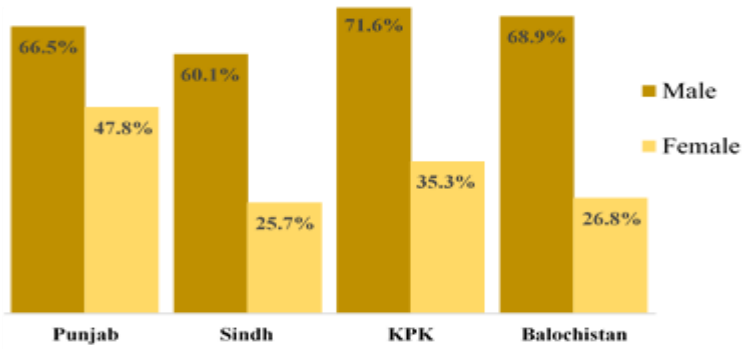


Figure 1.2

Percentage of Gender Enrollment in Punjab

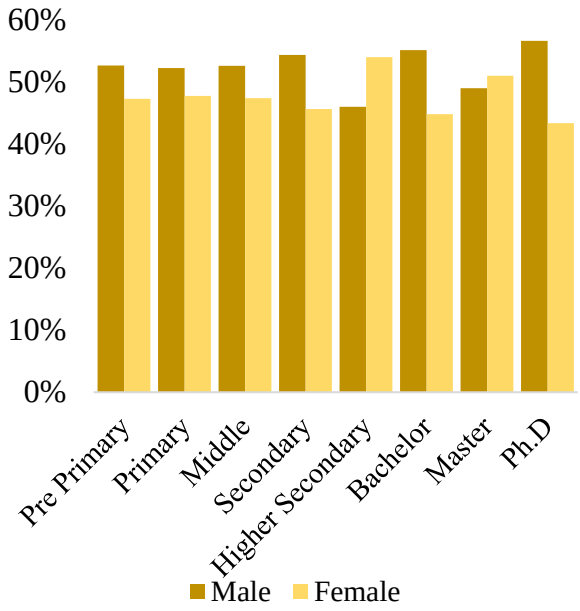


Figure 1.3

Percentage of Gender Enrollment in Sindh

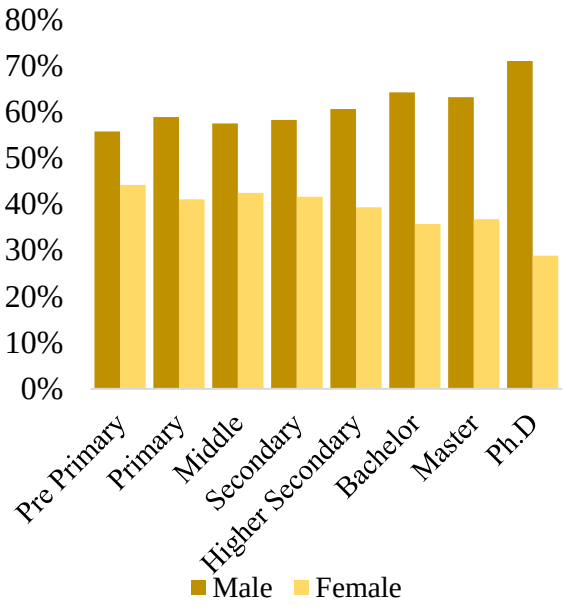


Figure 1.4

Percentage of Gender Enrollment in Balochistan

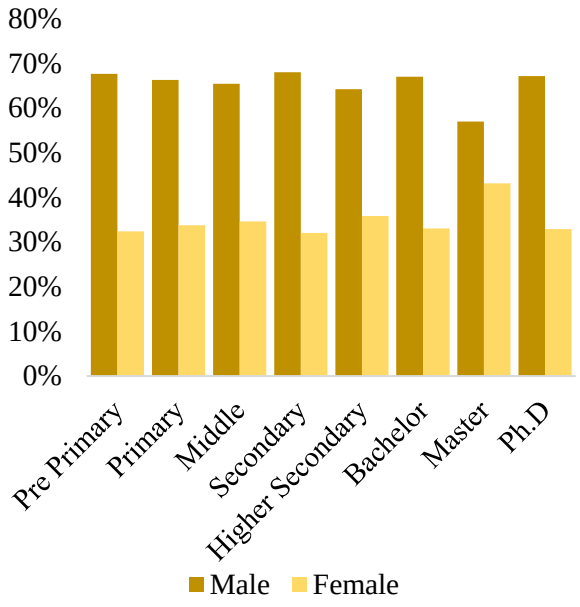
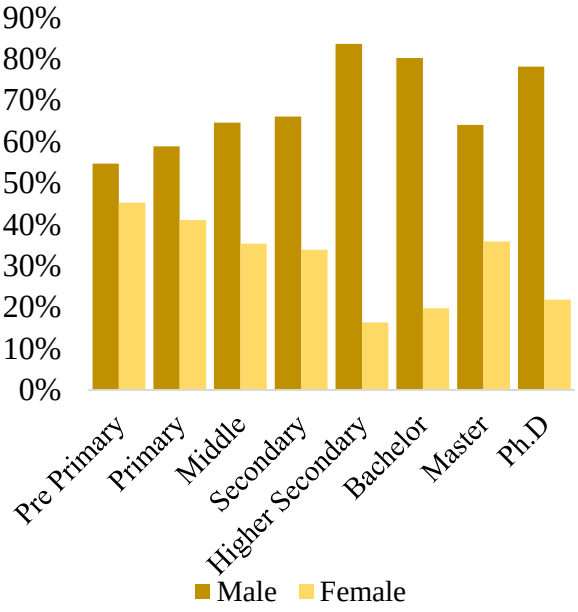


