The Journal of Animal & Plant Sciences, 28(6): 2018, Page: 1835-1845
ISSN: 1018-7081

EXTENT AND DETERMINANTS OF RURAL POVERTY IN PAKISTAN: ROLE OF ADOPTING RISK MANAGEMENT STRATEGIES

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ABSTRACT

Poverty eradication has become one of the main agenda of development policies all around the globe. Besidesmanypoverty eradication programs, still, developing countries are trying hard to cope with poverty. Based on a household survey of 480 farm households, this study assesses the extent, degree of rural poverty among farm households in different districts of Punjab province, Pakistan. The study used Foster-Greer-Thorbecke (FGT) approach to calculate level and extent of poverty and logistic regression method to identify the determinants of rural poverty among farm households in Punjab, Pakistan. The study revealed exciting findings and showed that more than half of the farm households in the study districts are living under the poverty line of $2 a day of them about one-tenth are earning even less than $1 a day. The study also found that use of different income sources in addition to agriculture not only reduced the level of poverty but also help farm households in reducing the depth of poverty. The study also found an inverse effect of education, off-farm income, farming area, annual unearned income, access to credit, number of animals and adaptation to various risks on poverty status of farm households. Further distance from input market and dependency ratio were positively associated with poverty status of farm households.

Key words: Vulnerability; Adaptation; Development; Income distribution; Education.

INTRODUCTION

Since last few decades, poverty eradication has become one of the most important agenda of the development and development policies globally. Literature presents vast research done on different dimensions of poverty and its linkages with different economic sectors. At one hand, developing economies are struggling to eradicate poverty in the presence of various social, economic and political challenges (WB, 2001). On the other hand, increasing environmental and climate-related disasters such as floods, earthquakes, and extreme climatic events are likely to disturb all the eradication efforts done so far in most of the developing economies especially in South Asia. According to an estimate, climate change may lead up to 30% reduction in cereal productivity along with up to 37% loss of gross per capita water availability from 2001 to 2059 in South Asia (Parry, 2007).

South Asia is one of the most populous regions in the world and accounts for one-fifth of the total global population. According to an estimate, among 1.2 billion poor people living under one dollar a day, about 36% belongs to South Asia (FAO, 2005). Like other South Asian economies, poverty in Pakistan is widespread and about 40% of the population live under the poverty line (if counted at $1.25 per day). The UNDP's human development report ranked Pakistan 146th out of 187 countries with low human development index (0.515) which is a worldwide comparative measure of standards of living, education, life expectancy and literacy (HDR, 2013). Poverty in Pakistan is basically a rural phenomenon. While two-thirds of the population in Pakistan live in rural areas and accounts for 80% of the country's poor people. Pakistan has experienced cycles of high growth interrupted by various shocks and crises. Similarly, poverty shows an overall declining trend since the1970s to date despite some rise in 1990s and again fall in 2000s (Arif, 2000). However widespread floods in 2010 and 2011 added to Pakistan's economic trouble and threatened to reverse earlier efforts in poverty eradication IFAD (2012). Current rising levels of conflict and insecurity within the country along with other environmental and economic challenges such as water scarcity, stagnant economic growth,and low adaptive capacity have further restricted the country's capability to deal effectively with persistent poverty (IFAD, 2012).

Poverty can be defined in various ways. World Bank defined poverty as "pronounced deprivation in well-being" where well-being can be measured by individual or households' possession of income, assets,

education, health and certain rights in a society. The governmentof Pakistan defined poverty "a state or condition in which a person or community lacks the financial resources and essentials to enjoy a minimum standard of life and well-being that's considered acceptable in society" (GOP, 2014). Whereas, the poverty line is used to measure the level of poverty in any economy or society and may also consider the edge to differentiate between poor and non-poor. The thresholds of 1$, 1.25$ or 2$ a day are used to calculate the extent of poverty in economic terms. According to World Bank poverty headcount index 2014, at $1.25 per day threshold, about 21% of the population lives under the poverty line, and if this threshold is raised to $2 per days, then almost 60% of the total population in Pakistan is below the poverty level (GOP, 2014).

The extent of rural poverty in Pakistan may be explained well from the contribution of agricultural sector to the country's total gross domestic product (GDP) (21%) and total employment to the total labor force (45%). Overall two-thirds of the population in Pakistan (mainly rural population) directly or indirectly rely on agriculture sector for their livelihood (Abid *et al*., 2014). The lower share in GDP compared to its higher share in providing livelihood show the disparity and low income in rural areas which mainly consist of small farming households. The main reason for this income disparity and high dependence lies in small land holdings and limited employment opportunities other than agriculture sector which limits the earnings of farm households. According to an estimate, only in Punjab which is the most populous province in Pakistan, there are 3.35 million small farming families who hold on average less than 2 hectares of land (Abid *et al*., 2011). Other reasons which may contribute to rural poverty in Pakistan includethelow financial viability of rural households andthehigh cost of factors of production. Further, the low access to basic infrastructure (e.g., education and health) and institutional services such as farm advisory services, farm implements, and credit facilities are other important factors which indirectly contributing to rural poverty in Pakistan (Abid *et al.*, 2011).

