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DETERMINANTS FOR INCOME DIVERSIFICATION BY FARM HOUSEHOLDS IN PAKISTAN

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ABSTRACT

Farmers have numerous ways to tackle agricultural risks and most of them employ the income diversification strategies simultaneously. The present study analyses the determinants of the income diversification decisions by farm households. Data was collected from 400 farm households in Sindh province of Pakistan. Results show that 69 percent farm households were employing off-farm activities as diversification strategy. Business was the most adopted off-farm diversification strategy followed by government service. The marginal effect of probit regression divulged that one-year increase in education level would results in 2.5% escalation in the probability of farmer to go for off-farm income sources. Also, the multinomial probit regression revealed that adults participating in off-farm works coefficient were negative but highly significant in all diversification strategies. Likewise, farming area, dependency ratio and family size are the driving factors for participation in off-farm labour activities. Therefore, some different income diversifications strategies should be developed, by which farmers can earn additionally and smooth their income. Further, low interest credit arrangement should be introduced for the farmers, specifically for the small and marginal farmers to fabricate their own off-farm income producing sources. So that farmers can improvise and earn more benefits, improve their living standard and alleviate poverty as well.

Keywords: Off-farm income; Credit; Probit regression: Multinomial Probit Regression; Pakistan

JEL: C01, D30, J24, L25, Q12

INTRODUCTION

Agricultural farming is a complex system and the economic well-being is not only exaggerated by income, but also its fluctuations. For addressing the fluctuations in income lead from various risks, farmers can develop informal and formal system to deal with the income risk. Historically, the farming households' perceptions were, to just only to rely on agriculture, and off-farm activities were uncommon. Therefore, the policymakers had just been focusing on the farming sector. Since quite some time summative indications have indicated that marginal farming households are not reliant on agriculture only. Hitherto, farmers have been trying to sustain their income activities in which off-farm played a significant role (Reardon, *et al.*, 2001; Ping *et al.*, 2016). However, O'Donoghue *et al.,* (2009); Haggblade, Hazell, and Reardon (2010) indicated that half of the income of rural households is derived through different sources in developing countries. In the upcoming years, there is an anticipation that off farm income will increase due to rising population and have inadequate agricultural sources, which is a threat for agriculture sector. Nearly, all around the world obtaining income from non-agricultural sources is increasing. For instance, Fernandez-Cornejo *et al.,* (2007) indicted that almost two third of farm households were attached to off-farm work. However, for shaping farm and rural development policies, off-farm work is a significant addition to farm income (Corsi and Salvioni, 2012). Likewise, income diversification is considered as a household's strategy to cope with diminishing marginal returns to labor problem (Nin-Pratt and McBride, 2014). Especially, in rural areas where seasonal unemployment is common. Furthermore, income diversification could be employed to reduce risk or to fulfill the increasing basic needs of household, which depends on the research circumstances (Estruch *et al.,* 2013). For instance, farmers in Asia diversify away from low value crops into higher-value crops and different activities to boost their income (Pingali, 2007, 2004).

However, the key factors of farmers' participation in off-farm work are more benefits with lesser risk of investing in other sectors (Kilic *et al.*, 2009; Kotu, 2014). Thus, non-farm employment positively influences on agricultural production, as the income gained from non-farm could be utilized on farm if needed and benefits the farmer to practice timely (De Janvry and Sadoulet 2001). Similarly, Stampini and Davis (2009)

argued that non-farm employment has a positive effect on the use of input variables in rural Vietnam, i.e. on fertilizer, seed, hired labour, and agricultural services. Although, undertaking off-farm work for income generation and to fortify the households' overall income is the farmers self-guarding approach (Alasia *et al.*, 2009). Though, it is essential for the farmer in a state when losses incur in agriculture under unknown factors, may be climatic or productivity etc. One of the risk coping approaches to cover these risks is variability in income sources. Reardon (1997) divulged that household must consider income diversification as a strategy for decreasing the farming income risks. It fortifies in stabilizing income and alleviates income inequality among rural households. Numerous studies associated to this situation indicated that off-farm activities significantly enhance the growth of rural economy and also alleviate poverty (Lanjouw, 2001; Ping *et al.*, 2016).

Albeit, agricultural sector of Pakistan is the backbone of the country's economy and is passing through a dilemma. One of the key factor is uncertainty of farm income, especially for the deprived farmers. The agricultural GDP growth is falling due to population load and dissection of arable land (GoP, 2012). The economic pressure has pushed many farming household for supplementary income sources, and participate in off-farm activities to stabilize the income variability problem. Nowadays off-farm income is emerging a key strategy for the rural households' livelihood. By participating in off-farm activities, farmers can earn additionally other than on farm work. Thus, for understanding the economic well-being of farming households it is necessary to assess the variability of off-farm income as well as farm income variation.

