

Food insecurity and its determinants in rural Khyber Pakhtunkhwa, Pakistan

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Abstract

This paper empirically examines the determinants of households' food security in District Dir (Lower) Khyber Pakhtunkhwa. Primary data were gathered through a pre-structured questionnaire. The screening questions approach was adopted to solicit the information from a total of 200 households. The binary logistic regression was used for data analysis. Our results show that farm households with an employed head, and having improved access to farm and non-farm income, are more likely to be food secure. While larger sized farm households located away from the main stream markets, are more likely to be food insecure. We conclude that households' access to a secure source of income and markets have a significant influence to ameliorate the food security in rural areas. The policy is informed to improve households' access to farm and non-farm income vis-à-vis accessibility to the main stream markets. We recommend that interventions are needed to enhance off-farm employment opportunities, make the agriculture technology more accessible to farmers, and develop the physical infrastructure in rural areas. The findings of the study have significant policy implications in the context of food security in other developing countries.

Keywords: Food security, Binary logistic regression, Households' assets, Income

Introduction

Food insecurity is a daunting challenge in Pakistan. The World Food Program (WFP) estimates that 60% of the population in Pakistan are food insecure (WFP, 2017). While 56 % are insecure only in the Province of Khyber Pakhtunkhwa (FAO, 2017). Despite of the growth in agriculture over the years, the country is still struggling with food insecurity (FAO, 2017). This is an alarming situation affecting households' access to a secure source of food. Food insecurity has adverse impact on the health of individuals. As a consequence, Pakistan is ranked at 147 on the Human Development Index (HDI) while the neighboring India is at 139 and Bangladesh is at 131 (UNDP, 2017).

Inflation is a one of major contributing factor to food insecurity in Pakistan. The country has seen several folds rise in prices of food commodities. The food

prices increased approximately by 28% during 2008 and 2009 (WFP, 2010). As households' personal disposable income major share is spent on food, any likely increase in food prices contribute to increasing food insecurity. The consequences of the rising food and fuel prices are more serious for those countries which are the net importer of fuel and food products (Arndt et al., 2008). Pakistan is also facing the problem of rising fuel prices. Approximately 70% of the fuel products are imported while only 30% of the demand is satiated from the domestic sources. Although, Pakistan is not a net food importer, but the rising fuel prices translate into high food prices domestically via transportation cost and thus the purchasing power of the people reduces. The rising fuel price causes an increase the number of food insecure people in the country. It in turn increases in the severity of food insecurity and malnutrition (Witzke, 2008). Similarly,



uncertainty in the grain output prices has the potential to reduce the income of the farmers. As a result of this fall in the income of the rural poor, they become more prone to food insecurity (Pan et al., 2009).

Wheat is the major staple food, satisfying nearly 48% of the caloric needs of the population, followed by rice in Pakistan. However, the production of these two major staple crops is not enough to cater to the needs of the growing population. In Pakistan 48 districts out of 62 are producing wheat which is surplus to their demand. The wheat surplus districts are located outside of Khyber Pakhtunkhwa. There is not a single district which produces surplus wheat. Out of the 37 districts, which produce surplus rice, only seven are located in Khyber Pakhtunkhwa (SDPI, 2003). The number of extremely food insecure districts rose from 38 in 2003 to 45 in 2010. Similarly, 80 out of a total of 131 districts are facing some degree of food insecurity. While the number of food secure districts was just 20 in 2010 (WFP, 2010). The situation is more gruesome in the upper mountainous region of Pakistan especially in the province of Khyber Pakhtunkhwa. The existing socioeconomic, and demographic factors have an adverse impact on households' food security where majority of the households in the rural area are poor and the economic opportunities are scarce in rural areas of Khyber Pakhtunkhwa. The farm to market roads are in shabby condition and some areas metallic road are non-existent. In addition, excessive population growth, large family size and shortage of food as consequence of demand and supply fluctuation have further made the situation chronic. Moreover, the province have seen in the very recent past a wave of militancy and war which has further aggravated the economic conditions. The incidence of militancy and massive displacement of people from the war affected zones in the Khyber Pakhtunkhwa have enormous negative impact on the food security situation of the households (WFP, 2017). The food security issue and its association with various household level variables is rarely explored. There are studies which have studied the food security such as Malik (2012) and Rabbi and Shah (2010) in the post conflict period in North West Khyber Pakhtunkhwa. Nonetheless, the aspect of households' food insecurity and its association to households' assets, socioeconomic and demographic variables has been rarely investigated in the marginalized areas such as Dir (lower) in the province of Khyber Pakhtunkhwa. This paper examines empirically the determinants of households' food security in District Dir (Lower) Khyber

