

Is information communication technology and women empowerment helping to alleviate poverty in Pakistan?

Henna Ahsan*^{1, 2} | Hania Afzal^{3, 4}

1. School of Economics, Faculty of Social Sciences, Quaid-i-Azam University, Islamabad, Pakistan.
2. Pakistan Institute of Development Economics (PIDE), Islamabad, Pakistan.
3. Department of Economics, Faculty of Management Sciences, BUIITEMS, Quetta, Balochistan.
4. Department of Civil & Environmental Engineering, University of Nebraska-Lincoln, United States.

*Corresponding Author Email: henna.ahsan@pide.org.pk

Abstract:

The study investigates the role of Information Communication Technology (ICT) and women empowerment in reducing Pakistan's poverty by make use of the Household Integrated Economic Survey 2018-19. The poverty situation of a country, when defined through different poverty bands, has significant policy implications as categorizing people into different poverty bands helps in targeted policy initiatives for these groups. The five levels of the poor defined for this research are (extremely poor, deeply poor, poor, vulnerable, and marginally poor). To analyze the determinants of poverty Probit model has been used, whereas for targeted policy implication, quantile regression has been employed. The empirical results reveal that ICT has a significant role in alleviating poverty. Access to the internet plays a significant role in reducing poverty by rendering job and entrepreneurial opportunities. It helps the rural population keep abreast with the latest information and developments. Further, women empowerment has a significant impact on improving the living standard of a household, and the impact is strong for marginally poor households as compared to extremely poor households. Finally, other control variables like human capital and the experience of the household head also play a significant role in helping the households to improve their poverty state.

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1. Introduction

The first goal of sustainable development out of seventeen SDGs established by the UN in year 2015 is to achieve the target of no poverty till 2030. Pakistan has achieved this goal by 56.2%, which is quite low from the desired target. Even though Pakistan is ranked at 134th out of 193 countries on Global SDG Index 2019, Pakistan's Poverty alleviation programs and anti-poverty legislation are creating a great and meaningful impact in reducing poverty and achieving this target. As being the developing country, it should be our foremost agenda to reduce poverty to significant level by 2030, even if we cannot reduce it to zero.

Pakistan is one of the developing countries in Asia. Its GDP per capita is annually US\$1190, ranking among the lowest in terms of purchasing power parity. The annual per capita growth has been averaged around 2 percent that is less than South Asia's average by more than a half. Many factors have contributed negatively, and Pakistan's economy has been experiencing sluggish economic growth over the last two decades. Income inequality is a major factor that gives rise to the rural/urban disparity. If we look at the rural/urban categorization of poverty in case of Pakistan, it is observed that rural poverty is significantly higher than the urban poverty. An in-depth analysis of this rural/urban disparity reveals that in rural areas people have insufficient access to health, education, water and sanitation facilities and employment opportunities.

Poverty is a multidimensional phenomenon, and many determinants affect the nature and direction of poverty. However, the role of ICT and women empowerment to reduce poverty has been largely ignored in the scholarly literature. Both factors are of great significance as they have a positive impact in alleviating the poverty. The ICT helps in enhancing the productivity of the poor by providing them employment opportunities at their homes. It helps them in providing latest market information and also low transaction costs for these poor farmers and traders.

Khaliq et al. (2016) focused on studying the relationship between poverty reduction and role of the ICT among women in Kilosa, a district of Tanzania. His research study found the evidence that ICT tools were being used in a way that helped in poverty reduction among women and raising productivity in the agricultural sector. Most of the women owned and used mobile phones, internet, radio, television, and newspaper that helped them to improve their livelihoods by strengthening of social networks. The most important benefit that agricultural women were able to secure was that they were able to get better and competitive market price for their products by preventing the exploitation of the middlemen and cutting the travelling costs. Moreover, women were also able to generate income through business related ideas like selling the airtime, running telephone kiosk and by working as the agent of mobile banking services. It has been recommended that if the government wants to increase the use of internet facility particularly among women, then it needs improvements in supporting the ICT Infrastructure.

Information and communication technologies have spread deeply into various poor developing countries. This has resulted in huge use of mobile phones, use of internet to access globalized social network sites and massive digital content. Recent studies show that there is considerable literature available on the impact of ICTs on social, cultural, and economic aspects of life (Palvia et al., 2018). However, there is no literature available especially in Pakistan on micro level that how ICT helps in achieving the target of poverty reduction in developing countries. The role of ICT has mostly been discussed in a positive manner highlighting how it helps in promoting development and thereby reducing poverty. However, Kanjo (2020) on employing the descriptive research design method using the qualitative approach suggested that ICT can also aggravate the poverty. It is not only about having accesses to the ICT, but rather how one uses it and for what purpose.

Moreover, data description of poverty over the times shows how poverty has changed over time in Pakistan. This information is of great importance as it gives us a clear picture of whether poverty is decreasing or increasing over the time however this information does not tell us how poor a poor is. This information can only be explained by using the concept of poverty bands. As the poverty bands divide the poor into different categories of extremely poor, deeply poor, poor, vulnerable and marginally poor.

This study is going to be a valuable addition in exiting literature as it is focusing on the major factors like ICT and women empowerment along with other determinants in reducing poverty for a developing country like Pakistan. In this new era of technological advancement, the role of ICT and women empowerment has become significantly important. Therefore, the main objective of our study is two folds: first we are going to introduce new determinants of poverty that are women empowerment and role of ICT in alleviating poverty and other socioeconomic and demographic factors based on Household Integrated Economic Survey (HIES) 2018-19. Second objective of our study will be to analyze the determinants of poverty across different poverty bands using the concept of quantile regression.

Rest of the paper is organized in the following manner. In the next section we will analyze the relevant literature related to determinants of poverty. Section 3 discusses theoretical framework, while methodology to measuring poverty and empirical model to analyze the determinants of poverty are discussed in section 4. Data and descriptive analysis are discussed in section 5. Section 6 discusses the empirical results of determinants of poverty incidence through Probit model and Quantile regression model as well. Conclusion and policy implication is presented in last section.

2. Literature review

Poverty can be defined in multiple ways. Under the standard criteria as defined by UN, Poverty can be absolute, or it can be relative. The absolute poverty is defined as a situation in which a human being is deprived of all basic human needs, which include food, safe drinking water,

sanitation facilities, health, shelter, education, and information. Relative poverty on the other hand basically compares an individual's income and spending pattern with the general population.

Majeed and Malik (2015) did an in-depth analysis of different determinants affecting the poverty level across the four provinces in Pakistan. According to this study the main determinants of poverty include education, experience, household size, employment status, remittances, gender, region(rural/urban) and province. The determinants affecting the poverty in a positive manner are household's age, households' size, provincial residence, and male headed households. Whereas the determinants that helped in alleviating poverty include education level, experience, remittances receiving, employment status and living in urban region.