To reduce poverty in rural areas, serious efforts are needed both at the policy level as well as at grass root level. Although poverty in Pakistan exhibits a declining trend but still crossing the mere poverty line threshold may be good policy in the long run and may require improvement in the basic stander of living in rural areas. The literature on eradication of poverty shows various measures to reduce poverty. Specifically, in the context of Pakistan, rural poverty may be reduced with improvement in agricultural productivity and improved labor wages in rural areas which are quite low even compared to its neighboring countries (Pasha and Palanivel, 2004). Various other studies (FAO 2005; IFAD 2014) have also found a positive link between increased agricultural growth and poverty reduction. Farm diversification which takes into consideration other non-farm income options may be another effective tool to eradicate poverty in rural areas. This will not only directly reduce the dependence of small farming families on agriculture sector, but it may also indirectly enhance agricultural productivity by increasing labor productivity (De Janvry and Sadoulet, 2001; Lanjouw and Murgai, 2009). Similarly lowering household dependency ratio or number of working members in a family does also have a significant impact in reducing poverty among rural households (Saboor, 2004). A household may have a lesser probability of being poor if more household members are working (Hanna, 2004). Similarly, more involvement of females in agricultural sector may play its role in mitigating poverty among rural households (Chaudhry, 2003).

Much work has been done so far on various dimension of poverty and measures to eradicate poverty in the world (e.g. Adeyeye, 2001; Hanna, 2004; De Janvry and Sadoulet, 2001; Lanjouw and Murgai, 2009) as well as in Pakistan (Saboor, 2004; Malik, 1996; Chaudhry, 2003; Haq *et al*., 2015). However, the current literature on poverty in Pakistan misses the linkage of different income sources with poverty and impact of adaptation to ongoing environmental risks. Hence this study not only explored the current poverty status and its determinants but it also emphasized on linkages of poverty with sources of income and adaptation to various environmental risks at the farm level. Specifically, this study answered to three research questions;

1. What is the current status and extent of poverty in Punjab province, Pakistan?
2. What are the determinants of the rural poverty in Punjab, Pakistan?
3. How does education and adaptation to various kinds of risks play their role in reducing poverty among farm households in study regions?

MATERIALS AND METHODS

Study area: The studywas mainly conducted in Punjab province which is located in semi-arid and lowlands zone between latitudes 31 N and longitudes 72 E (Abid *et al*., 2015). Punjab is the most populous and second largest (concerning area) province of Pakistan. We selected Punjab as study area due to its total agricultural share in the country's economy. According to an estimate, Punjab accounts for more than half of the total agricultural share of gross domestic product (GDP) and the total cultivated area, two-thirds of total cereal production and more than fourth-fifth of total cotton production in Pakistan (GOPun, 2015; Abid *et al*., 2015).

Punjab province consists of 36 districts and can be further divided into various regions based on its

diverse cropping patterns. Main cropping systems in Punjab include wheat-cotton, wheat-rice, mixed cropping zone and wheat-maize. Each district consists of sub-districts (*tehsils*) which are composed of several numbers of union councils followed by several villages. The climate of Punjab province is temperate. The mean annual minimum temperature in Punjab ranges between 16.3 to 18.2 °C and the rainfall pattern follow a different variation depending on the geographical location of the province (Abid*et al*. 2015).

