

Determinants of Off-farm Activity Participation among Cotton Farmers in Punjab, Pakistan

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Abstract

The study was conducted to determine the aspect affecting the farmer in taking part in off-farm activities in three cotton growing districts of Punjab province, Pakistan. Since off-farm activities have become an imperative part of income strategies among rural families in developing countries like Pakistan. The data was documented from a total of 180 cotton farmers using multistage cluster sampling technique. A binary logistic model was used to evaluate the determinants motivating the farmers to participate in different off-farm activities. Various socio-economic factors were found significantly associated with probability of immersion in non-farm activities. The results of the model reveal different factors like total farming area and farmers having access to road were significant for several business activities through odds ratio 1.051 and 0.088 respectively. Though more experienced farmers with odds ratio (1.063) had more likelihood for labour activities. Lastly more educated farmers and large family size have higher probability to go for services type of off-farm activities and their odds ratio estimated is 1.297, 2.069. These findings have essential implications for policy, economic growth and development.

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Introduction

In the past the opinion was that farming households were just dependent on agriculture, and didn't need any off-farm activities. So the policy makers just focused on farming sector. But during the last several years there have been amassed indications which show that small farming households do not rely on agriculture only. Historically farmers have tried to maintain their range of income activities in which off-farm activities have played a vital role (Barrett, Reardon, and Webb, 2001). Though Haggblade, Hazell, and Reardon (2010) pointed out that income from other than agriculture sources has a share of about 35 to 50 per cent of the total income of rural households in developing countries. There is an anticipation that portion of off-farm income will increase in the upcoming years, mainly in the countries where there is rapid increase in population and have inadequate agricultural sources are a big threaten for agriculture sector (Haggblade, Hazell, and Reardon, 2007). Almost the trend of receiving income from non-agriculture sources is increasing in all countries i.e. Jolliffe, (2004) indicated that in rural Ghana in 2004 near about 74% of farming households were involved in off-farm sector, while another study by (Fernandez-Cornejo, 2007) narrated that 65% farm household were attached with off-farm income sources and in Taiwan this rate has increased up to 75% respectively.

Albeit the main reasons of farmers' involvement in off-farm sector are greater returns and low risk of investment in non-agriculture sector (Kilic, Carletto, Miluka, and Savastano 2009). As De Janvry, Sadoulet, and Zhu (2005) divulged that non-farm employment has a favorable effect on agricultural production, because the income obtained through this sector can be used for investing on farm and will benefit the farmer to practice farming on time. Moreover Stampini & Davis, (2009) foretold that non-farm employment has influenced the use of variable inputs in rural Vietnam, where farmers having off-farm employment sources invested more on seeds, fertilizer, agricultural services and hired labour.

Still off-farm activities have become a key fragment of farmer's overall income in the developing countries. As agriculture sector is quite risky, because farm production dependent on many factors which are un-controllable by the farmer. In spite to this there is no guarantee of beneficial returns from farming. Many farmers have tried to adapt different sources of earnings to ensure their farm income (De Janvry & Sadoulet, 2001; Ruben & Van den Berg, 2001; Haggblade et al., 2007). There are many reasons for this observed changing phenomenon which may be reduction in farm income and willingness to protect farm productivity against different risks (Reardon, 1997; Ellis, 1998).

Doing off-farm work for generating income is a way of self-insuring strategy of the farmers to strengthen the households overall income (Alasia, Weersink, Bollman, and Cranfield, 2009). It is very helpful for the farmer in a condition when he has to face loss in agriculture due to any factor which may be natural or etc. Variation among income

sources is one of the risk management strategies to cover the risks. Reardon, Delgado, and Matlon (1992) indicated that household must give attention to income diversification as a strategy to minimize the farming income risks. It can play a positive role in stabilizing income and reduce income inequality among rural households. A variety of studies related to this scenario exposed that off-farm activities have a vast role in enhancing the growth of rural economy and also reducing the poverty level (Ianjouw, 2001; Weijland, 1999).