Arif and Farooq (2014) studied in detail the dynamics of rural poverty in Pakistan. This study has a great significance and a good addition in literature as it focused on in depth analysis of transitory and chronically poor households. The three cross sectional waves of poverty have been analyzed using the three PPHS datasets of 2001,2004 and 2010. Fluctuations in poverty estimates have been observed starting from 2001 to 2010. Poverty has declined in 2001-2004 and spiked in 2004-10. According to the estimates retrieved from PPHS 2010, it has been seen that poverty in 2010 was at 20.7 percent. Moreover, the findings of multivariate analysis show that demographic variables like household size and dependency ratio have positive relationship with chronic poverty making more people fall into poverty. Economic status if improved shows that it helps people get out of the vicious circle of poverty.

Pakistan is currently facing the twin problem of reducing poverty and increasing growth. Poverty is reducing currently but at a very slow pace. ADB (2002) focuses on bringing the expansionary macroeconomic policies coupled with the improvements and functioning of systems of government. Poor governance is a key underlying issue of increased poverty level as it enhances the vulnerability by causing low business confidence. The other demographic characteristics that aggravate the issue of poverty are unemployment, low education level, age of household head and inability to migrate. Environmental degradation also has devastating effect on the poor. Similarly, Awan and Iqbal (2015) analyzed that education attainment at any level whether middle, matric, intermediate, bachelors or professional degrees will reduce the likelihood of being poor. Another determinant that is family size affects the poverty level positively, as the family size increases, keeping the income or resources growing at a slower pace, more people are pushed into poverty. It is because of availability of lesser resources available for the welfare of individuals. Moreover, another important result we can infer from this study is that poverty level decreases if an individual is provided with some basic facilities of life which include availability of water supply, gas, telephone and sewerage.

Eyasu (2020) presented his analysis regarding Ethiopia which shows that the impact of some common determinants there is same as for Pakistan. The major determinants of the household

poverty in Ethiopia were the family size, total land owned, and the bad health of household head. These factors have contributed positively to increasing poverty across the country under analysis. It was recommended by the author that more emphasis should be paid to government policies and on programs oriented towards family planning, health insurance and welfare particularly in rural areas. It can help reduce the poverty levels to a significant low level, especially rural poverty could be tackled by adopting these policy suggestions.

The information & communication technology penetration has significantly increased across the globe. Among all the ICT facilities, internet is the most important indicator. Increasing the availability of internet to households can help combat poverty and reduce inequality immensely. Beside this some training programs should be introduced to enhance the level of skills and knowledge among the poor and low educated households. Certain policies should be designed and implemented that focuses on providing equal access to internet, computer, and cities. For fast-paced development regarding ICT penetration requires the attention of the government and relevant stakeholders. Study has suggested that access to cellphones among the poor households helps to reduce the poverty (Yilmaz et al., 2018).

Many of the developing countries growth agenda involves the access of telecommunication services to reduce poverty and enhance the economic growth but little is known how it should be done and very few research articles have addressed the issue. Access to mobile phones play a significant role in poverty reduction so necessary measures must be taken to make it accessible to all individuals to achieve the economic and social benefits from the rural areas of the country. Provision of the basic digital mobile phone facility will help us in accruing the positive benefits that includes improved level of education, training and other health care facilities along with the poverty reduction (Bhavani et al., 2008).

Ruhyana and Essa (2020) suggest that development of ICT sector is aimed at improving the quality of human life, reducing inequality and poverty reduction. It is suggested by the researchers that ICT can be introduced as an alternative poverty reduction program in developing countries which have a clear divide between villages internet, mobile phones and computers.

Moreover, women empowerment has a major role for wellbeing of societies, child development and ultimately to eradicate poverty. Findings of (Wei et al., 2021) show that women access to education, asset ownership and decision-making in children's health and education have contributed positively to uplift the household not only by increasing the income level but it also helps the household to pull-out from multidimensional poverty in developing nations like Bangladesh. Similarly, Chandarsekar and Prakash (2010), examined that ICT based micro enterprises act as poverty reduction vehicles as these help in equipping the poor women with the relevant skills and expertise and opportunities for growth. Such projects help women to enter into the lowest tier of IT sector and enable them to earn minimum levels of income required to meet for the family needs. This study emphasizes that if adequate governmental

support is provided then ICT based jobs can be used for rewarding the poor and socially marginal women.

3. Theoretical framework

This section discusses theoretical framework that how ICT and women empowerment with other control variables affect the incidence of household poverty.

3.1. ICT and poverty

Twenty First century being the era of Information and Communication Technology has contributed tremendously to social and economic uplifting of the masses by providing greater employment opportunities and higher productivity. The World Development Report 2000/01: *Attacking Poverty*, identifies three important areas to target poverty: increasing opportunity, enhancing empowerment, and improving security. Opportunity enables markets to work for the poor and to increase their assets. Empowerment helps to remove barriers and makes state institutes to work better for the poor. And security helps poor people in managing their risks. Experiences from India and from other developing world show that ICT defined as a set of activities that facilitate storage, processing, transmission and display of information could play a significant role in poverty reduction. The use of ICT increases opportunities for poor people by enhancing their access to markets, education and online health facilities (Cecchini & Prenzushi, 2002). Greenberg (2005) also maintains that ICTs can act as effective instruments in reducing poverty. The flexible nature of ICTs enables them in addressing people problems related to health, education and livelihoods. Ultimately ICTs play a significant role in people's empowerment and in strengthening human rights. Therefore, along with other factors ICT has an important role that can pull out people from poverty.

To capture the role of ICT on poverty alleviation, we measured availability of ICT like (internet, mobile, computer/tablet etc.) at household level, as number of ICT items increase there is more chance of decrease in poverty (Yilmaz et al., 2018). Secondly, we measured the role of ICT by taking the variable whether the household head is internet user for the last three months.

3.2. Women empowerment and poverty

Other most important issue for researchers and policy makers in the field of wellbeing or development is related to the concept of women empowerment. It has been argued that women empowerment could play an important role in poverty reduction and in ensuring a sustained economic growth, especially in developing countries (Klasen & Lamanna, 2009; Hanmer & Klugman, 2016; Akhter & Cheng, 2020; Sarwar & Chaudhry, 2021). Empowerment means offering enough latitude to a person or group so that they can freely make their life decisions and can work in pursuit of their goals (Pratto, 2016).

Women empowerment entails decision-making regarding family matters, input in matrimonial relationships and childbirth, and protection from household violence helps in improving women's social and economic position in society. The literature suggests that women free movement for getting education or for going to work and absence of any form of discriminations are necessary for women empowerment. Encouraging women to acquire education or to work makes them empowered. Education helps women in improving their socio-economic status which helps to improve their wellbeing and enables them to protect their rights in a better way.

To measure women empowerment, we developed the women empowerment index by using four indicators regarding decision of employment, education, marriage, and purchase of household items. Every indicator has 7 responses. Responses 1, 4, and 5 indicate that women are empowered and are assigned the value "1" and "0" for otherwise. Then we took the mean of women empowerment at household level that takes the value between 0 and 1 for all four indicators mentioned earlier. To make the women empowerment index we used the Principal Component Analysis (PCA). PCA simply reduces the number of variables of a data set, while preserving maximum possible information.