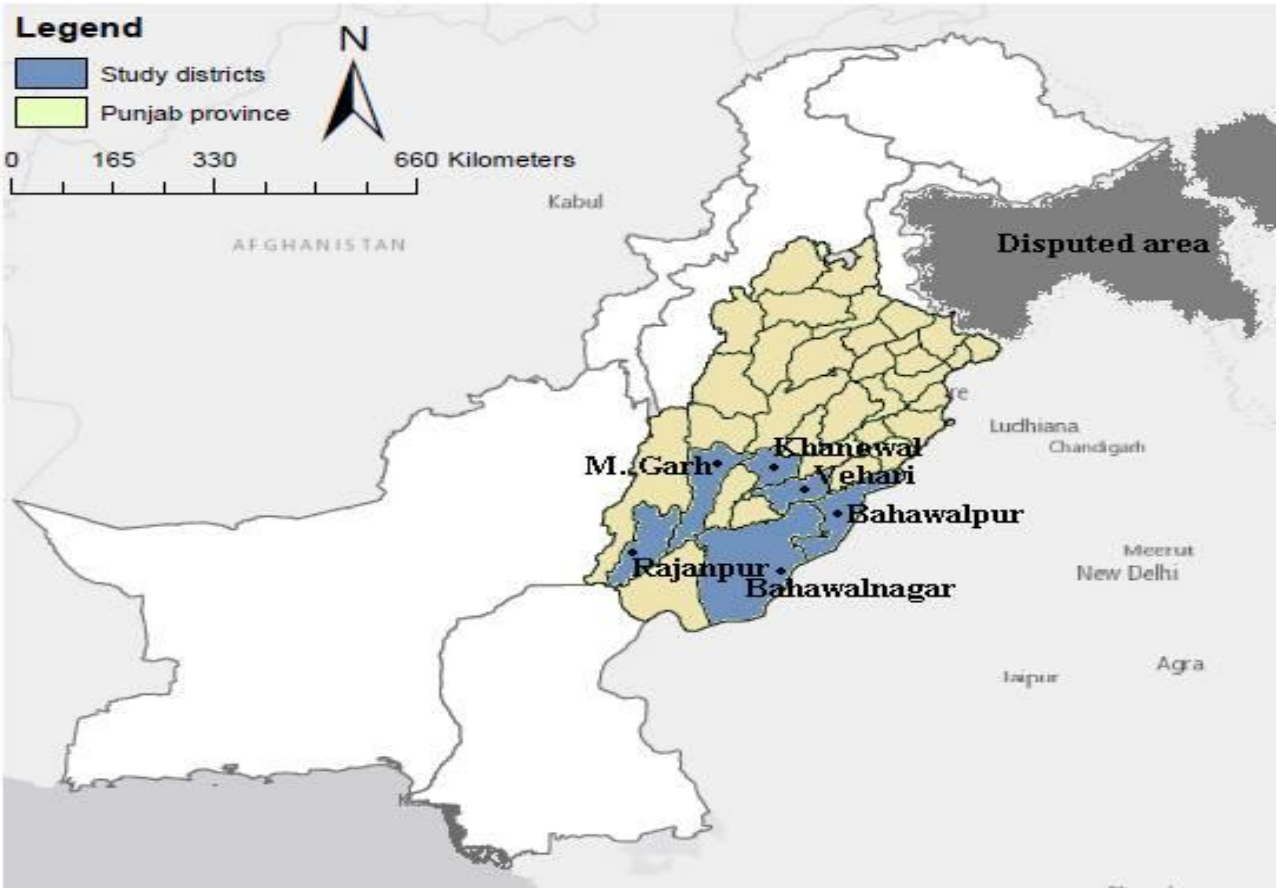

Figure 1: Map of study districts Punjab province, Pakistan

Sampling and data collection: A Multistage sampling technique was used to select study sites and sample of 480 farming households. The study mainly focused cotton farmers while selecting the sample farming households keeping in view the risk associated with cotton crop compared to other crops. In the first stage, from 9 division of Punjab province, three divisions were selected based on the share to total cotton production in the province. In the second stage, two districts with the most cotton production were selected from each division. In the third stage, a random number of union councils was selected from each district. In fourth and last stage, about 80 farmers were selected from each district. So the final districts selected for data collection included Vehari, Khanewal, Bahawalpur, Bahawalnagar, Rajanpur, and Muzaffargarh.

The study was conducted between October 2014 and January 2015. About 480 farm households were interviewed irrespective of gender, tenancy status ,and farm size through a semi-structured farm household questionnaire. The questionnaire used for survey includes information on; socio-economic and demographic characteristics of farm households; sources of income; land tenure; crop management practices; environmental risks faced and adaptation measures are taken to avoid associated negative impacts. Before the start of the study, a pretesting of the questionnaire was also done to avoid missing any important information. Data collection was completed with the help of five master and undergraduate level students who were trained about study objectives and data collection before the inception of the study.

Analytical framework

Calculating extent and level of rural poverty: Following Mukerjee and Benson (2003), Gibson (2001) and De Janvry *et al*. (2005), this study uses Foster-Greer-Thorbecke (FGT) approach to calculate the extent and level of rural poverty among various categories of

farmers based on their income sources. The FGT index can be written as;

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{m}\left(\frac{Z - Y_i}{Z}\right)^\alpha$$

Where n is the total number of sample used, m is the number of household living under the poverty line, Y_i is the income of household from i to m which are arranged in an increasing order, Z is the poverty line income (threshold of $2 per day) and α is the poverty aversion parameter.

Based on the studies by Mukerjee and Benson (2003) and De Janvry *et al*. (2005), we considered three scenarios for the value of poverty aversion parameter α (α=0, α=1, α=2) where; FGT equation with α value equals to zero will calculate the proportion of population under the poverty line or it may also be called the headcount ratio; while FGT equation with α value equals 1 will calculate the poverty depth or the amount through which poor family is lower than the poverty line; The last scenario, FGT equation with α=2 calculates the poverty gap squared index or the severity of poverty.It determines the degree of poverty. The Squared Poverty Gap Index is very similar to the Poverty Gap Index because it also weights the poor based on how poor they are. Further last scenario will also present the changes in the distribution of income among the poor (Adams and Page, 2005).

Determinants of poverty: To determine the factor affecting the probability of farmer to be poor, a logistic regression approach (DudekandLisicka, 2013;Achia*et al*., 2010;Abdul-Hakim and Che-Mat 2011; Khan *et al*., 2015) is used.

$$Y_i^* = \alpha + \beta_k X_k + \mu_i$$

Where, $Y_i^*$is the dependent variable which displays the measure of household poverty with subscription i which shows specific household, α stand for the model intercept, X_k are the independent variables used in the model, while k embodies the specific explanatory variable that effect the poverty status of the farm household i; β_k are the parameters to be projected and μ_i is the error term which is normally distributed and homoscedastic (Zero mean and constant variance (Schmidheiny, 2013).