Pakhtunkhwa. It is based on the results of a field survey conducted in the District Dir (lower) in Khyber Pakhtunkhwa. The paper has been divided into four sections. In the first section, the problem of food insecurity in the context of Pakistan vis-à-vis Khyber Pakhtunkhwa has been highlighted. In Section two, Food security literature review. Section three present the methodology of the study. While in section four, the results of the study are elaborated and conclusion were drawn.

The problem of food insecurity exists since the ancient times in most parts of the world. The existing literature points to a number of socio-economic factors that pushes people in the brackets of food insecurity. These factors range from the source of income to overall poverty and from individual characteristics to household and societal characteristics. Starting from the macro level, economic growth leads to a reduction in poverty and therefore an increase in calories intake and food diversity. Like many other developing countries, Pakistan is also is faced with food insecurity. Research on food insecurity have highlighted food insecurity as a major issue of applied economics. (Mahmood et al., 1991; Ahmad and Siddiqui 1995; Alderman and Garcia, 1996; Ahmad, et al., 2004; Shaikh, 2007; Ahmad, 2009 and Dorosh et al., 2010). Alderman and Garcia (1996) explored the relationship between poverty and food insecurity. Studies also show that, since economic growth does not ensure the equal distribution of benefits, there may be discrepancies in calories intake and food diversity among poor and non-poor households (Mishra and Ray, 2009). Feleke et al. (2003) examined the demand and supply side factors. They found that on the supply side, farming system adopted, farm size, technological adoption, and land quality have a very strong partial effect on food security. On the demand side, size of the household, per capita aggregate production and access to market are highly significant factors that lead to food security. However, the study concludes that supply side factors are more influential than the demand side. Other studies (Cook and Frank, 2008; Rush and Rusk, 2009) have found similar results. Education level of the households' head have also a significant influence on food security situation (Haile et al., 2005; Mishra and Ray, 2009). While other studies show that age of the households' head have a positive influence on households' food security (Hofferth, 2003; Obamiro and Kormawa, 2003). While households with large farms are likely to be



more food insecure (Paddy, 2003; Pankomera et al., 2009).

In addition to households' demographics, economic variables such as households' farm income have strong association with food security (Haile et al., 2005; Pankomera et al., 2009; Pan et al., 2009). Moreover research have shown that food prices, and time allocation to work impact the food security condition of the households (Shaikh, 2007). Food insecurity have also been shown to be more among older than youngsters in developing countries. It is attributed to functional limitation of the elders across some communities (Wolfe et al., 2003). A study by Hanson et al. (2007) established that divorced men are exposed to food insecurity. According to Alderman and Garcia (1996), Household income level and transitory income are the important determinants of food insufficiency. Negative income shocks increases the probability of food insecurity (Leete and Bania, 2009).

In response to food insecurity, households adopts various coping strategies; for example as family incomes falls short of the expected, individuals tends to smoothen their consumption either through borrowing from non-formal sources such as relatives, local stores and friends or by storing grain in the peak season (Mahmood et al., 1991). Borrowing from the formal sources also reduces the incidence of food insecurity. This is specifically true when there are soft terms associated with the credit availability (Pankomera et al., 2009).

Food security is a multidimensional phenomenon, and all of its aspects cannot be covered in a single study. It is multifaceted and multifactor phenomenon. Previous research show that households' demographic variables, and economic variables play a significant role in determining food security and insecurity issues in Pakistan. . Nonetheless, studies specifically focused on the households' level variables, and assets endowments in case of rural Khyber Pakhtunkhwa are scarce. This research examines the determinants of households' food security in case of district Dir (lower) in Khyber Pakhtunkhwa and add to the existing literature useful insights.