Figure 1.5

Percentage of Gender Enrollment in KPK



At province level, there is big difference between literacy rate of rural women and men. The figures 1.2 to figure 1.5 represent the four provinces of Pakistan, depicting that female enrollment at different level of education is less than the boy's enrollment in rural areas of all provinces. The 18th amendment in Pakistan Constitution resulted in more autonomy to each province. The implication of the amendment was that the planning, policy, syllabus and education standard will be the responsibility of each province. Therefore, the purpose of this study is to explore all possible socio-economic determinants that affect female attainment or level of education in rural areas of Pakistan. The identification of true determinants will help to develop effective education policy in the education sector of each province. The contribution of this study to the literature is to incorporate a set of qualitative as well as quantitative determinants that are not discussed in existing studies and play important role in determining the female attainment of education. This study also

has the research gap of empirical methodology which is not utilized by earlier studies in determining the female attainment of education.

II. LITERATURE REVIEW

The lower female enrollment has adverse effects at national level as well as at household level. There are many economic theories that highlight the significance of education in a country. The theory of human capital hypothesized that education increases the output and worker efficiency by growing the level of intellectual skills of labor force. The theory originated from famous development theory of macroeconomics. In 1950s, production function was consisted on four factors of production i.e. Labor, capital, land and entrepreneur (Mincer, 1962b; Becker, 1993). In 1960s, economists were struggling to analyze the economic growth of the United States based on these four factors of production but they faced lot of difficulties to explain it (Schultz, 1961). By then, an essential condition and assumption for economic growth was growth in capital as factor of production. Few empirical studies challenged this assumption first time in history of economics (Becker, 1964; Schultz, 1961 & Mincer, 1974). These empirical studies developed the hypothesis that people who acquire education increase the stock of human capital. Human capital theory illustrates that people who invest on training and education perform well in productive activities than those people who have less training and education. So, higher level of training and education rewards people with higher rate of return. The Endogenous growth model incorporated the technology as endogenous factor determining the economic growth in the long run. The technology progress is endogenous in the model showing that there are few determinants that determine the technological progress. The endogenous growth model considers the production function showing output depends on the technology, labor and capital. The labor engaged in research and development or human capital will result in new capital goods and technology. Hence, change in capital will positively depend on the labor engaged in more research and development or human capital. The endogenous growth theory depicts that investment on innovation, human capital and knowledge is an important determinant of economic growth. The knowledge-based economy results in spillover effects and positive externality which ultimately leads to economic development (Romer, 1986; Lucas, 1988).

Many studies have made efforts to identify the socio-economic factors that influence the female enrollment and their level of education. The tertiary education of rural women overcomes the gender disparities prevailing in non-farm sector employment. The women have more drop out ratio than male in initial stage of education at 14 years' age. In the joint family system, the unemployment rate of rural women with a young child is higher than the rural women living in nuclear family system (Dhanraj and Mahambare, 2019). The travel freedom, sexual harassment, feudalism, religious misconception, lack of higher education institutes and gender discrimination are the dominant perceived factors affecting female education. Sexual harassment is the mostly observed factor having negative influence on the female higher education. The parent permission for girls to acquire education has negligible outcome in lower female enrollment. Most of the people misinterpret the concept of religion regarding female education (Mehmood et al., 2018; Selvan, 2017; Salik, 2014; Sandhu et al., 2005; Shaukat & Pell, 2015).). In access to higher education, significant disparities exist between men and women emerging from background of parent, location and household wealth. However, children and parent aspirations for acquiring education hardly affect female education but household wealth significantly determines female education as liquidity improves (Sanchez & Singh, 2018).

The social criteria along with exorbitant unemployment among young generation diminishes women investment in human capital and imposes their dependence on men. It is concluded that economic situation may improve the status of women in conservative societies by relaxing human resources restrictions. However, this does not directly lead to improved social outcomes (Elsayed & Roushdy, 2017). In Pakistan, people do not prefer women education and hence, they are failed to build a strong society. Sick mentality and bad norms in society are the major factors behind the lower literacy rate of women. The status of a girl in rural areas has been very degraded due to gender biasness (Mustafa et al., 2016). Lower female enrollment in education and participation in labor market in Afghanistan have been resulted in higher fertility rate. The ban on the female education was a religious misconception that adversely affected. It was also observed that female teachers were not allowed to teach the girls who have age more than 8 years (Noury & Speciale, 2016). In Pakistan, the Supply Side requirements which incorporate school distance, lack of teachers and schools Quality regarding Physical amenities are accounted for by around 20 percent in an analysis. The regional differences with respect to rural development and population could not be ignored while analyzing rural enrolment because these plays significant role in determining level of education in rural areas (Jamal, 2014; Yaqoob, 2012). The families with lower income level and higher male to female ratio affect the rural female enrollment but encourage the male enrollment (Farid et al., 2014; Sathar et al.,