Here the dependent variable is a binary variable for poverty which takes value one if farm household is poor and zero otherwise. The criteria to define a poor is based on a threshold level of $2 per capita income of the household as defined by GOP(2014). It means, if the per capita income of household is below than the poverty line, then the household will be considered as poor. If the per capita household income is equal or greater than the threshold of $2 a day, thefarmer will be considered non-poor. The dependent variable from equation one can be elaborated in more specific form as;

$$Y = \begin{cases} 1 & if\ Y_i^* < \tau \\ 0 & if\ Y_i^* \geq \tau \end{cases}$$

Where Y_i is the observed variable for poverty status of farm household which takes value 1, if the income of ith household (Y_i^*) is less than a 2$ threshold of poverty level (τ),i.e. ($Y_i^* < \tau$), On the other side, Y_i takes value zero if the income of ith farm household is equal to or greater than the threshold poverty line i.e. ($Y_i^* \geq \tau$).

Hypothesis testing for model significance: To test the overall significance of the model a global null hypothesis approach is used. For this study, we made a null hypothesis by supposing all the regression coefficients in logistic model equal to zero versus an alternative hypothesis (H_1) that at least one of the regression factors (β_K) is not zero (Abid*et al*., 2015):

H_0 : $\beta_K = 0$

H_1 : at least one $\beta_K \neq 0$

This test is feasible to check whether the model with predictors is statistically significant and better than the model with intercept only which can be represented as:

$Y_i^* = \alpha$

The test statistic is calculated by taking the difference of the residual deviances between the two models mentioned above. The test statistic follows the Chi-square distribution and its degree of freedom is equal to the difference of the number of variables in the model with predictors and intercept only model (Stephenson *et al*., 2008).

Further, we also used classification table and also calculated pseudo-R^2 to determine the goodness of fit of the model.

The results of global null hypothesis, pseudo-R^2 and classification table are presented in table 3 which show that associated p-value is less than 0.001 and chi-square (465.68) is highly positive from which it can be concluded that model with predictors fits significantly better than the intercept-only model. Further classification table values which are the measure of model correctness, were found higher in case of a model with predictors (91%) as compared to the model with intercept only (54%). Hence based on the test statistics, we can reject the null hypothesis (H_o) and accept the alternative hypothesis (H_1) that at least one of the regression coefficients (β_k) is not zero. A further value of R-square (0.62) shows a better fit of our model in explaining poverty in our study areas. Based on the results from the classification table, global null hypothesis and pseudo-R^2, we can assume that the model selected for the study is best fit and can accurately estimate the factors determining the poverty status among rural farmers in Punjab, Pakistan.

RESULTS AND DISCUSSION

This section further divided into different subsections to discuss the findings of the study.

Descriptive statistics: Table 1 describes the descriptive statistics of the explanatory variables used in the study. In this study, we have used two kind of variables, i.e. continuous and discrete choice dummy variables. According to the results of the study, the average years of schooling in the study area is eight years while the average farming experience was found 21 years. In the same way, the average land holding size in the study area was around 7 hectares. Further average dependent household member per working member was around 7. On average, each household owns six animals. Majority of the farm households reported that they have access to credit. More than half of the farmers reported that they hadadapted the farming against various kinds of environmental risks. Study also found that utmost one-third of the farm households also involved in different off-farm activities to sustain their livelihood.

Table1. Description of Explanatory variables used in the model.

Explanatory Variable	Mean	SD	Description	Expected Sign
Education (years)	8.27	3.28	Continuous	(-)
Farming Experience (Years)	21.83	8.85	Continuous	(-)
Location (distance in Km from main city)	11.93	4.60	Continuous	(+)
Off-farm income	0.38	0.49	Dummy takes the value 1 if have off-farm income otherwise 0	(-)
Farming Area (acres)	16.67	9.01	Continuous	(-)
Dependency Ratios	7.00	2.75	Continuous	(+)
Annual unearned income	0.26	0.44	Dummy takes the value 1 if have unearned income otherwise 0	(-)
Loan Access	0.71	0.46	Dummy takes the value 1 if have access otherwise 0	(-)
Number of livestock	6.16	4.10	Continuous	(-)
Risk Management strategies adapted	0.55	0.50	Dummy takes the value 1 if adapted otherwise 0	(-)

It is clear from the table 2 that sources of income for the agricultural household are divided into three main types. First one is the agricultural income which is the combination of crop income and livestock income, which is calculated from income of all crops and livestock on a yearly basis then converted into per month. The second is the non-farm income which is obtained by the farmers from doing any job, business or other laborer work to increase the family income. The last one is the unearned income attained from pension, bonus, remittances or any other type of transfer payment. The share of agriculture income is high because it is the main source for a farmer (Che-mat and Jalil, 2011). However, it can be noticed that one-fourth of the total income is the non-farm income. So now farmers not only rely on agriculture income they try to enhance the range of income sources (Barrett *et al*., 2001; Haggblade *et al*., 2010). After considering income from non-farm sources the average income increase about Rs.16476.While the share of unearned income was around 1.8%.