3.3. Gender and poverty

Gender bias or gender discrimination is thought to be one of the characteristics of our society (Okojie, 2002; Majeed and Malik 2015). Women usually face low and unequal opportunities regarding educational attainments and earnings when compared with men. Female participation in the society is assumed low and it is usually seen that households headed by a female face a great difficulty in escaping from the poverty trap.

3.4. Human capital and poverty

Human Capital plays an important role in improving living standard of a household. A significant portion of the theoretical literature stresses a strong relation between human capital and poverty. Human capital accumulation leads to economic benefits such as income equality, reduced unemployment and enhanced productivity which ultimately results in improving living standard of the individual (Becker, 1975; Santos, 2011; Teixeira, 2014). To analyze the role of education, we have taken the education of household head by assuming that in case of developing countries like Pakistan the head of household is mostly involved in economic activities. Hence it is assumed that education has a negative relation with the poverty and higher levels of education play a significant role in reducing poverty.

3.5. Age and poverty

Another important attribute of the household head which plays a significant role in poverty alleviation is age as explained by the Life Cycle theory. It is assumed that the person's earnings

are low when he/she is young (due to low work experience) and increase gradually with the gaining of experience however this start decreasing in the old age due to declining health and poor productivity. Therefore, to analyze the impact of age on poverty incidence we divide the age into subcategories (Garza-Rodríguez, 2021).

3.6. Employment status and poverty

A great chunk of Pakistan's population is linked with agriculture directly or indirectly, so it is imperative to find out that whether employment in agriculture shows and differences when compared to non-agriculture sector.

3.7. Family size and poverty

It has been argued that with increase in family size, the chances of poverty also increase (Lanjouw & Ravallion, 1995). The greater the number of dependents in a household, the larger will be the family size and thus additional resources will be required which may keep household poor. Conversely, it is expected that increase in number of earners may help to reduce the poverty of a household.

3.8. Property and poverty

Property owned is another important dimension to assess household poverty. Owning some property has a positive impact in reducing poverty (Ahsan et al, 2021). By property here we mean the number of residential or commercial lands and buildings owned by any household. This property acts as a source of income for the household, or it may serve as a saving or investment as usually with the passing of time the value of property is increased. We have divided the property into three categories as no property, low property, and medium level property.

3.9. Remittances and poverty

Remittances, whether domestic or foreign, are a big source of relief for struggling families to manage their basic needs such as food, clothing, sanitation, and energy needs. These financial activities directly impact the poverty reduction in low-income households living below or near the poverty line (Majeed & Malik, 2015). These remittances usually play a significant role in reducing poverty in rural areas as mostly individuals from rural areas work in foreign countries as labour or in big and developed cities of the own country thus sending money to their households through different financial channels.

3.10. Region and poverty

Rural areas are more deprived in term of job, education and health facilities as compared to the

urban areas in Pakistan. Moreover, rural areas are the direct target of many natural calamities like floods and droughts. So, a huge difference usually seen between facilities available to rural and urban areas which may depict the biased government policies. Therefore, it is imperative to assess that weather region is an important factor regarding incidence of poverty.

4. Method to measure poverty

The choice to measure poverty is diverse, different indicators have been used like income and expenditure. Literature shows expenditure a better measure of poverty than income as Deaton (1997) backed expenditures on two main grounds: first expenditures are more clearly reported, and secondly, they are likely to give a better insight of resources available to a household. Therefore, in our study, we also used expenditures as a mean to measure poverty line. Literature also suggests two other methods to measure poverty: Calorie Intake Method and Cost of Basic Need (CBN) approach. Poverty line based on CBN is simply the sum of expenditure incurred for food and non-food items. It provides the minimum cost of absolutely necessary food and non-food items required to escape from poverty. The study used the CBN poverty line measured by Afzal and Ahsan (2021) that is 3776 per adult equivalence consumption at month. Once the poverty line is determined, the next step is to classify households as poor and non-poor considering whether their per capita expenditure is below or above the poverty line. Regarding this, the most common measure is headcount index (P0) which was introduced by Rowntree (1901). It provides the percentage of population below the poverty line.

$$Po = \frac{N_p}{N}$$

Where, N_p is the number of poor and N is total population, such that $0 \leq Po \leq 1$, '0' indicating no poverty and '1' means that all are poor.

4.1. Empirical model: probit vs quantile regression

Measuring poverty by using the head count ratio has advantage of easily explaining how many people are below and above the poverty line. Therefore, to analyze the determinants of poverty we have used Probit model as our dependent variable is poverty incidence of household which measures through dichotomous variable labelling poor as "1" vs non poor as "0". The probit model (Garza-Rodríguez et al., 2021; Kedir & Sookram, 2013; Székely, 1998) predicts which factors define the probability of being poor. Our Probit Model is defined as below.

$$\text{Log} [P \text{ poor} / (1 - P_{\text{non poor}})] = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \dots + \beta_n x_n.$$

The explanatory variables chosen for the Probit model were household head's sex, age, educational level, household size, occupation incidence, cash received in term of remittances, role of ICT and women empowerment index etc.

Measuring Poverty through head count ratio does not present the true extent and depth of poverty i.e., how poor the poor are (Afzal and Ahsan, 2021). To address this issue the concept of poverty bands has been used. Poverty bands are measured through expenditure per adult equivalence scale to poverty line (EPE/P). That is also defined by income to poverty ratio (Peng et al., 2019) and poverty gap by (Atkinson et al., 2002). The poverty situation defined through different poverty bands has great policy implications as categorizing people into different poverty groups helps in designing targeted policy actions for diversified group of households as the determinants of poverty have differential effect.

To analyze the poverty bands the quantile regression can be used to understand the determinants of poverty (Peng et al., 2019; Garza-Rodríguez, 2021). It allows to analyze the effect of various factors of poverty using different quantiles in the distribution of the dependent variable, thus showing the full picture of the relationships between variables (Habyarimana et al., 2015). Whereas traditional Ordinary Least Square (OLS) method is used that focuses on the mean parameters of the regressions and do not examine the asymmetric effects of explanatory variables on household income (Kedir & Sookram, 2013). Quantile regression is useful to understand the relationships between variables outside the mean of the data, making it useful for understanding the outcomes that are non-normally distributed and have nonlinear relationships with predictor variables.

As the traditional OLS regression model has the following form.

$$Y_i = \beta_0 + \beta_1 x_i + U_i$$

Where Y_i is the dependent variable measured through the (EPE/P) ratio that is vector of household characteristics. β_i is the vector of unknown coefficients to be estimated, and U_i is disturbance term. In OLS model, the method for obtaining the parameters is by using the minimization of squared errors:

$$\begin{aligned} \text{Where, The Quantile Regression Model Equation for the } \tau\text{th quantile is } Q_\tau(Y_i) \\ = \beta_0(\tau) + \beta_1(\tau) X_{i1} + \dots + \beta_p(\tau) X_{ip} \\ i=1 \ 2 \ 3 \dots n \end{aligned}$$

Where t represents the quantiles that take the value between 0 and 1.