2013; Bradshaw et al., 2013). Access is probably going to be the principle determinant behind the enrollment in secondary schools. The representation of women at different level is hindered due to few obstacles such as social, cultural, individual and structural. An important reason behind this biasness against a woman is the society itself because society consists of organizations and individuals. People behave in a society followed by their socialization. Hence, these are social and cultural factors that underrepresent the status of women in each aspect of life (Batool, Sajid, & Shaheen, 2013).
The education of boys is preferred over the education of girls. The wealth level of the household and mother education are important factors determining the female enrollment in education institutions. Family size is also an important determinant of the female enrollment in education. The cultural characteristics played significant role toward female education as compared to male education (Bilal & Imran, 2012; Yusuf, 2013; Qureshi, 2012). In developing countries, the reduction in economic participation of women depresses the growth economic growth and female education is the only source which can improve women participation in an economy. These findings propose that nations with diversified initial levels of girls schooling and women participation in labor force will have diverse tracks to the development (Linkov, 2008). In most world communities, women are born to give birth and house chores. Women give birth to children and keep themselves busy to feed up newly born babies/ children. They are deemed to be as domestic helper while men are physically strong and leave their children for extended periods. Therefore, men are more likely to be engaged in venture such as hunting and fighting and other socio-economic activity. According to these social man-made norms, girls receive less food, less access to education, poor health care than a male child, and as a result, girls are more likely to die from childhood diseases. It has been reported that those girls who acquired training from vocational institutes have few chances to become teacher in vocational centers due to inefficiency of employment opportunities and lack of finances. The Drop rate of girls is very high and girls are kept home to do house chores or to take care of younger siblings/children, when requested by family or if the financial situation is very viable (Hirway & Mahadevia, 1996).

III. DATA AND METHODOLOGY

To achieve research objectives, this study targets three provinces of Pakistan named as Sindh, Punjab and Khyber Pakhtunkhwa. This study utilized the secondary data from Pakistan Rural Household Panel Survey (PRHPS) conducted and provided by International Food Policy Research Institute (IFPRI) and Innovative Development Solution (IDS) in 2014. Pakistan Rural Household Panel Survey 2014 contains data of 2018 rural households. The Pakistan Rural Household Panel Survey 2014 did not contain any information about the province of Balochistan due to war and security reasons there during the survey. Since, this survey contains education information or data for the women aged 5-18 living in a household therefore, the analysis of this study is also restricted to women aged 5-18. The econometric model of the study carries the count dependent variable represents level or attainment of education of girls. The sample size of enrolled female aged 5-18 is 941.
The model of the study to be estimated is as following:

$$z_i = \varphi_0 + \sum_{i=1}^{35} \varphi_i m_i + \varepsilon_i \quad z_i = (1,2,3,4,5,6) \qquad (3.1)$$

The explanatory variables are denoted by m_i and dependent variable is denoted by z_i. The subscript i represents a female or one cross-section. The parameters of the model are denoted by φ_i and ε_i represents the residual of the model. The count data model shown in equation (3.1) also carries dummy variables as well as continuous variables as explanatory variables. The standard distribution of Poisson is required to understand the different count data models. The objective to develop such distribution was to specify model having discrete choices. There are two restrictive assumptions of the Poisson distribution. The density function for Poisson distribution is shown below in equation (3.2).

$$\rho(Z = z_i) = \frac{e^{\gamma_i}\gamma_i^{z_i}}{z_i!}, z_i \in \{0\} \cup \mathbb{R}^+ \quad (3.2)$$

$$i=1, 2..., n$$

The expected value or conditional mean and variance of Z are equal in Poisson distribution and are represented by one parameter γ_i. The mean and variance of Z are the function of set of regressors and their respective parameters. The mathematical expression for this function can be shown below in equation (3.4).

$$E(Z|m_i) = \gamma_i = e^{(m_i'\varphi)} \quad (3.4)$$

Overdispersion takes place when conditional mean gets lower than the heteroskedastic conditional variance. The maximum likelihood approach estimates the Poisson regression model by utilizing either iterative reweighted least square or Newton-Ralphson formula. The equation of likelihood function for Poisson model is shown in equation (3.5).

$$l(\varphi) = \sum_{i=1}^{n}(z_i m_i'\varphi - e^{m_i'\varphi} - \ln(z_i!)) \quad (3.5)$$

The function in equation (3.5) depicts the global concavity and confirms the convergence. The Poisson model shows robustness in case of overdispersion if the specification of conditional mean is correct. The estimator of pseudo-likelihood is needed to overcome the overdispersion (Cameron & Trivedi, 1998). The Poisson regression is a good technique for count data but when variance will be greater than the mean of the distribution, then data is called over dispersed and vice versa. The violation of this assumption leads to the spurious results of the model. Therefore, larger variance deflates standard error and inflates value of standardized normal. Poisson models do not have capability to overcome these issues. To overcome that problem, Negative Binomial or Generalized Poisson regression can be employed to get the values of parameters by including the dispersion parameter (Famoye, 1993; Lawless,1987; Elhai et al., 2008). To resolve the issue of overdispersion, modifications have taken place in the Poisson model and this modified version is called negative binomial model for count data. The negative binomial distribution specifies that there is exponential relationship between the mean of count data and the regressors. The mathematical expression for this relationship is shown in equation (3.6).

$$E(z_i|m_i) = \mu_i = \mu_i(m_i) = e^{(m_i'\varphi)} \quad (3.6)$$

This form of distribution comprises of a parameter θ for dispersion and functional form of conditional variance. The conditional variance is non linearly associated with mean because the variance function contains square of mean as shown in equation (3.7).

$$Var(z_i|m_i) = \mu_i + \theta{\mu_i}^2 \quad (3.7)$$

The negative binomial model and its log-likelihood function is illustrated in equation (3.8) and (3.9) respectively.