Material and Methods

This study has adopted the binary logistic model for data analysis. When the response variable is discrete (qualitative) rather than continuous (quantitative), the classical linear regression model cannot be used due to

its assumptions. One assumption of the classical linear regression model is that it cannot deal with discrete outcome (dichotomous and categorical) variables (Pampel, 2000). Menard (2001) also argue that with dichotomous dependent variable, classical linear regression estimates are inefficient due to the violation of its important assumptions (i-e Normality, homoscedasticity and linearity). In such situation, either logit or probit model should be used. In choosing a model out of these two, there are no compulsions, however researchers prefer logistic regression model due to some of its merits over probit model. For example it is mathematically simple and the probability (P_i) reaches to zero or one much slower in logit than in probit (Gujarati, 2004) and is simple from mathematical view point and is easy to interpret its parameters compare to probit (Hosmer and Lemeshow, 2000). Menard (2001), and Cox and Snell (1989), also prefer the use of logistic regression, which is a particular case of a generalized linear model used to examine the relationship between the discrete outcome variable and a set of independent variables of any types (discrete, categorical, continuous or a mix of all). Binary discrete variable normally takes the form of a dichotomous indicator. Although, it is possible that this study has adopted the binary logistic model for data analysis. When the response variable is discrete (qualitative) rather than continuous (quantitative), this study has adopted the binary logistic model for data analysis. When the response variable is discrete (qualitative) rather than continuous (quantitative), the classical linear regression model cannot be used due to its assumptions. One assumption of the classical linear regression model is that it cannot deal with discrete outcome (dichotomous and categorical) variables (Pampel, 2000). Menard (2001) also argue that with dichotomous dependent variable, classical linear regression estimates are inefficient due to the violation of its important assumptions (i-e Normality, homoscedasticity and linearity). In such situation, either logit or probit model should be used. In choosing a model out of these two, there are no compulsions, however researchers prefer logistic regression model due to some of its merits over probit model. For example it is mathematically simple and the probability (P_i) reaches to zero or one much slower in logit than in probit (Gujarati, 2004) and is simple from mathematical view point and is easy to interpret its parameters compare to probit (Hosmer and Lemeshow, 2000). Menard (2001) and Cox and Snell (1989), also prefer the use of logistic regression, which



is a particular case of a generalized linear model used to examine the relationship between the discrete outcome variable and a set of independent variables of any types (discrete, categorical, continuous or a mix of all). Binary discrete variable normally takes the form of a dichotomous indicator. Although, it is possible to represent the two values with any numbers, employing variables with values of 1 and 0 has advantages. The response variable itself only takes values of 0 and 1, but the fitted values for binary logistic regression take the form of mean proportions or probabilities conditional on the values of the explanatory variables (Pampel 2000). The model is specified in appendix A. Keeping in view the merits of the logit model, it is used to analyze the determinants of household food security in the study area. The independent variables considered in the study were household head age, employment, farm income, non-farm income, family type, and distance from the food stuff market, dependency ratio, household size, and distance from the road and number of livestock. The data was analyzed using the STATA software.

Results and Discussion

The results of the analysis is given in Table 1. While the marginal effects are given in Table 2. The descriptive statistics are available in Table 4. The binary logistic regression was used to analyze the factors affecting food security.

The findings showed that employment status of the household head (Emp HH), farm income (Farm.Y), Non-Farm income (Non-Farm. Y), distance from the food stuff market (Dist. MKT), household size (HH. SIZE), distance from the road (Dist. ROAD), and the livestock value (Livstk. VLV) have positive and significant association with households' food security. The results show that, employment status of the household head (Emp. HH), farm income (Farm Y) and non-farm income (Non-Farm Y), were positively correlated with food security. On the contrary, distance from the food market (Dist. MKT), household size (HH. SIZE), distance from the road (Dist. ROAD) and the livestock value (Livstk. VLV) were found to be inversely correlated with household food security. The relationship is significant at 1% probability level. The positive correlation between food security and non-farm income reflects that as non-farm income increases, it increases households' food security and vice versa. These results are supported by the findings

Ellis and Mdoe (2003), Chapman and Tripp (2004), Baiphethi and Jacob (2009). It was further observed that there is a positive association between households' farm income and households' food security. Our results confirm the findings of Haile et al. (2005), Pankomera et al. (2009), Pan et al. (2009) and Babatunde and Qaim (2010).