Similarly, Oluwatayo (2009) explored the determinants of diversification using tobit regression. Using the coefficients of gender, household size, poverty status and access to credit facility were found positively affecting the likelihood of diversification index. Also a study conducted by Awoniyi & Salman, (2001) revealed the level of non-farm income variation and also observed its effect on living standard of farming household. Further using logistic regression they examined the factors that affected the farmers decision to go for the non-farm income diversification including age, male headed household, having formal education, household poverty status and farm size. The important judgment of the study was that farm households living under the poverty line among them 53.9 per cent were those whose household heads were not betrothed in off-farm activities to earn more. Concluding that the household heads were more susceptible to poverty if they had no off-farm income sources when compared with farming household that were involved in non-farm income generating sources.

As agriculture is the spine of Pakistan's economy, but is going through a dilemma. One of the major issues is instability of farm income, especially, for poor farmers. The increasing trend of is reducing due to the burden of population and division of land. From overall farm size nearly 80% of consist less than 12.5 acres (GOPun, 2015). Economic pressure has forced many household to go for additional income sources like off-farm activity to handle the problem of income variability. Nowadays off-farm income is becoming a major part of livelihood strategies for rural households in our country. Off-farm employments are those activities from which farmer can earn apart from farm work. It includes all non-crop activities that are not directly related to crops.

The main objective of the study is to determine the factors influencing the farming household for participating in off-farm employment activities. It is very imperative to highlight the entry barriers and restraints for household to involve in these activities. If off-farm income can increase household income and lessen the risk and inequality, then it is important that such limitations are fulfilled. This paper will provide additional information about off-farm activity participation in rural areas of Pakistan for accessing the status of off-farm activity participation.

Methodology

Considering the area where cotton was cultivated in a large proportion. Punjab province consists of nine divisions on administrative basis. Among these nine divisions three divisions were selected on the basis of vast area sown under cotton. From each division one district was selected with highest share of area under cotton crop. Mainly three districts namely Bahawalpur, Muzaffargarh and Vehari of Punjab province were selected according to area cultivated under cotton crop. According provincial statistics in Bahawalpur (272,000 hectares), Muzaffargarh (94,000 hectares) and Vehari (223,000

hectares) area was cultivated (GOPun. 2012). Finally these districts were selected for survey.

Rural off-farm activities in the study areas were categorized into three types; i) Services including all types of employment in public and private sector institutions, teachers, lawyers, village doctors etc. ii) Business enterprises like shop keeping, commission agents and fertilizers or pesticide business holder in grain market, any type of trader, contractor services etc. iii) Off-farm labour comprising different types of mechanics, daily labour in rural areas, transport operations, construction labour etc.

The primary data was collected from the cotton growers from the above mentioned districts. Multistage stage cluster sampling technique was used to select 180 respondents. From each district 60 respondents were interviewed randomly consisting 20 respondents from each group of off-farm activities aforementioned. The survey was premeditated to collect the information about farming household overall composition and other socio-economic characteristics, which include information about the involvement of individual household member in different income generating activities.

Model

The theoretical background to investigate the effects of the elements prompting the partaking in non-farm economic deeds has its origins in the threshold theory of decision making. According to this theory when the strength of the inducements goes beyond the individuals reaction then an action happens (Hill and kau 1973). The choice of involvement in non-farm economic activities may have two options either to join or not to participate. Further considering the participation in off-farm activities as a function of farm and farmer characteristics i.e. age, education, farm size etc. The dependent variable for the model is participation in different types of off-farm activities such as business, services and off-farm labour. Since the dependent variable was dichotomous, hence OLS cannot be used. Households that participated in off-farm activities were denoted by 1 otherwise 0 for HHs not participating in off farm activities. As the dependent variable is dichotomous, a logistic regression model is pursued to estimate the household participation in off-farm activities (Isgut, 2004; Akaakohol & Aye 2014; Dary & Kuunibe 2012; Lanjouw, 2001).