$$\rho(\mu_i, \theta, z_i) = \frac{\gamma(z_i+\theta^{-1})}{z_i!\gamma(\theta^{-1})} \cdot \left(\frac{\theta\mu_i}{1+\theta\mu_i}\right)^{z_i} \cdot \left(\frac{1}{1+\theta\mu_i}\right)^{\theta^{-1}}, z_i = 1, 2, \ldots. \quad (3.8)$$

$$l(\theta, \varphi) = \sum_{i=1}^{n}\left[\left(log\frac{\gamma(z_i+\theta^{-1})}{\gamma(z_i+1)\gamma(\theta^{-1})}\right) - (z_i - \theta^{-1})\log(1+\theta\mu_i) + z_i log\theta\mu_i\right] \quad (3.9)$$

In above equation (3.8), $\gamma(.)$ represents the gamma function and parameter of dispersion θ is unknown here. If parameter of dispersion θ approaches to zero, the equation (3.8) will yield the Poisson regression model. The positive value of dispersion parameter θ depicts the over dispersion of dataset. The generalized poisson model is best alternative when there is under-dispersion or over-dispersion (Famoye, 1993). This model is known as a good competitor model for the negative binomial model. The generalized Poisson model is stated below in equation (3.10).

$$\rho(\mu_i, \theta, z_i) = \left(\frac{(1+\theta z_i)^{z_i-1}}{z_i!}\right) \cdot \left(\frac{\mu_i}{1+\theta\mu_i}\right)^{z_i} \cdot e^{\left(\frac{-\mu_i(1+\theta z_i)}{1+\theta\mu_i}\right)}, z_i = 1, 2, \ldots. \quad (3.10)$$

The mean and variance for the generalized Poisson model are illustrated by $E(z_i|m_i) = \mu_i$ and $Var(z_i|m_i) = \mu_i(1+\theta\mu_i)^2$ respectively. In this model, when parameter of dispersion θ approaches to zero, generalized Poisson model becomes Poisson model. When the value of dispersion parameter θ is positive (negative), count data is over-dispersed (under-dispersed) (Heilbron, 1994; Gupta, 1996; Famoye & Singh, 2006). The types and description of the response and explanatory variables for count data model are shown in table 1.6.

Table 1.6

Description of the Variables for the Count data Model

Dependent Variable

Variable Name	Type	Description of the variable
Female Enrollment	Count	1=Pre-primary education 2=Primary education 3=Middle education 4=Secondary education 5=Higher secondary education 6=Bachelor or graduation
Explanatory Variables		
Female Characteristics		
Farm work	Categorical	The female worked in own agriculture farm or livestock (1=Yes 0=No)
HH Niece (Ref: Grandchild)	Categorical	The female's relationship with the household head is measured by generating dummy variable (1=Niece 0=Else
HH Child (Ref: Grandchild)	Categorical	The female's relationship with the household head is measured by generating dummy variable (1=Child 0=Else)
HH Sister (Ref: Grandchild)	Categorical	The female's relationship with the household head is measured by generating dummy variable (1=Sister 0=Else)
HH Other (Ref: Grandchild)	Categorical	The female's relationship with the household head is measured by generating dummy variable (1=Other relationship 0=Else)
Domestic work	Continuous	The time spent by female on the different tasks at home is measured in average hours per day in a year i.e. these tasks include cleaning, cooking, water collection, wood collection, washing clothes and family care etc.
School Joining Age	Continuous	The age when a female joined school first time is measured in years.
Demographic and Household Characteristics		
Sindh (Ref: KPK)	Categorical	The province female belongs to (1=Sindh 0=else)
Punjab (Ref: KPK)	Categorical	The religion of female (1=Punjab 0=else)
Pakhtoon (Ref: Punjabi)	Categorical	The dummy variable is generated for the ethnicity of female (1=Pakhtoon 0=else)
Baloch (Ref: Punjabi)	Categorical	The dummy variable is generated for the ethnicity of female (1=Baloch 0=else)
Sindhi (Ref: Punjabi)	Categorical	The dummy variable is generated for the ethnicity of female (1=Sindhi 0=else)
Saraiki/Shina(Ref: Punjabi)	Categorical	The dummy variable is generated for the ethnicity of female (1= Shina/Hazarwal/Saraiki 0=else)
Family Size	Continuous	The number of family members living in a household
Social Safety Net	Categorical	Any member of the female's household who is getting any kind of financial assistance such as BISP, education scholarships, Zakat etc. The dummy variable represents the status of the household whether getting any financial assistance or not. (1=Yes 0=No)