On the other hand, distance from the road and food security is inversely correlated. As the distance of the households increases from the road, the probability of households' food insecurity increases and vice versa. This is attributed to the fact that more away a household is from the road, higher will be the transportation cost of food stuffs from the market which increases the probability of food insecurity. Second, if household is living far away from road are having less opportunities to get employment and to earn income.

Livestock unit has been used by researchers (Muriuki et al., 2001) as a determinant of food security. We have used the value of livestock as proxy for livestock unit. The expected relationship between food security and of the livestock value was positive. However, the coefficient took a sign in contrast to the expectations. The possible explanation of this outcome is that, in the study area, livestock is not used as a coping strategy against food insecurity. Rather those households which don't have any other income source, keeps livestock as a source of keeping themselves engaged. Furthermore, keeping livestock is a symbol of poverty. Livestock is not reared on commercial scale but it is kept for one's own domestic needs.

Distance from the food stuff market was statistically significant at 5% level of probability. Distance from the food stuff market and food security is inversely correlated. The far away a household is from the food stuff market, the higher is the probability for the household to be food insecure and vice versa. The possible reason for this inverse relationship is that, distance from the market increases the transportation cost of the food stuffs which increases the probability of food insecurity. Secondly, distance from the market also reduces the chances for a household to run their own business and get employment. Feleke et al. (2003) has termed the distance from the food stuff market as the physical access to the market. Our findings also confirm the findings of this study.

In many studies like Haile et al. (2005) and Mishra and Ray (2009) household head education has been used as a determinant of food security. However, in this study, employment status of the household head is



taken as a proxy variable for the household head education level. Employment status of the head of the household and food security is positively correlated. The relationship is significant at 10% probability level. The head of the household being employed increases the probability of food security and reduces the probability of food insecurity.

Table1: Logistic regression estimates of the determinants of households' food security

Variables	Measure	Coefficient	Z
Constant	-----	-15.47	-3.65 (0.00)
Age.HH	Years	-0.14	-0.78 (0.43)
EmpHH	Dummy	1.05***	1.80 (0.07)
Farm.Y	Rupees	0.89*	3.32 (0.00)
NonFarm.Y	Rupees	4.55 *	4.50 (0.00)
FmTYPE	Dummy	0.88	1.38 (0.16)
Dist.MKT	Kilometers	-0.24**	-2.09 (0.03)
Dep.RATIO	Ratio	-0.11	-0.14 (0.89)
HH.SIZE	Count	-3.33***	-1.95 (0.05)
Dist.ROAD	Kilometers	-1.78*	-4.01 (0.00)
Livstk.VLV	Rupees	-0.58*	-3.06 (0.00)

Log likelihood = -65.711319 LR $\chi^2(10)=124.99$
 Prob> χ^2 = 0.0000 Pseudo R2 =0.4875

Number of observations (n) = 200 Note: *, ** and *** indicates significance at 1%, 05% and 10% probability respectively. Figures in the parentheses are the probability values (P>|z|)

A significant and positive association (% 10 probability) exists between households' size and food security because as the household size increases, the probability of the food to become food insecure increases and vice versa. On the other hand, a negative

relationship exists between family size and food security. It implies that a bigger households' size reduces households' food security. A larger household size increases the incidence of food insecurity and a smaller household size reduces the incidence of food insecurity. As a characteristic of the study area, most of the households' have a single bread earner (normally male headed household). Our findings are in conformity to the findings of Feleke et al. (2003), Pankomera et al. (2009), Paddy (2003), Bogale and Shemlis (2009).