The logistic model for this study is indicated as

$$\frac{P_i}{(1 - P_i)} = \frac{1 + \exp(Z_i)}{1 + \exp(-Z_i)}$$

As the above equation is non-linear, it can be linearize by taking the natural log, then the given model is

$$\begin{aligned} Li &= \text{Ln} \left[\frac{Z_i}{(1 - P_i)} \right] Z_i \\ &= \beta_0 + \beta_1 X_{i1} + \dots + \beta_9 X_{i9} + e \end{aligned}$$

Where $P_i/(1 - P_i)$ is the ratio of the probability that the farmer will be involved in off-farm activity to the probability that farmer will not involve in specific off-farm activity. So the endogenous variable is binary and it has two values 1 and 0. If a farmer has off-farm activity then its value is 1 and 0 for the farmers who do not have particular off-farm work.

- β_0 = constant
- $\beta_1 - \beta_9$ = logistic regression coefficients
- X_{i1} = Age of respondent
- X_{i2} = education (number of years of formal education)
- X_{i3} = farm size (total farming area of respondent
- X_{i4} = location (distance from main city)
- X_{i5} = household workers (number of earning member in household)
- X_{i6} = dummy variable for having access to road (1 for having access and 0 otherwise)
- X_{i7} = dependency ratio (obtained by dividing total member of household and earning member)
- X_{i8} = farming experience of household in years
- X_{i9} = family size (total members of family)
- e = error term

Results and Discussion

The summary statistics of the variables used in the model are presented in table-1. However, table-1 indicates that the farmers are on average 45 years of old. On average farmers had 9 years of formal education and 20 years of farming experience. The average farming area is 15 acre and the mean distance of the village from the main city was 11 km; similarly the mean value for number of earning members in a family and family size were 2.74 and 8.25 members respectively. Majority of the farmers from target area had access to road from their village. The average value of dependency ratio is 3.21 of total members of household and total earning members in a family respectively.

Table 1 Summary statistics of the variables used for regression

Variables	Mean	SD	Min	Max
Age	45.42	8.18	24.00	68.00
Education (Years)	9.61	3.39	0.00	16.00
Total farming area (acre)	15.23	7.22	3.00	37.00
Location (Distance from main city in Km)	11.33	4.35	3.00	30.00
Number of earning members in family	2.74	0.73	2.00	4.00
Access to road	0.94	0.24	0.00	1.00
Dependency ratio	3.21	1.02	1.67	6.00
Farming experience (Years)	20.99	8.82	2.00	45.00
Family size	8.25	1.47	4.00	12.00

Composition of Average Annual Household Income

Data related to income obtaining from each crop was collected from respondents. Income on farm basis was calculated for the complete cropping season.

Table 2 Average Annual Income from different sources (PKR)

Income Sources	Business	Off-farm labour	Services
Crop	566,517.02	516,861.95	458,969.90
Livestock	56,275.00	63,760.00	59,624.16
Others*	3,920.00	14,000.00	30,100.00
Sub-Total (A)	626,712.02	594,621.95	548,694.07
Off-farm Income			
Business	118,933.33	-	-
Off-farm Labour	-	101,040.00	-
Services	-	-	102,760.00
Sub-Total (B)	118,933.33	101,040.00	102,160.00
Grand Total (A+B)	745,645.35	695,661.95	650,851.07

*It includes the income from pension, remittances and other unearned income.

Table 2 divulges the share of different income sources to overall household income. The overall household income consists of crop income, livestock income and other income sources i.e. pension, remittances etc. The total household income also has contribution from off-farm income sources such as business, off-farm labour and services. These results can be coincided with Babatunde, Olagunju, Fakayode, and Adejobi (2010) and De Janvry and Sadoulet (2001).

Determinants of Participation in off-farm Activities

The parameters of the logistic model estimated to identify the elements prompting participation in off-farm activities are presented in table 3, 4 and 5.

A logistic regression model was used separately for the business, off-farm labour and services sectors to explore the significant factors affecting the participation of farmers in these three types of off-farm activities.