Household Saving	Continuous	The household savings is yearly measured and logarithm is taken to interpret it conveniently.
Household Debt or Loan	Continuous	The household credit or loan is yearly measured and logarithm is taken to interpret it conveniently.
Head count poverty	Categorical	The poverty illustrates whether female belongs to poor household or non-poor household. If the monthly per adult expenditures are greater than the threshold monthly expenditures set by the poverty line (Rs. 3030) based on cost of basic needs approach, then female belongs to non-poor household and if the case is converse of it, female belongs to poor household (1=Poor 0=Non-Poor).
Per adult household expenditures	Continuous	Yearly per adult household expenditures are obtained by dividing the total household expenditures except education expenditures on number of adult members in a household. The logarithm is taken to make the interpretation convenient.
Household Income	Continuous	The yearly household income measured in rupees includes income from all sources (agriculture, business, employment and livestock etc.). Logarithm is taken to interpret conveniently.
Asset index	Continuous	An index is constructed for the assets of the households with the help of Principal Component analysis.
Parental and Household Head Characteristics		
Age of Household head	Continuous	The age of the household head is measured in years.
Household head employment status	Categorical	The employment status of the household head is measured by binary variable. (1=Employed 0=Unemployed)
Mother_Prim_Edu (Ref: Never Enrolled)	Categorical	The female's mother who has primary or less than primary education is measured by introducing dummy variable. The female's mother having education equivalent to katchi-Pacci, class 1, class 2, class 3, class 4 and class 5 is considered in the category of the primary education (1=Primary education 0=else)
Mother_Sec_Edu (Ref: Never Enrolled)	Categorical	The female's mother who has secondary or above but more than primary education is measured by introducing dummy variable. The female's mother having education equivalent to class 6, class 7, class 8, class 9, class 10, above secondary or madrassa is considered in the category of the secondary education (1=Secondary education or above 0=else)
Father_Prim_Edu (Ref: Never Enrolled)	Categorical	The female's father who has primary or less than primary education is measured by introducing dummy variable. The female's father having education equivalent to katchi-Pacci, class 1, class 2, class 3, class 4 and class 5 is considered in the category of the primary education (1=Primary education 0=else)
Father_Sec_Edu (Ref: Never Enrolled)	Categorical	The female's father who has secondary or above but more than primary education is measured by introducing dummy variable. The female's father having education equivalent to class 6, class 7, class 8, class 9, class 10, above secondary or madrassa is considered in the category of the secondary education (1=Secondary education or above 0=else)
Schooling Characteristics		
Govt. School (Ref: Private/Madrassa)	Categorical	The type of school in which female is enrolled (1=Government 0=else)
Repetition of Last class	Categorical	The female who repeated last class due to failure or low grades (1=Yes 0=No)
Bike/Chin chi (Ref: Bus/Datsun)	Categorical	The female used bike/chin chi as source of travel while going to school is measure by binary values (1=Yes 0=No)

Walking/Residence in School (Ref: Bus/Datsun)	Categorical	The female has residence in school or walking as source of travel while going to school is measure by binary values (1=Yes 0=No)
Travel 0-15minutes (Ref: 45 minutes above)	Categorical	The time spent on traveling while going to school is measured in range of minutes (1=0-15minutes 0=else)
Travel 16-30 minutes (Ref: 45 minutes above)	Categorical	The time spent on traveling while going to school is measured in range of minutes (1=16-30minutes 0=else)
Travel 31-45 minutes (Ref: 45 minutes above)	Categorical	The time spent on traveling while going to school is measured in range of minutes (1=31-45minutes 0=else)

Many studies concluded that consumption expenditures of a household are the good measure of materialistic welfare than the income of a household. The consumption of a household can capture the permanent income that's why consumption depicts true welfare of the household. The income of a household may mislead regarding welfare because total earnings by the members of a household can fluctuate over the time but consumption remains smoother. Furthermore, people do not report the accurate income of the household due to tax imposition but they report consumption relatively better (Sajid & Khan, 2016; Meyer & Sullivan, 2003). Therefore, this study utilizes the per adult monthly expenditures to calculate the head count poverty which is the proxy for the economic status or welfare of the household. The head count poverty is calculated by following the cost of basic needs CBN approach. The CBN approach takes into account the monthly per adult food expenditures required to take 2350 calories per day and monthly per adult expenditures to satisfy basic needs (health, education, shelter and clothes etc.) in a household (Farooq & Younais, 2018). The analysis of this study is based on the dataset of Pakistan Rural Household Panel Survey conducted in 2014 so, it will be useful to consider the poverty line set by Government of Pakistan for the same year of 2014. In Pakistan, the estimated poverty line based on HIES dataset was Rs. 3030 per adult monthly expenditures in 2013-14 and this study has used it to calculate the incidence of head count poverty (Amjad et al., 2018). If per adult monthly expenditures are greater than Rs 3030, female belongs to non-poor household and if per adult monthly expenditures are less than the Rs 3030, female belongs to poor household. By following previous studies, asset index has been constructed and utilized as the proxy for a household's economic status (Sajid & Khan, 2016). The different assets owned by a household used to construct the asset index. The Pakistan Rural Household Panel Survey contains the information on the more than 70 assets of a household i.e. watch ownership, water pump, energy saver, spade, beds, sofa set, armoire, guns, suitcases, T.V set, bicycle, motorcycle, mobile, refrigerator, car, fan, iron etc. The value of each asset was measured in rupees and this value has been considered for each asset to construct the asset index. The Principal component analysis (PCA) is one of the appropriate and component analysis to develop asset index by assigning the weights to each asset.

IV. RESULTS AND DISCUSSION

The descriptive analysis guides about the distribution of dataset i.e. normal distribution etc. The application of empirical methodologies and estimation techniques to draw inferences are subject to the descriptive analysis of dataset. The response variables for the econometric model of this study is count variable. Since, mean and standard deviations for the categorical variables are not of much importance, the study demonstrates all these statistics for continuous variables only (Shaukat, javed, & Imran, 2020).

Table 5.1

Summary Statistics for Continuous Explanatory Variables

Variables	**Statistics**			
	N=941			
	Mean	S. D	Min	Max
Age of Girl	10.03	3.38	5	18
Household Head Age	48.14	12.09	20	89
Domestic work	0.8	1.43	0	11.98
Household Saving	18754	99388	0	1020000
Household Assets	0.72	2.73	-2.51	19.31
Household per Adult Expenditures	84985	96851	6644	985975
Female sibling (15 year above)	2.06	1.23	0	9
Female sibling (5-15-year-old)	2.03	1.37	0	8
Male sibling (15 year above)	1.17	1.05	0	6

Male sibling (5-15-year-old)	1.87	1.51	0	11
Children (0-4-year-old)	0.87	1.13	0	7
Family size	9.07	4.34	3	37
Household Income	329231	525500	60000	4532400
Household debt	51999	120207	0	1130000
School joining Age	5.22	1.17	3	12

The table 5.1 provides the summary statistics for the continuous explanatory variables of count data model. The mean age of enrolled girl is ten years whereas the minimum and maximum age of the enrolled girl is five and eighteen respectively. On average, the enrolled girls work 0.8 hours per day at home. The average number of children aged 0-4 year in the household of enrolled girls is 0.87. The mean numbers of female siblings above 15-year-old for enrolled girls is 2.06, female siblings 5-15 years old is 2.03, male siblings 15 year above is 1.17 and male children 5-15-year-old is 1.87. The average school joining age of enrolled girls is 5.22 years while the minimum school joining age of an enrolled girl is 5 years and maximum school joining age of an enrolled girl is 12 years.