5. Data

The data for this study has been obtained from Household Integrated Economic Survey (HIES) conducted at 2018-19 by Pakistan Bureau of Statistics. HIES is being conducted since 1963 with some breaks and it is representative at provincial level, HIES 2018-19 covers 24,809 households. The data being used for this study targets the four provinces of Pakistan (Punjab, Sindh, KPK and Baluchistan). It provides vital information on household income, savings,

liabilities, and consumption expenditure at national and provincial level with urban/rural breakdown. Current HIES also provides the information regarding the uses and availability of information communication technology (ICT) and various dimensions of women empowerment that are the important factors of poverty. Moreover, the household where women have not been observed is eliminating from the estimation. Therefore, the sample of remaining household size is 18623.

Table 1: Construction of Variables

Household Head Characteristics:	
Gender	“1” for Male and “0 for Female”
Education	
Below Secondary	The individual whose highest education is (5 to 9 class) assign the value “1” and “0” otherwise.
Secondary and Intermediate	The individual whose highest education is between 10 to 13 class assign the value “1” and “0” otherwise.
Tertiary Educated and Above	The individual whose highest education is between 14 or above assign the value 1 and “0” otherwise.
	The illiterate is reference category.
Age	The age of household head is between 15 to 90 years. We decompose the age into subcategories with 10-year interval and used as dummy variable (15-24, 25-34.....60 and above) assign the value 1. Age 15-24 is reference category.
Employment Status	If the individual belongs to agriculture sector, assign the value “1” and “0” if he belongs to any other sector.
Household Characteristics	
Family Size	Family size is measure through number of individuals in a household.
Number of Earners	Total number of earners in a household.
Type of Property	
Low property	If household has any 1 or 2 items (agriculture land, non-agricultural land, residential building and commercial building) assign the value “1” and “0” otherwise.
Medium Level Property	If household has 3 to 4 items of above property assign the value “1” and “0” otherwise. The no property is reference category.
Region	If household belongs to urban region, it assigns the value “1” and “0” if the household belongs from rural region.
Province	If household belongs to Punjab, it assigns the value “1” and “0” otherwise. If household belongs to Sindh, it assigns the value “1” and “0” otherwise. If household belongs to KPK it assigns the value “1” and “0” otherwise. If household belongs to Baluchistan, it assigns the value “1” and “0” otherwise. Baluchistan is reference category.
Cash transfer in term of Remittances	If the household receive domestic or foreign remittances during the last one year assign the value “1” and “0” otherwise (Revive no remittances).
ICT	
ICT Facilities	If household has these ICT facilities (internet, mobile phone, landline, and computer/tablet etc).
Household head use Internet	If household head uses the internet, it assigns the value “1” and “0” otherwise.
Women Empowerment Index	Measured through principal component analysis by using the item given in above text.

Table 2 gives the descriptive statistics of dependent and explanatory variables. The poverty incidence of present sample size is 19.7 and mean of EPE/P ratio is 1.7. This may indicate that on average people are above the poverty line. Pakistan is a male dominant society in which men embrace power in all important institutions of the society. The Male headed households are on average 93.8 percent. The average year of education of head is 5 and average age of household head 45.7.

Table 2: Descriptive Statistics

Dependent Variables	Mean	SD
Poverty Incidence	19.777	39.833
Expenditure per adult Equivalence scale to Poverty Line (EPE/P)	1.708	1.488
Explanatory Variables		
Household Head Characteristics		
Male	0.938	0.241
years of Schooling	5.106	5.179
Dependent Variables		
Age	45.789	13.289
Agriculture Employment Status	0.224	0.417
Household Characteristics		
Family Size	4.997	2.443
Number of Earners	1.957	1.376
Low Property	0.748	0.434
medium Property	0.114	0.318
Receive Remittances	0.155	0.362
Region (Ref: Rural)		
Urban	0.364	0.481
Province (Ref: Baluchistan)		
KPK	0.201	0.401
Punjab	0.475	0.499
Sindh	0.227	0.419
Receive Remittances	0.155	0.362
ICT Facility Availability	1.476	0.861
Household Head Use Internet	0.171	0.376
Women Empowerment Index	-0.026	1.495

6. Empirical results

To analyze the determinants of incidence of poverty for a household being a poor the Probit model has been used. The results are presented in table 3. The negative sign of coefficients of explanatory variables shows that chance of being the poor decreases and positive sign indicates

that probability of household being poor increases. The result of model 1 explains that male headed household is insignificant in case of Pakistan. Whereas human capital plays an important role to pull out the household from poverty. As the education of a household head gets improved from one level to another, his chances of being poor decreases significantly. Similarly, as the household head whose education improves from one level to another, the probability to being poor of that household has been declined. As the educated household head guides the other family members in a better way to improve their poverty state. The age of the household head is also negatively associated with poverty that reflects on the experience of the household head.

The household head whose employment status belong to agriculture sector has less chance of being poor than those who work on other trades. Household size is one of the primary determinants of poverty level across the household level. Usually, there is a positive relation between a large family size and the household poverty level. The empirical analysis also shows that a household is poor if it has a large family size (Fusco & Islam, 2020). Whereas number of earners does not play a statistically significant role to improve the poverty status of the household. However, the household who owns a property has less chance to being a poor family. This is because the property may help them to earn some rent or some dividends after a passage of time.

When we come to region, it has been observed that household who belongs to urban region has less probability to being poor as compared to those who belongs to rural region. Similarly, the household who belongs to the Punjab follow by the Sindh and Khyber Pakhtunkhwa provinces has less probability to being a poor as compared to those who belongs to the Baluchistan province.

Remittances are shown to be a source of income for the households and of great help in reducing poverty incidence. To analyze the role of remittances on poverty, we add the remittances that household received during last year in model 3 and our results of other control variable are consistent with previous model. whereas the coefficient of remittances shows that household who receives remittances has less chance to being poor than those who didn't receives.

In model 3 we add the role of ICT to analyze its impact on poverty, our results indicates that household which has access to ICT facilities and household head who is user of internet has less chances of being a poor. ICT may increase the economic opportunities like free lancing, access to online educational opportunities and different trainings. Similarly, the households where women are more empowered may also reduce the chances of being poor. Similarly model 4 suggests that the women empowerment significantly help to reduce the occurrence of poverty at household level. The household where women are more empowered, they can pull out their family from poverty trap.