Extent and level of rural poverty: We considered the criteria of $2 per day per person (equivalent to Rs. 202 in Pakistan in 2014) as described by GOP(2014) for poverty line calculations. The same benchmark was used to segregate the poor and non-poor in targeted regions. If the per capita household income is less than Rs.202 ($2 a day), then the household will be considered poor and if per capita income is equal or above than Rs. 202 then household will be considered as non-poor. According to the findings of the study shown in figure 2, more than half of the households were under poverty line,i.e. earning less than Rs. 202 ($2 a day) a day. Further, about one-tenth of the households have per capita income even less than Rs. 100 (< $1) and may consider under absolute poverty(Jan *et al*., 2009). Among the farm households who are non-poor, the majority of them are marginally above than poverty line with per capita income between Rs. 200 and Rs. 300 ($2-$3). While only 16% of the farm households were having per capita income above than Rs. 300 (> $3). The study findings are in line with the findings of the study conducted in other parts of Pakistan (Jan *et al*., 2009; Haq *et al*., 2015).

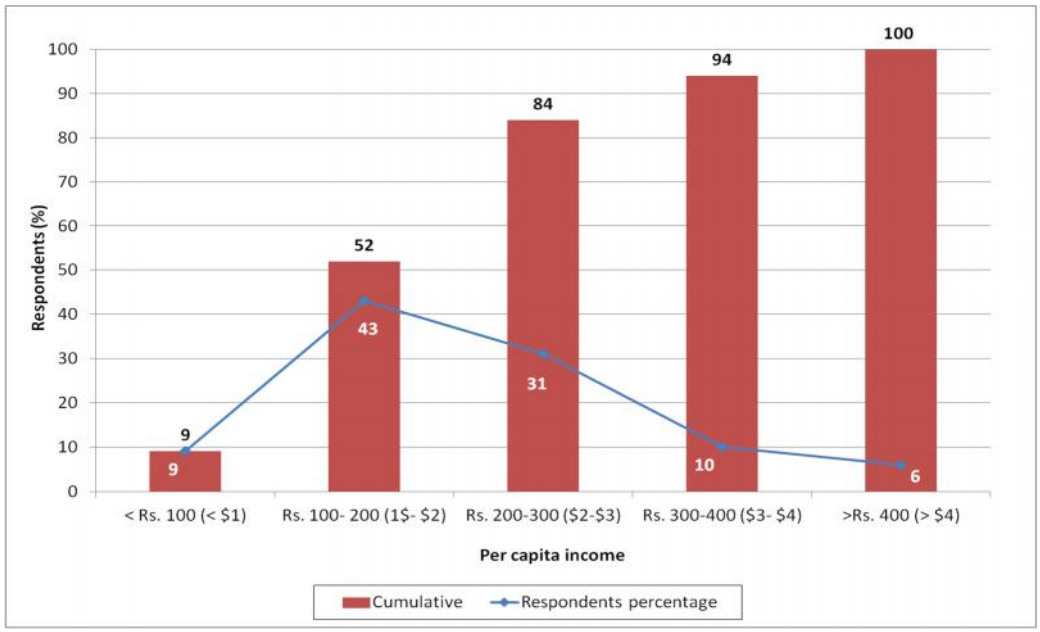

Figure 1. Poverty status among farm households in study areas

Table 2 presents the level, extent, and degree of rural poverty under a different source of income (with base agriculture) among farm households in the study areas. The results show a decreasing trend in the level of poverty from the category of farmers having only agriculture as a source of income (baseline category) to farmers having other non-farming sources of income other than farming (table 2). At α=0 it shows the level of poverty, when only agriculture source of income is considered, then about 68% of farm households were observed under the poverty line ($2 per day). If we consider other non-farm income sources in addition to agriculture as a source of income, then about 15% reduction in the level of poverty can be observed as compared to baseline category, i.e. 58% would be under the poverty line. If farmers also have unearned income in addition to agriculture as a source of income, then about 65% of farm households will be under poverty line. If we consider all income sources including agriculture, non-farm, and unearned income then 54% of the farm household will be under poverty line.

Table 2.Poverty level and extent across various categories of farmers based on income sources.