Table 5.2

Correlation Matrix for the continuous explanatory variables of Count data model

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Domestic work	1.000								
(2) School Joining age	0.129	1.000							
(3) Asset Index	-0.052	-0.172	1.000						
(4) Household Head Age	0.048	-0.002	0.155	1.000					
(5) Family Size	-0.071	0.022	0.465	0.180	1.000				
(6) Household Income	-0.058	-0.052	0.607	0.145	0.328	1.000			
(7) Household Debt	-0.035	-0.008	0.250	0.134	0.157	0.417	1.000		
(8) Household Saving	-0.014	0.053	0.377	0.044	0.178	0.417	0.262	1.000	
(9) Per Adult Household Expenditures	-0.019	-0.070	0.218	0.013	-0.071	0.531	0.234	0.116	1.000

The table 5.2 shows the correlation among the continuous explanatory variables appeared in count data model. Domestic work done by girls has moderate and negative association with all explanatory variables except household head age. The strongest correlation is found among the asset index of household, household income, household debt, household saving and per adult household expenditures. There is weaker correlation between school joining age of girls and rest of explanatory variables. The household asset index and household income both are highly correlated but this correlation is tolerable and does not affect the consistency and reliability of the estimations. The least correlation can be observed between the household head age and school joining age of the girls.

Table 5.3

Summary Statistics for Count Dependent Variable

Variable	Mean	Variance	Min	Max
Level of Education	2.1264	1.0573	1	6

The table 5.3 illustrates the summary statistics for the count dependent variable. There are different count data models with different features based on their own assumptions. Generally, Poisson model is a familiar count data model with the assumption of equality between mean and variance of the sample known as equidispersion. If mean and variance of the sample are not equal, other count data models such as negative binomial and generalized Poisson models can be employed to tackle the issues of over-dispersion or under-dispersion of count dependent variable. The negative binomial model does not consider the under-dispersion in the dataset so, it is meaningless to employ if dataset is under-dispersed (Cameron & Trivedi, 2005). The table 5.3 shows that the variance of the count dependent variable is less than the mean showing the count dependent variable is under-dispersed. The generalized Poisson model is preferred count data

model over the negative binomial and Poisson models when count dependent variable is under-dispersed or over-dispersed (Winkelmann & Zimmermann,1994). In case of under-dispersion, the Poisson and negative binomial count models overestimate the standard errors and mislead the findings (Harris et al., 2012). In order to check the nature of dispersion, Poisson and negative binomial models are estimated to get the goodness of fit statistics such as deviance and Pearson Chi-square as shown in table 5.4. In case of over-dispersion, the ratio of deviance to degree of freedom and ratio of Pearson Chi-square to degree of freedom remain greater than one while in case of under- dispersion, value of both ratios remains below one. The value of both ratios equal to one illustrates the equidispersion of count dependent variable hence, Poisson model should be employed (Mccullagh & Nelder, 1989). Another possible way to check the equidispersion or over-dispersion is the value of estimated dispersion parameter in negative binomial model. Since, negative binomial model only accounts for equidispersion or over-dispersion, its dispersion parameter has zero lower bound. In negative binomial model, the value of dispersion parameter equal to zero shows equidispersion and value greater than one shows the over-dispersion (Cameron & Trivedi, 2009).

Table 5.4

Tests for Model selection

	Poisson Model	**Negative Binomial Model**
Deviance/degree of freedom	0.299	0.3
Pearson Chi-Square/degree of freedom	0.301	0.301
Akaike Information Criteria	2764.99	2766.99
Bayesian Information Criteria	2934.64	2941.48
Dispersion parameter (Alpha)	NA	0

NA stands for not applicable

The goodness of fit measures such as ratios of deviance and Pearson Chi-square to degree of freedom for Poisson and negative binomial model are shown in table 5.4. The values of both ratios are less than one and almost similar for both Poisson and negative binomial models showing that the count dependent variable of this study is under-dispersed. The likelihood-ratio test indicates that the value of dispersion parameter in negative binomial model is zero showing that there is equi-dispersion and Poisson model can be estimated. It should be noted that the dispersion parameter in negative binomial model does not account for under-dispersion and there is the possibility of under-dispersion as illustrated by goodness of fit statistics. The Akaike information criteria and Bayesian information criteria for Poisson and negative binomial model are almost similar because both models assume Poisson distribution based on equi-dispersion.