Table 3: Empirical result of probit model to estimate the determinates of poverty

Variables	Model 1	Model 2	Model 3	Model 4
Household Head characteristics				
Male	0.0325 (0.0221)	0.00151 (0.0228)	-0.000315 (0.0229)	-0.0102 (0.0231)
Below Secondary	-0.0983*** (0.00698)	-0.0988*** (0.00698)	-0.0778*** (0.00690)	-0.0764*** (0.00691)
Secondary Intermediate	-0.196*** (0.00878)	-0.196*** (0.00876)	-0.148*** (0.00897)	-0.146*** (0.00898)
Graduate and Above (Reference: Illiterate)	-0.355*** (0.0198)	-0.355*** (0.0198)	-0.254*** (0.0210)	-0.252*** (0.0210)
Age 25-34	0.0491*** (0.0161)	0.0463*** (0.0161)	0.0452*** (0.0158)	0.0439*** (0.0158)
Age 34-44	0.0448*** (0.0158)	0.0410*** (0.0158)	0.0341** (0.0155)	0.0334** (0.0155)
Age 45-54	-0.0516*** (0.0162)	-0.0533*** (0.0162)	-0.0519*** (0.0160)	-0.0517*** (0.0160)
Age 55-64	-0.0899*** (0.0174)	-0.0880*** (0.0174)	-0.0794*** (0.0172)	-0.0791*** (0.0172)
Age 65 and above (Reference: Age 15 to 24)	-0.0650*** (0.0202)	-0.0585*** (0.0203)	-0.0503** (0.0200)	-0.0489** (0.0200)
Employment Status				
Agriculture (Ref: Non-Agriculture)	-0.0880*** (0.00760)	-0.0829*** (0.00765)	-0.0876*** (0.00746)	-0.0879*** (0.00746)
Family Size	0.0280*** (0.00159)	0.0290*** (0.00160)	0.0342*** (0.00159)	0.0344*** (0.00159)
Number of Earners	-0.000533 (0.00269)	-0.00262 (0.00271)	-0.00525** (0.00266)	-0.00497 (0.00266)
Low Property	-0.0296*** (0.00890)	-0.0294*** (0.00888)	-0.0350*** (0.00877)	-0.0343*** (0.00876)
Medium Property (Reference: No property)	-0.0660*** (0.0134)	-0.0660*** (0.0134)	-0.0559*** (0.0133)	-0.0552*** (0.0133)
Urban (Reference: Rural)	-0.172*** (0.00715)	-0.173*** (0.00713)	-0.142*** (0.00718)	-0.140*** (0.00719)
Khyber Pakhtunkhwa (KP)	-0.0864*** (0.0107)	-0.0755*** (0.0109)	-0.0478*** (0.0107)	-0.0446*** (0.0107)
Punjab	-0.126*** (0.00941)	-0.118*** (0.00949)	-0.0942*** (0.00934)	-0.0840*** (0.00969)
Sindh (Reference: Baluchistan)	-0.0192* (0.0102)	-0.0177* (0.0102)	-0.00364 (0.0100)	0.00248 (0.0101)
Receive Remittances (Ref: No Remittances)		-0.0637*** (0.0115)	-0.0479*** (0.0114)	-0.0482*** (0.0114)

ICT				
ICT Facility at Home			-0.107***	-0.106***
			(0.00595)	(0.00595)
Household head use Internet (Ref: No use Internet)			-0.0641***	-0.0631***
			(0.0140)	(0.0140)
Women Empowerment Index				-
				0.00919***
				(0.00233)

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

To analyze the determinants of poverty across the poverty bands, quantile regression is applied by using the methodology of Peng et al. (2019). For this we regressed five quantile regression models one for each quantile determined according to the EPE/P ratio. Where mean value of EPE/P line of first quantile is 0.719 which represents the extreme poor and 5th quantile mean is 1.39 which represents the marginally poor.

Table 4: Poverty bands

Poverty Band	Mean	SD
Extreme Poor	.7195883	.0940999
Vulnerable Poor	.9272646	.0481383
Poor	1.079108	.0414739
Vulnerable	1.22639	.0450007
Marginally Poor	1.391358	.0520435

The results of quantile regression are given in table 5. The sign of coefficients explains the relationship between the determinants of poverty and EPE/P ratio across the different poverty bands. The sign of coefficients is according to the theory and literature. The coefficient of significant variables of quantile regression is also presented in below figure. The dashed line shows the 95% confidence interval and straight line presents the value of coefficients across the quantiles. The X-axis represents the quantiles and Y-axis represents the coefficients of determinants of poverty.

Table 5: Quantile regression results to analyze the determinants of poverty

Explanatory Variables	Extreme Poor	Deeply Poor	Poor	Vulnerable	Marginally poor
Male	-0.00863 (0.0331)	-0.0195 (0.0290)	-0.0491* (0.0259)	-0.0340 (0.0255)	-0.0300 (0.0364)
Below Secondary	0.0904*** (0.00908)	0.105*** (0.0119)	0.116*** (0.0122)	0.123*** (0.0114)	0.135*** (0.0131)
Secondary Intermediate	0.191*** (0.0108)	0.221*** (0.0129)	0.259*** (0.0151)	0.279*** (0.0162)	0.303*** (0.0147)
Graduate Above (Ref: Illiterate)	0.427*** (0.0246)	0.526*** (0.0257)	0.624*** (0.0351)	0.693*** (0.0257)	0.800*** (0.0248)