Pα	**Agriculture income only**	**Agriculture and Non-farm income**	**Agriculture and unearned income**	**Income from all sources (1+2+3)**	**% change**	**% change**	**% change**
	(1)	**(2)**	**(3)**	**(4)**	**[(2-1)/ 1*100]**	**[(3-1)/ 1*100]**	**[(4-1)/ 1*100]**
α=0	0.679	0.579	0.652	0.548	-14.725	-3.991	-19.320
α=1	0.247	0.176	0.234	0.167	-28.751	-5.257	-32.673
α=2	0.120	0.077	0.113	0.073	-36.106	-5.574	-39.351

The level α=0 does only show the level rather than its depth, i.e. how much average amount the poor fall below the poverty line. So if we assume α=1, then the table measures the average difference between poor and poverty line. Again here, the similar decreasing trend in depth of poverty if we add one or more source of income other than agriculture. Lastly, α=2 calculates the squared poverty gap and gives a very valuable inquiry. All poverty measures illustrate that after the accumulation of non-farm income and unearned income to the agricultural household income it diminishes the depth and severity of poverty in the targeted district. However, the size of lessening depends on the technique through which poverty is measured. According to FGT index after adding non-farm income to the agricultural income the level of poverty decreases by 14.72% and inducing unearned income to the agricultural income, it decreases 3.9%. Nevertheless, when all three sources of income are

added then poverty decreases up to 19.32%, it is the maximum reduction as reported by Che-mat *et al*. (2012). Similarly, poverty gap and squared poverty gap also decay as non-farm income and unearned income are added to the agricultural income. For example,highest decrease in poverty gap and squared poverty gap is 32.67% and 39.35% respectively when non-farm income and unearned income are added to the agricultural household income, similar results were found by Che-mat and Jalil (2011).

Determinants of Poverty: Table 3 describes the results of logistic regression and marginal effects calculation of the explanatory variables. Majority of the parameter have similar signs as expected before the analysis.

Table 3. Parameter estimates of the logistic regression and marginal effect calculation.

Explanatory variables	Estimates	Standard deviation	Marginal effects	Standard deviation
Intercept	7.9960***	1.4211		
District Bahawalpur	-0.8953	0.6773	-0.0556	0.1442
District Khanewal	-0.4873	0.8263	-0.0302	0.1229
District Muzaffargarh	0.8750	1.0343	0.0543	0.1774
District Rajanpur	-0.7510	0.5578	-0.0466	0.1187
District Vehari	-1.2819*	0.5852	-0.0795	0.1711
Education (years)	-0.2724***	0.0769	-0.0169	0.0341
Farming Experience (Years)	-0.0022	0.0217	-0.0001	0.0030
Distance from main input market (km)	0.1499***	0.0491	0.0093	0.0191
Off-farm income (dummy)	-1.7336***	0.4594	-0.1076	0.2149
Farming Area (acres)	-0.3081***	0.0456	-0.0191	0.0372
Dependency Ratios	0.3505***	0.0894	0.0217	0.0439
Annual unearned income (PKR)	-2.4845***	0.5004	-0.1542	0.3086
Loan Access	-1.1306**	0.4700	-0.0702	0.1485
Number of livestock	-0.2224***	0.0590	-0.0138	0.0275
Risk management strategies adapted	-1.2224***	0.4229	-0.0760	0.1639
Cox and Snell R-square	0.62			
Model correctness (%)	91			
-2log Likelihood	195.32			
Chi-square	465.68			

***, ** significant at significance level 0.01 and 0.05 respectively

Districts: Location of farm household does also have an important role in defining the poverty status of farm household. According to the results of the study shown in Table 3, all the districts have negative and insignificant sign expect district Muzaffargarh which has a positive coefficient. Only the district Vehari also has negative sign variable significant coefficient which implies that if the farm household belongs to Vehari district, then his chances to be poor will reduce by 8%. This negative relation between district Vehari and poverty status may be due to the higher productivity in Vehari district and due to its higher soil fertility compared to other districts.

Years of schooling: Education may play an important role in shaping farm household's decision-making approach to increase both farm productivity and farm income. In our study, the coefficient of education variable is highly significant and is negatively related with a dependent variable which implies that the probability of a household being poor decreases with increase in years of schooling (Table 3). According to the results of marginal effects, an increase of one year of schooling would result in 3.4% reduction in the probability of farmer is poor. This could be concluded that farmers with more education may be more efficient in managing their farm and income sources compared to farmers with low education. These findings are in line with the findings by other studies (Chaudhry, 2009; Abdul-hakim and Che-Mat 2011).

Farming Experience: Although the coefficient of farming experience has a negative sign, but it has anon-significant impact on the probability of farmers being poor, which implies that even having experience in farming may not guarantee that farmer would be non-farm and there are also other factors which are more important in defining poverty status of the farmer.

Distance from input market: The distance of farm from main input market may be an important factor in defining poverty status of farmers. Farmers in close premises of input market may be able to get quick information over input or output rates and new technologies which may

lead them to make wise decision to adopt certain new technology or sale and purchase of inputs or output from the market at reasonable price. Further, those farmers may also be able to be in contact with other farmers or input dealers to exchange different type of information which may positively contribute to makingeffective decision regarding farm management practices (Abid *et al*., 2015; Maddison 2007). In the present study, the coefficient of location is positive and significant. It means that farmers located in close premises to the local input market have 15% fewer chances to be poor as compared to farmers who are located at faraway distance from the market.