Table 3 Logistic regression results for participation in Business activities

Variables	β	S.E.	Exp(β)
Age	0.008	0.038	1.008
Education	-0.063	0.059	0.939
Total farming area	**0.05	0.025	1.051
location	0.06	0.041	1.062
Household Workers	**2.814	1.218	16.681
Access to road (dummy)	***2.431	0.876	0.088

Dependency ratio	***2.872	1.078	17.679
Farming experience	** -0.084	0.037	0.919
Family Size	** -1.294	0.511	0.274
Constant	-4.271	3.353	0.014
Model Prediction success (MPS)	72.8%		
Log-likelihood ratio	190.299		
Hosmer and Lemeshow Test	(df=8) significance test result 7.635 (p-value=0.470)		
Cox & Snell R ²	0.194		
Negelkerke R ²	0.270		

*Significance at 10%; **Significance at 5%; ***Significance at 1%

Table 3 elucidates the results of binary logistic regression, explaining the determinants for farmers to participate in off-farm activities like business. The Hosmer and Lemeshow (H-L) test results show non-significant indicating that the model is good fit. While Cox & Snell R² and Negelkerke R² values are 0.194 and 0.270 which indicates that about 19 to 27 percent variations are explained by the model. The model predictive ability is 72.8%.

The coefficients of the variables do not give the direct information about the effect of changes in explanatory variables on the probability of participation in business activities. To know this odds ratio/Exp(β) is necessary to discern. This is the ratios of the probability of participating in business activities to the probability that the person will not take part. The variables which are affecting significantly the probability of participation in business activities are total farming area, household workers, access to road, dependency ratio, farming experience and family size, among which total farming area, household workers, access to road, dependency ratio are the variables which are positively changing the probability. However farming experience and family size have negative signs. The results explain that by increasing the total farming area the chances of farmer to go for business activities increases by the value of associated odds ratio which is 1.05. There may be the reason that by increasing farming area household may earn more and so there is chance to invest higher income in business activities. Similar finding are also reported by (Rahman, 2013).

Similarly the probability of participating in business activities increases with rising number of household workers and dependency ratio. It is understandable that as household workers and dependency ratio increases the probability that the other members will go for business type of activities rises. On the other hand, farming experience and family size decreases the probability of business activities. The farmers which have more access to road they have more chance of doing business activities. These results are expected because having more infrastructure would accelerate the probability of doing business. As reported by Babatunde, Olagunju, Fakayode, and Adejobi (2010) the coefficient of family size is unexpectedly negative as there may be reason of time constraint as larger household may have more children or old people in their family so more time is required for their care.

Table 4 Logistic regression results for participation in Off-farm Labour activities

Variables	β	S.E.	Exp(β)
Age	-0.025	0.037	0.976
Edu	***-0.168	0.058	0.845
Total farming area	0.008	0.024	1.008
location	*-0.081	0.045	0.922
Household Workers	-0.821	1.001	0.44
Access to road (dummy)	1.542	1.106	4.673
Dependency ratio	-0.63	0.863	0.532
Farming experience	**0.061	0.032	1.063
Family Size	0.293	0.386	1.34
Constant	1.819	3.054	6.163
Model Prediction Success (MPS)	72.8%		
Log-likelihood ratio	200.061		
Hosmer and Lemeshow Test	(df=8) significance test result 2.833 (p-value=0.944)		
Cox & Snell R ²	0.149		
Negelkerke R ²	0.207		

*Significance at 10%; **Significance at 5%; ***Significance at 1%

Another regression was performed using the dependent variable off-farm labour with same independent variables. The results are presented in table 4. Results shows that the Hosmer and Lemeshow test (H-L) values are non-significant do model is good fit and the values of Cox & Snell R² and Negelkerke R² indicate that 14 to 20 per cent variations are explained by the model with MPS value 72.8%. The probability of participation in off-farm labour activities decreases with education and location. Similarly Dary & Kuunibe (2012); Rahman, (2013) also reported such type of findings. More educated and farmer located far away from main city stand at 0.845 and 0.922 chance of not getting the off-farm labour activities. Because generally more educated people will not prefer to go for labour activities, also it is difficult for the people residing in remote areas to come to city areas to find labour opportunity. However more experienced farmers are more likely to participate in labour activities. Usually small land holding farmers try to find labour activities to get more income in addition to farm income.