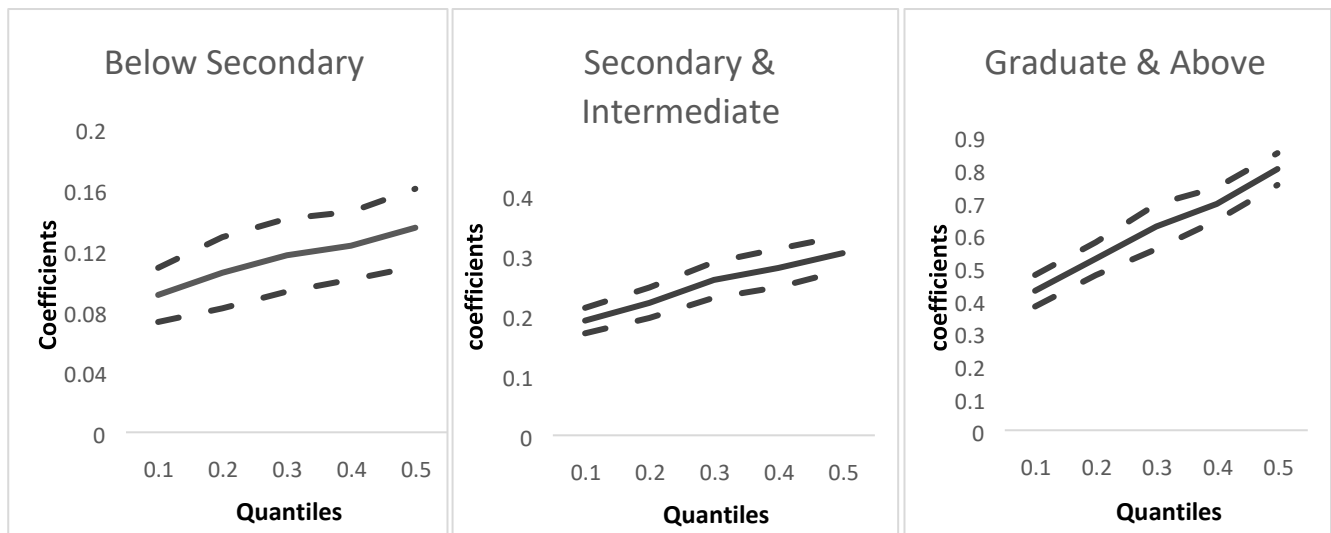
Age 25-34	-0.0480 (0.0327)	-0.079*** (0.0200)	-0.084*** (0.0276)	-0.078*** (0.0243)	-0.073*** (0.0228)
Age 34-44	-0.0135 (0.0318)	-0.0294* (0.0172)	-0.0283 (0.0263)	-0.0133 (0.0246)	-0.0169 (0.0238)
Age_45-54	0.105*** (0.0371)	0.0991*** (0.0235)	0.125*** (0.0265)	0.151*** (0.0262)	0.161*** (0.0261)
Age 55-64	0.170*** (0.0388)	0.156*** (0.0218)	0.177*** (0.0301)	0.205*** (0.0285)	0.220*** (0.0262)
Age 65 and Above (Ref: 15-24)	0.102** (0.0418)	0.118*** (0.0232)	0.124*** (0.0360)	0.167*** (0.0433)	0.175*** (0.0331)
Employment Status					
Agriculture (Ref: Other than Agriculture)	0.0864*** (0.0109)	0.106*** (0.00878)	0.114*** (0.00785)	0.115*** (0.00743)	0.119*** (0.00982)
Family Size	-0.043*** (0.00197)	-0.053*** (0.00211)	-0.061*** (0.00253)	-0.070*** (0.00265)	-0.076*** (0.00263)
No of Earners	-0.00218 (0.00344)	-0.00478 (0.00489)	0.000355 (0.00386)	0.00157 (0.00375)	0.00391 (0.00408)
Low Property	0.0330*** (0.00981)	0.0287*** (0.00913)	0.0357*** (0.0116)	0.0388*** (0.0133)	0.0340** (0.0168)
Medium Property (Ref: No Property)	0.0528*** (0.0193)	0.0482*** (0.0181)	0.0489** (0.0200)	0.0836*** (0.0248)	0.0789*** (0.0274)
Urban	0.207*** (0.00804)	0.252*** (0.00779)	0.280*** (0.00924)	0.318*** (0.0104)	0.357*** (0.0126)
KPK	-0.0302* (0.0169)	-0.0437** (0.0223)	-0.0465** (0.0230)	-0.0482** (0.0228)	-0.0397** (0.0175)
Punjab	0.0106 (0.0140)	0.0199 (0.0166)	0.0204* (0.0155)	0.0414*** (0.0139)	0.0573*** (0.0116)
Sindh (Ref: Baluchistan)	-0.067*** (0.0157)	-0.069*** (0.0156)	-0.083*** (0.0131)	-0.073*** (0.0122)	-0.080*** (0.0132)
Receive Remittances	0.0657*** (0.0191)	0.0633*** (0.0151)	0.0588*** (0.0190)	0.0635*** (0.0153)	0.0819*** (0.0188)
ICT Facility Availability	0.142*** (0.00747)	0.187*** (0.00916)	0.226*** (0.00931)	0.253*** (0.0119)	0.263*** (0.0110)
Household Head Use Internet	0.133*** (0.0167)	0.137*** (0.0163)	0.151*** (0.0172)	0.187*** (0.0213)	0.214*** (0.0185)
Women Empowerment Index	0.0174*** (0.00270)	0.0196*** (0.00231)	0.0185*** (0.00327)	0.0190*** (0.00267)	0.0209*** (0.00347)
Constant	0.718*** (0.0591)	0.843*** (0.0408)	0.932*** (0.0410)	0.979*** (0.0413)	1.066*** (0.0430)

Standard errors in parentheses

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

The gender of household head being male is negatively associated with poor and is only significant at 10% level of significance for poor household. This may indicate that gender of household head has no role to influence the poverty. This is consistent with the result of corresponding Probit model.

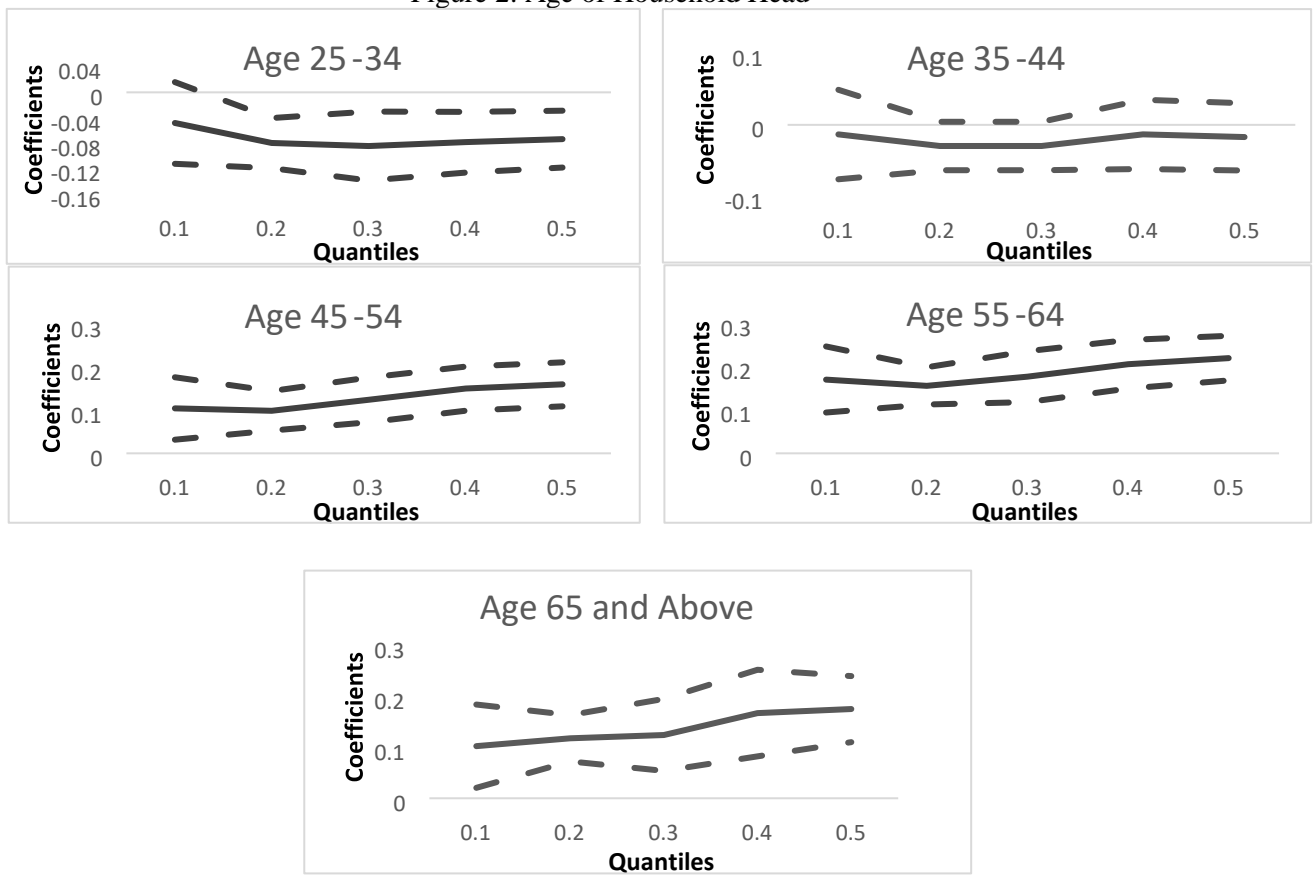
Figure1: Education Level of Household Head



As expected, human capital significantly improves the living standard of household for all poverty bands. Any education level of household head higher than illiterate significantly improves the EPE/P ratio of household. The results of education level are in line with the Probit model. Figure 1 shows that EPE/P ratio vary across the quantiles for below secondary and secondary and intermediate as for below secondary the EPE/P ratio increases from 0.04 for extremely poor to 0.16 for marginally poor household. However, for graduate and above, magnitude of the association increased substantially and is deepest effect when one moves from low quantile to upper quantile ranging from 0.4 to 0.8.