Household head age (Age HH), family type, i.e. nuclear or joint (Fm TYPE) and the dependency ratio were found to be statistically insignificant variables. Age of the household was expected to exhibit both positive and negative correlation with food security. A positive correlation has been reported between food security and age of the household head. However, our findings are in contrast to it. The study conducted by Vander and Gebrehiwot (2011) reports an inverse relationship between food security and household head age. There is a plausible explanation for this inverse relationship between the age of the household head and food security. As a household head become elder, his/her earning capability diminishes. Most of the household head in the study area are illiterate. Educational facilities were not available to them because of a ban on education in the study area by Nawab Shah Jehan, who ruled the area till late 1960. Most of the heads of the household who are illiterate are involved in income earning activities which require physical strength. As those households' heads get aged, they become physically weaker and therefore, their earning capability diminishes. The family type was categorized as extended family and nuclear. Joint family type was found positively correlated to food security but is insignificant. The findings are in contrast to Vander and Gebrehiwot (2011). The possible explanation for the observed relationship is that in the joint family system, the number of earners is more as compared to nuclear family. The burden of the family is shared by many earners and therefore the probability of the household to be food secure increases.



Table 2. Marginal effects of the explanatory variables

Variables	dF/dx	Z	x-bar
AgeHH	-0.01	-0.68 (0.49)	3.85
EmpHH*	0.10**	1.99 (0.04)	0.71
Farm.Y	0.09***	3.24 (0.00)	2.98
Non-Farm.Y	0.47***	4.99 (0.00)	4.11
FmTYPE*	0.07	1.22 (0.22)	0.61
Dist.MKT	-0.02**	-2.10 (0.03)	3.20
Dep.RATIO	-0.05	-0.82 (0.41)	2.19
HH.SIZE	-0.01*	-1.68 (0.09)	11.26
Dist.ROAD	-0.21***	-4.33 (0.00)	1.19
Livstk.VLV	-0.06***	-3.22 (0.00)	3.93

(*) dF/dx is for discrete change of dummy variable from 0 to 1

¹The dependency ratio is calculated by dividing the number of family members in the age group ($\geq 15 \leq 61$) by the number of earners in the family. This group is not contributing to the income of the family and is totally dependent on others for all its needs.

Note: ***, ** and * Indicates significance at 1 %, 5 % and 10 % probability level respectively. Figures in the parentheses are the probability values ($P > |z|$)

The above table shows the marginal effects of the explanatory variables which were obtained by using STATA. Marginal effect of each explanatory variable is calculated by keeping all other variables constant at their mean. Furthermore, the marginal effects of only those variables are discussed which are statistically significant.

Household employment takes a value of 1 if the head of the household is employed and 0 otherwise. Keeping all other variable constant at their mean, employment of the head of the household increases the chances of the household to be food secure by 0.10832 units. This variable is significant at 5% level of probability. Farm income and off-farm income are both significant at 1% level of significant. Keeping all other variables in the model constant at their mean, an increase in farm income by one unit increases the

probability of the household to be food secure by 0.09117 units. Off-farm income is playing a vital role in household food security. Off-farm income is the income received by the household from sources other than agriculture. Keeping all other variables constant at their mean, a one unit increase in off-farm income increases the chances of the household to be food secure by 0.47991 units. Both farm and off-farm incomes are distance from the road and distance from the market are both negatively correlated with food security. Distance from the market is significant at 5% level of probability while distance from the road is significant at 1% level of significant. Keeping all other variables in the model constant at their mean a one unit increase in the distance from the food stuff market reduces the probability of food security of the household by 0.02743 units and a one unit (kilometer) increase in the distance from the nearest road reduces the probability of the household food security by 0.21062 units.

Household size is inversely related with food security. As the household size increases, the probability of the household to become food insecure increases and vice versa. Keeping all other variables constant at their mean, a one unit increase in the size of the household reduces the probability of food security by 0.00918 units. Finally, livestock value is also inversely related with food security. Poor people keep livestock because they do not have any job and they just want to engage themselves. However, it is possible that livestock after some point may be positively affecting food security.

Conclusion

This paper has empirically examined the association between households' food security and households' assets, socioeconomic, and demographic variables. Our results conform to the findings of earlier studies that households' access to farm and non-farm income and accessibility to market are some of the key determinants of food security in rural areas. Moreover, households' food insecurity increases in areas which have less market accessibility and employment opportunities. It is concluded that any development intervention in the rural areas should include programs that generate non-farm income employment opportunities, raise farmers' farm income and increase access to markets. The findings have important policy implication for development intervention in Pakistan and other development countries.



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