Off-farm Income: In addition to farm income, other off-farm income sources may play an effective role in fulfilling the households' needs and may decrease the probability of farmers being poor (De janvry and Sadoulet, 2001; Ferreira and Lanjouw 2001). The marginal effects described in Table 4 show that if the farm household is also involved in off-farm activities then its likelihood of being poor reduced by 10.7%. The probable reason could be that by diversifying income sources into the farm and off-farm source, farm household divides their risk into different sources and become less dependent on agriculture which is itself exposed to various external risks (Ellis and Freeman 2004). By having some off-farm income sources, farmers may also be able to better adapt to perceived or observed risks to its farming by investing into different adaptive measures and may be able to generate more profit compared to the farmers relying only on farming for their livelihood.

Farming Area: The area under cultivation may be another important factor that may affect farmer's chances of being poor. The results in Table 3 point out that farming area is highly significant and has a negative relation with the dependent variable. It implies that a unit increase in the farming area decreases the probability of being poor by 1.9%. It is understandable that as landholding increases, more production is expected which may lead to an increase in income and better adaptation to observed risk at farm level which can contribute to reducing the chances of being poor.

Dependency ratio: According to the findings of the study presented in Table 3, the coefficient of dependency ratio is highly significant and positively related to the probability of farm household being poor. It implies that as dependency ratio increases the chances of being poor also increases. In Table 3 marginal effects results show that a unit increase in the dependency ratio increases the likelihood of farm household to be poor by 2.1%. These results are in line with the findings by Abrarulhaq *et al*. (2015).

Annual unearned income: As anticipated having unearned income will reduce the household chances of being poor. The results presented in Table 3 show a significant negative relationship between unearned income and probability of being poor which implies that farm households having unearned income are less likely to be poor. Access to unearned income reduces the probability of being poor by 15.4% (Table 3). The highly significant coefficient may be due to the reason that unearned income is such type of income source which has no prior investment. For example, if a farmer is receiving remittances from his family member working abroad, it will directly improve his living standard and may decrease the likelihood of poverty. Similar findings were drawn by Abdul-Hakim and Che-Mat (2011) and Khan *et al*. (2015).

Access to credit: Proper access to formal or informal credit may enhance farmers' ability to averse the potential risks at the farm level. Easy access to credit may also play an important role in increasing farm productivity by enabling the farmer to purchase inputs on time or to avoid low price sale of his farm produce. According to the results shown in Table 3, the coefficient of credit has significant inverse relation with poverty status of the farmer. Access to credit reduces the chances of a farmer being poor by 7%. Credit may also be taken as a tool to eradicate poverty at farm level by enabling them to better adapt to observed risks (both economic and natural) and to increase the farm productivity. The results are in line with Adeyeye (2001).

Number of livestock: As expected number of livestock is highly significant and negatively disturbing variable (Table 3). In our study results show that having more animal leads toareduction in poverty. Having one number of livestock decreases the probability of being poor by 1.3 % (Table 3). Farmers may also utilize livestock output (milk, cheese) and also sell them at time of need which may play an effective role in reducing poverty.

Adaptation to various risks: As farming is riskier than any other sector, hence, adaptation to observed natural risks may enable the farmer to avoid potential losses in crop yields and income which may reduce the chances of a farmer being poor (Meuwissen *et al*., 2001). Marginal effects in Table 3 show that adapting to various risks reduced the likelihood of poverty by 7.6 %.

Poverty across various categories of farmers: This sub section explains the poverty status of farmers across various categories of farmers based on education, land holdings and adaptation. Figure 2 describes the status of poverty among farm households' categories based on years of schooling. It is clear from the results in figure 2 that farm households having more education are less likely to be poor and it is true for all districts. For instance, in Muzaffargarh districts, among non-poor farm

households, the majority of them do have more than ten years of schooling, and similarly, in poor farm households, the majority of the households were having less than five years of schooling. Hence it is proved that education plays an important role in alleviating poverty and we can say that farmer with higher education may be better able to cope with poverty and may earn more income compared to less education farm households. Education gives farmers an edge in making a better decision at farm level which may earn more profit compared to unwise decision making.

Figure3 shows the poverty status among farming households' categories across study districts based on adaptation to a different type of risks. According to the results in figure 3, farmers who timely adapted to the different type of risks at farm level are less likely to be poor and poverty is more evident in farm households who do not adapt their farming to risks.