Table 5.5

Estimates of Generalized Poisson Model for the Girls level of Education

Explanatory variables	**IRR**	**Robust St. Er.**	**Z**	**p-value**	**Sig**
Female Characteristics					
Farm work (Ref: Non-participant)	0.837	0.053	-2.78	0.005	***
HH Niece (Ref: Grandchild)	1.128	0.049	2.78	0.005	***
HH Child (Ref: Grandchild)	1.219	0.137	1.76	0.078	*
HH Sister (Ref: Grandchild)	1.192	0.083	2.52	0.012	**
HH Other (Ref: Grandchild)	1.096	0.092	1.1	0.273	
Domestic work	0.75	0.047	-4.64	0	***
School Joining Age	0.947	0.01	-5	0	***
Demographic and Household Characteristics					
Sindh (Ref: KPK)	0.868	0.041	-3.02	0.003	***
Punjab (Ref: KPK)	1.042	0.014	3.90	0.000	***
Pakhtoon (Ref: Punjabi)	0.782	0.046	-4.23	0	***
Baloch (Ref: Punjabi)	0.727	0.092	-2.53	0.011	**

Sindhi (Ref: Punjabi)	0.851	0.113	-1.21	0.225	
Saraiki/Shina (Ref: Punjabi)	0.928	0.03	-2.3	0.021	**
Family Size	0.981	0.004	-5.3	0	***
Social Safety Net (Ref: Non-beneficiary)	1.029	0.028	1.06	0.291	
Household Saving	1.011	0.007	-2.24	0.025	**
Household Debt or Loan	0.988	0.005	-2.25	0.024	**
Head count poverty (Ref: Non-Poor)	0.784	0.065	-2.96	0.003	***
Per adult household expenditures	0.864	0.039	-3.26	0.001	***
Household Income	1.032	0.013	2.48	0.013	**
Asset index	1.024	0.006	3.88	0	***
Parental and Household Head Characteristics					
Age of HH	1.009	0.001	7.19	0	***
HH employment status (Ref: Unemployed)	1.077	0.04	1.97	0.048	**
Mother Prim_Edu (Ref: Never Enrolled)	0.999	0.092	-0.01	0.993	
Mother_Sec_Edu (Ref: Never Enrolled)	1.006	0.047	7.13	0.00	***
Father_Prim_Edu (Ref: Never Enrolled)	1.016	0.04	1.96	0.05	**
Father_Sec_Edu (Ref: Never Enrolled)	1.208	0.089	2.57	0.01	***
Schooling Characteristics					
Govt. school (Ref: Private/Madrassa)	0.942	0.03	-1.84	0.065	*
Repetition of Last class (Ref: No)	0.788	0.038	-5	0	***
Bike/Chin chi (Ref: Bus/Datsun)	1.263	0.05	5.91	0	***
Walking/residence in school (Ref: Bus/Datsun)	1.294	0.071	4.71	0	***
Travel 0-15minutes (Ref: 45 minutes above)	1.115	0.042	2.86	0.004	***
Travel 16-30minutes (Ref: 45 minutes above)	1.096	0.01	10.1	0	***
Travel 31-45minutes (Ref: 45 minutes above)	1.071	0.031	2.38	0.017	**
Reference Categories					
Constant	4.184	1.044	5.74	0	***
Delta	-0.67	0.028			***

Chi-square for L-R test of Delta=0	461.29	Prob>L-R chi2	0
Pseudo r-squared	0.175	Number of obs	941
Chi-square	1109.56	Prob > chi2	0
Akaike crit. (AIC)	2305.708	Bayesian crit. (BIC)	2154.481

**** p<.01, ** p<.05, * p<.1*

The table 5.5 depicts the estimates of generalized Poisson model for the level of education of enrolled girl aged 5-18.

Female Characteristics: The estimates show that the expected value of count of an enrolled female who works at own farm significantly decreases by 16.3 percent than a female who does not work at farm. The girls working at farm utilize their much time on agriculture tasks on the cost of education time. Therefore, less allocated time to education results in lower education level of the girls. The dummy variable of HH Niece showing that if a girl is the niece of the household head, the expected value of count is more likely to increase by 12.8 percent than a girl who is grandchild of household head. The HH Child has significant incident rate ratio showing that if a girl is child of household head, expected value of count is more likely to increase by 21.9 percent than the benchmark category of a girl who is household head's grandchild. The dummy variable HH Sister showing that if girl is the sister of household head, the mean value of expected count increases by 19.2 percent than the girl who is grandchild of household head. The variable HH Other has insignificant incident rate ratio showing that if a girl is cousin or other relative of household head, the expected value of count remains unaffected. Holding other variables constant, mean value of count variable decreases by 25 percent if a girl's domestic work increases by one hour per day. The parents of the children in rural areas remain busy in agriculture tasks while the girls at home bear the burden of household chores. As they get older, the burden of household chores increases have negative influence on the education level.

The incident rate ratio of school joining age illustrates that mean value of count variables decreases by 5.3 percent as school joining age of a girl increases by one year.

Demographic and Household Characteristics: The location of girls with respect to provinces has significant effect on the count dependent variable. The expected value of count decreases by 13.2 percent if the location of girls changes from the reference category of KPK to Sindh whereas the expected value of count increases by 4.2 percent if the location of girls changes from KPK to Punjab. It can be observed that the girls belong to Punjab are more likely to have higher level education than other provinces because there are less socio-economic barrier in Punjab than other provinces. The dummy variables for the ethnicity of a girl have significant impact except Sindhi ethnicity. The mean value of count decreases by 21.8 percent if Punjabi girls are replaced with Pakhtoon girls. The expected value of count for education level decreases by 27.3 percent if Balochi girls take place instead of Punjabi girls. Lastly, the mean expected count for shina, Saraiki or hazarwal girls decreases by 7.2 percent in comparison to the Punjabi girls. The family size affects a girl's level of education significantly in the model. The expected count decreases by 1.9 percent if family size increases by one family member. The greater family size requires greater financial resources to acquire education. Lack of financial resources does not allow each member to acquire higher education level. The social safety net has no significant role in determining a girl's level of education. The household saving and household debt or loan have positive and negative effects on the expected count respectively. The mean value of count increases by 1.1 percent when household saving increases by one percent while expected count decreases by 1.2 percent if household debt increases by 1 percent. The higher household savings assists higher financial resources to the girls to acquire higher education in future. On the other hand. higher household debt or loan snatches out the opportunities of higher education from girls because household debt is paid on the cost of financial resources required to get higher education in future. The expected count for the girls who belong to poor household is more likely to decrease by 21.6 percent than the girls who belong to non-poor household. It is possible that children from non-poor households perform well in education attainment because non-poor families can afford high quality education of their children whereas poor families even cannot afford ordinary quality of education for their children. The parent-child relationship is the source of motivation for children to outperform in education attainment (Cheang & Goh, 2019). The household expenditures have negative and significant impact on the expected count. When household expenditures increase by one percent, the expected count decreases by 13.6 percent. The household income and household asset index affect expected count positively and significantly. The mean value of count increases by 3.2 percent when household income increases by one percent whereas mean count increases by 2.4 percent when household asset index increases by one unit.