The coefficient of age of household head is positively associated with the living standard of household, as household head who experiences the young age group between (25-34) there EPE/P ratio is negative across all poverty bands. As Kedir and Henry (2010) argues that high unemployment is observed in adult and less productive causes the poverty of household. However, the household head whose age is 45 to above are more productive and get better experience which ultimately helps to improve the living standard of the household as EPE/P ratio increases and have its deepest effect on vulnerable and marginally poor households. Whereas the older age group shows that EPE/P ratio is increasing at decreasing rate across all the poverty bands.

Figure 2: Age of Household Head



The result of employment status is as expected and in line with literature (Majeed and Malik, 2015) indicating that household is better off when it belongs to agriculture sector. The impact become stronger when household moves to the upper quantile ranging from 0.8 for extreme poor household to 0.119 for marginally poor household. This may be due to the fact that Pakistan is basically an agrarian economy and 70 percent people directly or indirectly belong to agriculture sector. Moreover, agriculture sector pays off better for the poor segment of society than those who work in other trades.

Figure 3: Agriculture Employment Status

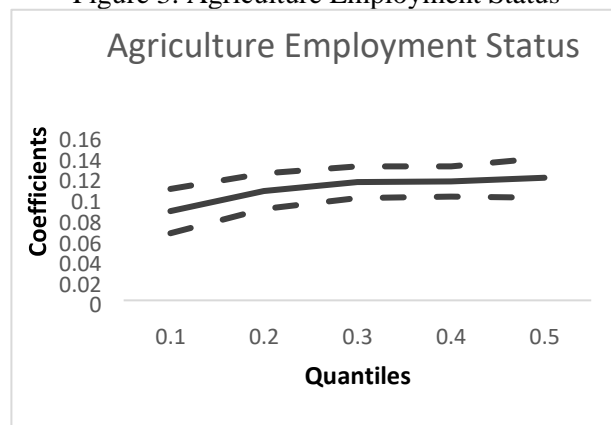
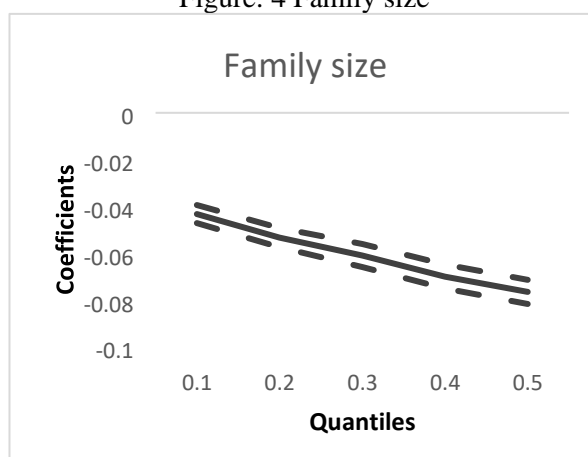
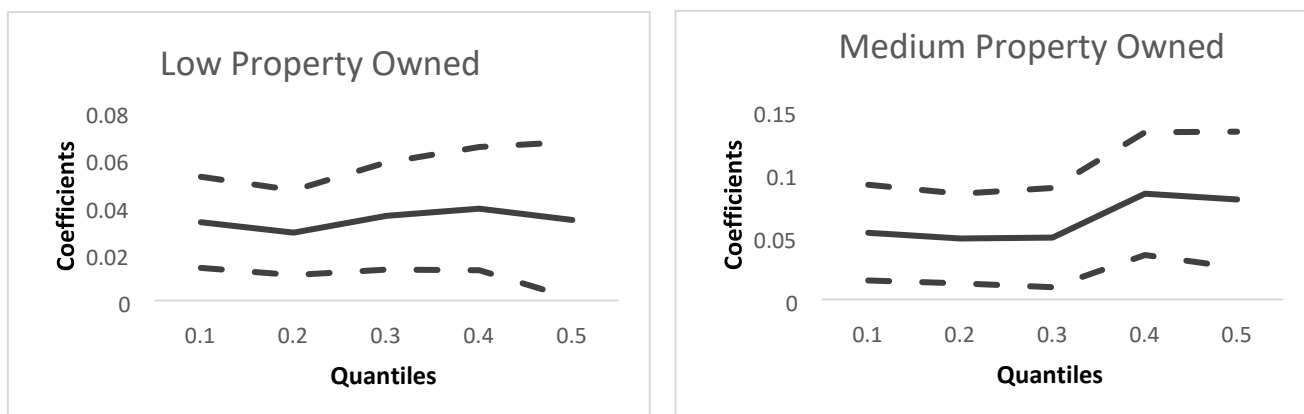


Figure: 4 Family size



The impact of family size has significantly negative impact on the living standard and EPE/P ratio. The magnitude of the association increases substantially as one moves up from one poverty bands to upper poverty band. The general pattern of the quantile estimates is that household size is rather beneficial to households in the lower quantiles but detrimental to the consumption expenditure of those households closer to the poverty line. This indicates that increasing family size has more impact on vulnerable and marginally poor households as compared to extreme poor and poor household.

Figure: 5 Property Owned

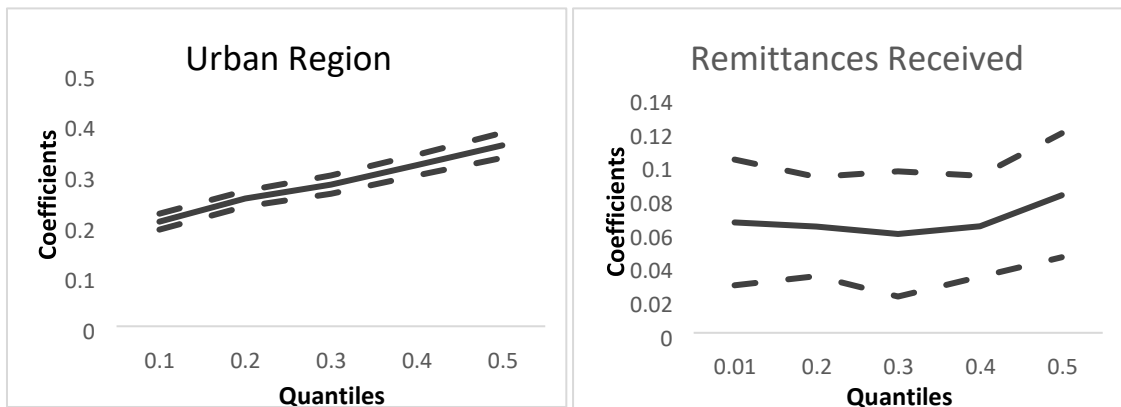


With respect to property, household that owns property low or medium property as compared to no property helps to pull out from poverty and improves the living standard. Figure 5 for low property did not vary much across the quantiles, however for medium property shows upward trend which indicates that as one moves up the distribution EPE/P ratio the impact of medium property is strong to improve living standard of household, as EPE/P ratio increases from 0.05 for extreme poor to 0.08 for marginally poor household.