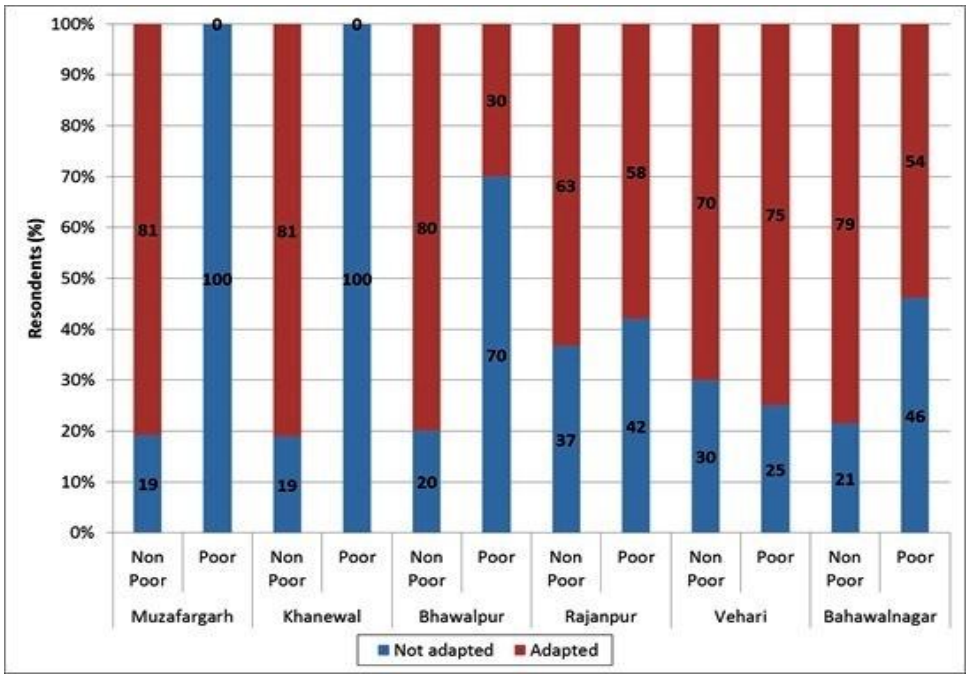

Figure 2. Poverty status across categories of farmers based on education

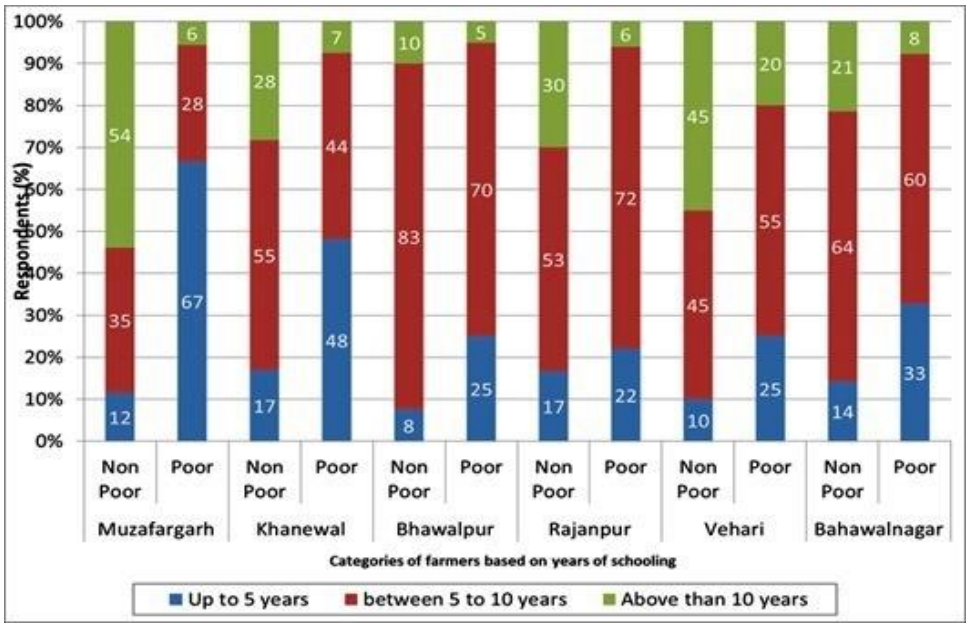

Figure 3.Poverty status across study districts among categories of farm households based on adaptation to different farm level risks.

Conclusion: The study analyzes the current poverty status and determinants of poverty in Punjab, Pakistan based on a cross-sectional data of 480 farmers collected from 6 selected districts in 2014. Survey farmers were interviewedwith the help of asemi-structured questionnaire. The study reveals that poverty is widespreading all districts and about half of the sample farm households fall below the poverty line ($2 a day).

The results of the study show that severity and extent of poverty reduce with increase in the diversification of income sources moving from agriculture to other off-farm sources of income. If there is only agriculture as source of income then 68% of the farm households were under the poverty line, while adding non-farm and unearned income sources to agriculture sector will reduce poverty up to 54%. The study also reveals important findings in defining rural poverty in study areas. The study shows that education, farming area, distance from input market, access to credit, livestock ownership is negatively related to poverty status of farmers which implies that these factors may be important to consider while designing effective policies to eradicate rural poverty in Pakistan.

The study also shows an important role of adaptation to various environmental risks in eradicating poverty in the study areas. The highly significant impact of adaptation on poverty status of farmers implies that by adapting to various kind of environmental risk, the farm may avoid potential losses to their crops and farm. All these adaptation efforts may enable farmers to enhance their farm productivity and farm incomes.

The study reveals that still most of the farmers are relying only on agriculture sector which could be one of the main reasons for existing poverty in the study areas. Hence, proper policies are required to address these issues. Farmers' may need awareness or proper guidance to diversify their farm to divide or share their risk. This risk aversion behavior may be an effective tool in reducing poverty in the rural areas.

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