Parental and Household Head Characteristics: The age of household head is positively related the expected count of a girl's level of education. The expected count for a girl increases by 0.9 percent if the age of household head increases by one year. The employment status of household head also has positive and significant effect on the expected count. If household head of a girl is employed, the expected count is more likely to increase by 7.7 percent than a girl with unemployed household head. A dummy variable showing mother education of a girl equivalent to primary education is found insignificant in determining the expected count of the model but the expected count for a girl increases by 0.6 percent if her mother has secondary education in comparison to a girl whose mother did not enroll. As for as father education is concerned, the expected count for a girl is more likely to increase by 1.6 percent if her father has primary in comparison to a girl whose father has no education while expected count for a girl is likely to increase by 20.8 percent if her father has secondary or above education in comparison to a girl with no father education.

Schooling Characteristics: The type of school is a significant factor determining the girl's level of education. The girls who study at government school, their expected count is likely to decrease by 5.8 percent than the girls who study at private school or madrassa. The repetition of last class has significant and negative impact on the expected count. The expected count for the girls who repeated their last class is 21.2 percent less than the expected count for the girls who did not repeat their last class. The dummy variables for the travel sources used by girls to approach school are found significant. The girls who utilized bike or chin chi as travel source to reach at school have 26.3 percent greater expected count than the girls who use Bus or Datsun. The girls whose residence is in school or near to school have 29.4 percent greater count than the girls who use bus or datsun. Lastly, the dummy variables for the travel time required to reach at school are also found significant. The girls who travel 0 to 15 minutes for school have 11.5 percent more expected count than the girls who travel more than 45 minutes. The girls who travel 16 to 30 minutes for school have 9.6 percent more count than the girls who travel more than 45 minutes. The girls who travel 31 to 45 minutes for school have 7.1 percent more expected count than the girls who travel more than 45 minutes.

Goodness of fit: The parameter of dispersion named as alpha has negative and significant value showing that the count variable has under-dispersion. The likelihood ratio test for the alpha has zero probability value showing that null hypothesis has been rejected. The null hypothesis of the likelihood ratio test

distributed as chi-square shows that alpha is equal to zero while alternative hypothesis shows that alpha has positive or negative value. The likelihood test for overall model fit distributed as chi-square also has zero probability value showing that the regressors are jointly non-excludable and have significant effect on the count dependent variable. The value of pseudo R-square shows that model is good fitted against the model with only intercept.

V. CONCLUSION AND RECOMMENDATIONS

The sustainable social and economic development is only possible by providing and acquiring education. An important determinant of this social and economic development is the education of girls. The objectives of this study are to explore the determinants of girl's school -attainment or level of education at household level in Pakistan. In this study, the dataset of 941 girls aged 5-18 years has been obtained from Pakistan Rural Household Panel Survey 2014 conducted by International Food Policy Research institute. In this study, the Generalized Poisson regression model has been utilized to diagnose the determinants of girls' level of education. As for as the findings of Generalized Poisson model are concerned, household saving, household income, household assets, father education, mother education, household head age and household head employment have positive and significant effects on the count variable named as girls' level of education. On the other side, head count poverty, farm work status, school joining age, family size, household debt or loan, per adult household expenditures, Govt. type school, repetition of last class and domestic work are the factors that significantly affect the girls' level of education negatively. Furthermore, the girls whose school distance is less are more likely to enroll in higher class than the girls whose school distance is larger. It is also concluded that the girls who reside in school or who cover school distance by walking are also more likely to enroll in higher classes than the girls who use to travel on bike/chin chi or bus/Datsun. Keeping in view the findings, there are significant factors from the point of policy view. The poverty is one of the significant factors that determines the girls school enrollment. The government should consider the measures to alleviate poverty to increase the girls' attainment of education in rural areas. The age of the girl has positive and significant influence. In rural areas, girls' enrollment is often delayed. Therefore, government should provide pre-schooling facilities so that girls could be enrolled in very early age. The government should give incentives to the rural households to encourage savings to have greater financial resources for rural households. The government should provide the employment opportunities to the heads of households in rural areas as they positively affect the girls level of education. The authorities also need to improve the functioning of government schools in comparison to private schools because private schools have significant and positive impact on the girls' level of education. Finally, the government should construct schools and colleges near to the residence of girls so that for each next stage of education, the girls should not travel too much. All the recommendation and suggestions discussed above could have significant role in the formulation of education policies for all three provinces but estimations show Punjab and Khyber Pakhtunkhwa comparatively have greater marginal effects.

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