With regard to region, quantile regression results for region indicate that households residing in the urban sector are better-off as compared to those who belongs to rural region. One key pattern is that location is less important to the poor in the lower quantiles as compared to those

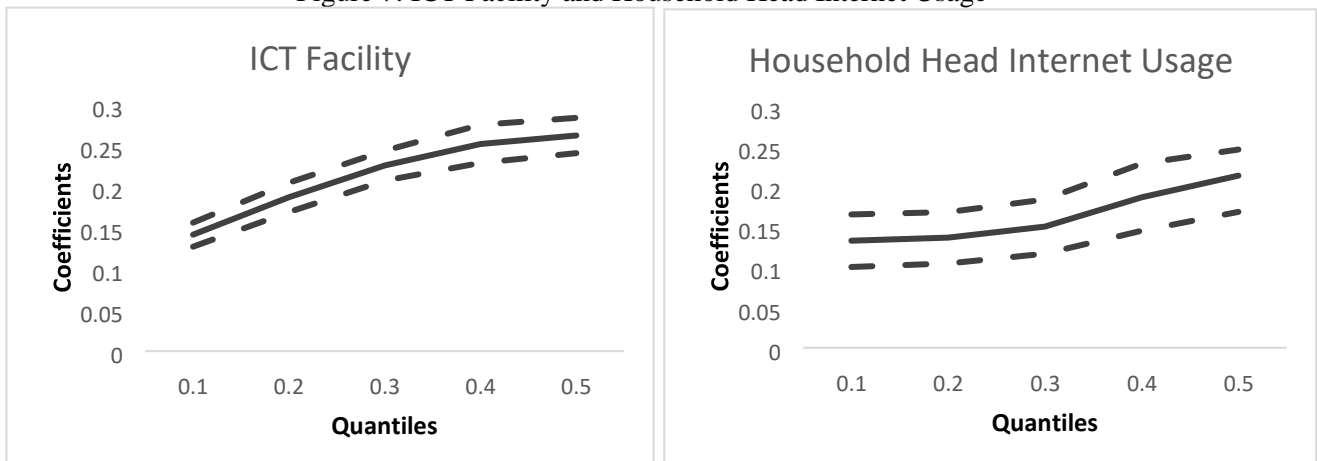
in the upper quantiles. As Figure 6 shows that urban household in the bottom quantiles and medium quantiles are less prosperous in the rural sector as compared to the households in upper quantile. Also, as Table 5 indicates for the households on top of the conditional distribution, vulnerable and marginally poor living in the urban sector have enjoyed better standard of living than rural sector. Similarly, the households which belong to the Punjab has better living standard and it becomes significant when one moves from poor to marginally poor group with reference to Baluchistan. Whereas KP and Sindh has worse-off condition in terms of living standard across all poverty bands. The results are consistent with (Majeed & Malik, 2015).

Figure 6: Urban Region & Remittances Received



In turning to remittances, the coefficient was significant across the poverty band, and the magnitude got larger as one moved up the distribution of the EPE/P ratio. The coefficient was 0.6 for the extremely poor and 0.8 for the marginally poor as compared to those which do not receive any cash in terms of remittances. Hence remittances seem to be very effective for enhancing wellbeing of poorer households as the magnitude of the coefficient improves when we move to higher quantiles in the expenditure distribution. So, remittances either these come from foreign or within country are helpful for developing country like Pakistan to pull out people form poverty trap.

Figure 7: ICT Facility and Household Head Internet Usage



ICT (ICT facility at household level and household head usage of internet) is significantly positively associated with EPE/P ratio and increases monotonically as one moves from lower to upper poverty bands. The results are in line with earlier Probit model. Figure 7 for ICT shows the quantile regression with 95% confidence interval and impact becomes stronger for those households whose head uses the internet as one moves towards upper quantile. So, our result support the previous studies (Khaliq et al, 2016; Yilmaz et al., 2018) that use of ICT tools and internet usage improves the living standard of household.



Figure 8 show that women empowerment has a significant impact in improving the living standard of a household. However, the coefficient of women empowerment has not much very as one move from low poverty band to upper poverty band, on average the household where women is empowered raise the EPE/P ratio by 0.015. Our result supports the previous findings Rui & Feng-ying (2021) for China and Nadim & Nurlukman (2021) for Bangladesh and Sarwar and Chaudhry (2021) for Pakistan economy.

7. Conclusion

This study investigated the impact of ICT and women empowerment as major determinants for poverty in Pakistan. Other determinants under consideration in our study were education, age and employment status of household head, family size, remittance's inflow and property owned at household level. Probit model is applied to identify the determinants of poverty associated with the probability of a household being poor, allocating individuals into poor or non-poor is sensitive to the poverty threshold.

To overcome this, the poverty level has been divided into five bands: extremely poor, deeply poor, at the poverty line, near poverty, and marginally poor households to analyze the impact of determinants across the poverty spectrum. The quantile regression model has also been applied to estimate the correlates of poverty at different points of the income distribution. The results obtained from the quantile regression are of great significance and can be used for policy implications as it can help formulate the targeted policies for different poverty groups as different determinants affect the poverty level in a unique way.

Education of the household head has a greater contribution across the poverty spectrum as educated households head has a comparative advantage to secure job or work as an entrepreneurial agent to have better earnings. It has been observed from the results that there is a consistent decline in poverty as the education level improves. It helps him to provide his family with all necessities of life.

Empirical Analysis shows that ICT and use of internet has a positive and significant impact. Moreover, the demographic characteristics family size, age, education level and human capital also act as primary indicators of poverty reduction. Smaller the family size, more is the opportunity for the household head to provide a better living standard as the cost of dependents is almost the same for all expenditure groups.

Findings from the above-mentioned model suggest that remittances received significantly contribute towards reducing poverty and improving the living standard of households.

Moreover, eradicating poverty requires that all individuals should be provided with the equal opportunity especially the women should be given access to education, health, and nutrition. This can help women to contribute positively towards economic progress of the country and ultimately poverty reduction.

In conclusion, the findings indicate that important set of policies can be designed for targeted poverty groups. Access of education to all citizens equally, effective family planning program to control the family size and to grant priority to specific poverty groups (extreme & deeply poor) that will help in targeted poverty reduction interventions. Last but not the least, the most important poverty reduction factor is the use of ICT and particularly internet usage.

Declaration of conflict of interest

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ORCID iD

Henna Ahsan <https://orcid.org/0000-0002-4558-6485>

Hania Afzal <https://orcid.org/0009-0007-5440-7729>

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