Table 5 Logistic regression results for participation in services activities

Variables	β	S.E.	Exp(β)
Age	0.041	0.038	1.041
Edu	**0.26	0.069	1.297
Total farming area	** -0.054	0.026	0.948
location	0.015	0.041	1.015
Household Workers	-1.363	1.036	0.256
Access to road (dummy)	**2.278	1.146	9.757
Dependency ratio	** -1.803	0.918	0.165
Farming experience	-0.005	0.033	0.995
Family Size	*0.727	0.401	2.069
Constant	-3.116	3.355	0.044
Model Prediction Success (MPS)	76.1%		
Log-likelihood ratio	192.327		
Hosmer and Lemeshow Test	(df=8) significance test result 11.474 (p-value =0.176)		
Cox & Snell R ²	0.185		
Negelkerke R ²	0.257		

*Significance at 10%; **Significance at 5%; ***Significance at 1%

The last regression results exposed the factors inflating the farmer's behavior to adopt the services type of off-farm activities. Table 5 shows that the model is good fit as expressed by the (H-L) test values and 18 to 25 percent variations are explained by the model which is represented by Cox & Snell R² and Negelkerke R². The model has highest MPS value which is 76.1% as compared to other two regression models given. In the case of services education, dummy for road and family size played a positive and significant role, while total farming area and dependency ratio were negative. The odd ratio increases by 1.297 for educated people to go for services. According to (Gordon & Graig, 2001) more educated household of rural population have more right of entry in to employment opportunities. Likewise De Janvry & Sadoulet, (2001) pointed out the education as one of the main element to go for non-farm sector. Similarly farmers having more access to road and large family size are more likely to take part in services type of off-farm activities. The odds for education, access to road and family size increases about 1.297, 9.757 and 2.069 respectively. However the odd ratio for total farming area and dependency ratio decreases by about 0.948 and 0.165.

Conclusion

With the passage of time it has become crucial for the majority of the farmers to embrace non-farm economic activities to fulfill farming expense and many others. In this article, it is inspected that the prominence of off-farm employment and also the reasons for the farmers to encompass in off-farm employment activity in Punjab province Pakistan. The data was collected from 180 respondents through stratified random sampling technique from three main cotton growing districts i.e. Vehari, Muzaffargarh and Bahawalpur. Firstly we divided the all non-farm employment sources used in study region into main three types of activities which were business, off-farm labour and services. Logistic regression model was applied to the off-farm activities. Nine independent variables were used in this model as age, education, total farming area, location, household workers, access to road, dependency ratio, farming experience and family size. Different factors were found significantly affecting each type of off-farm activity. The logistic results showed that total farming area, household workers and dependency ratio had significant and positive support in endorsing off-farm activities like business. The probability of participation for off-farm labour activities increases with farming experience. However the likelihood of participation in services type of off-farm activities grows with education, access to road and family size.

Recommendation

Foreseeing the findings one policy implication should be of unrestricted access of farming households to intervene in non-farm economic activities. Since, income from non-farm economic sources can be attained in a short period of time. From that the farmer can invest his income in other farming activities to firm other incomes i.e. crops and livestock, as are the main sources of income for the small farmers. Both sectors (farm and non-farm) actually face similar constraints, hence it is recommended that such type of programs be developed in which both sectors can be served. For example availability of easy credit scheme can assist the farmers to inaugurate non-farm business and also at the same time can increase agricultural productivity. Likewise, establishment of infrastructure like roads can lessen transportation and operational cost for both sectors, and will upsurge the endowment of employment opportunities.

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