Income diversification is simply a process in which farming households create multiple income sources (Minot, *et al.,* 2006). Proxy indicator is the number of income sources of each household at given time. Although this indicator is closest to the original connotation of the word, and reflects income-generating activities. Further, income diversification is defined as a process in which farming households increase their employment and income from the off-farm activities. Regarding this, either the share of time spent on or the share of earnings from off-farm activities is used to highlight the importance of off-farm income in a household's livelihood (Barrett, *et al.*, 2001; Lanjouw, 2001; Ping *et al.*, 2016; Rizwan *et al.*, 2017a). For reducing risk, farmers usually tend to reallocate their productive asset in different activities to avoid risk or loss related to the essential income (Holmes and Jones, 2010). Farming households often select new activity like raising cattle and/or off-farm activities to cope with weather shocks (Kahan, 2013; Harvey *et al.*, 2014). Income diversification typically arises due to uncertainty of income sources and risk-averse behavior of household. Numerous researches reveal that poor farming households are more likely to have diverse income sources than richer households (Kouame and Komenan, 2012; Kahan, 2013). In addition, Oluwatayo (2009) argued about the determinants of diversification using variables like household size, gender, poverty status and access to credit significantly affected the likelihood of diversification index. Also, Awoniyi and Salman (2008), observed the level of non-farm income variability and its effect on living standard of farming household. Thus, divulged the factors that influenced the farmers' decision for the non-farm income diversification i.e. age, male household head, formal education, farm size and poverty status. However, 53.9 percent of farm households living under the poverty line were those whose household heads were not participating in off-farm activities for additional earnings. Though, the households were more vulnerable to poverty if had no off- farm income source comparatively with those farming household whom were generating off-farm income through different sources.

The aim of this article is to determine the factors influencing the participation of farm households in off-farm employment activities. It is imperative to identify the barriers and limitation for the farming household to involve in these activities. The article will deliver additional evidence of off-farm participation activities of the rural farming households.

MATERIALS AND METHODS

Study Area: Specifically, Sindh province was selected for study, because it has vast network of irrigation and drainage that falls into the Arabian Sea at Indus delta (LBG-IAC, 2013). Also in the last two decades, the province has experienced major floods in 2003, 2006, 2007, 2010, 2011 and 2012. The province lies between the north latitude 23–35° and 28–30, and east longitude 66–42 and 71–01°. Area of the province spreads over 44,016 miles^2 (17.7%) from 307,376 miles^2 of Pakistan's total area. It is roughly 360 miles in length, and 174 miles in width, in some areas it swells to 273 miles (Kazi, 2014).

Sindh province's climate is normally dry and hot, which puts it in a subtropical arid zone. It has alluvial plain distributed in three zones; upper, middle and lower zone. Maximum temperature more than 50^{o}C are recorded in upper zone in the summers and dust storms are common. Likewise, in the temperature falls down to 6^{o}C in the winters which is not unusual. The central zone stretches from Hyderabad to Sukkur, here the temperature is higher than the lower zone and lower than the upper zone. The weather usually stays dry and hot during the day, and nights are much calmer and pleasing. The lower zone lies between Hyderabad and the Arabian Sea and is highly humid. More than three fourth (78%) of the province is underlain by saline groundwater which is

inapt for general use and irrigation (Qureshi *et al.*, 2008). Due to inadequate drainage system, much of the drainage effluent is retained in the basin or disposed into the river, canals and drains. The existing drainage system serves an area of 6.2 million acres with an aggregate length of 6100km. Also, two sub-surface drainage system serve an area of 0.1 million acres (LBG-IAC, 2013).

Sampling and data collection strategy: For determining the sample size either for when the population is too large or the figure is unknown formula for shaped by Teddlie, and Yu (2007) was used. Finally, it was decided to administer 400 questionnaires to conduct this study. Further cross sectional farm level data was collected from 400 farmers using multi-stage stratified cluster sampling technique (Figure-1). In the first stage, we selected 6 districts from the study area selecting 80 respondents from each district. In the second stage, the districts were divided into two sub-districts and 40 respondents from each sub-district were selected. In the third stage, 8 villages' form each sub-district were selected, keeping in view both heterogeneity and homogeneity in some attributes. In the fourth stage, 5 to 6 farmers from each village were interviewed. Prior starting the study, enumerators were trained off-field and in-field about the study intentions, questionnaire and data collection methods were explained briefly. Further, questionnaire was pre-tested in the field, not only to fulfill the reasons of in-field training for interviewers, but likely for improving the quality of survey and to avoid missing any important data. The interviews were conducted based on shared research principles and research ethics (Abid *et al.*, 2016). Informal settlements were made, prior starting farmers interview by clarifying the intentions of the study. Using interviewing method, various questions related to different risks sources, type of strategies they are using to cope with risk sources, their income sources and various other farm household characteristics were asked during November 2015 to February 2016.

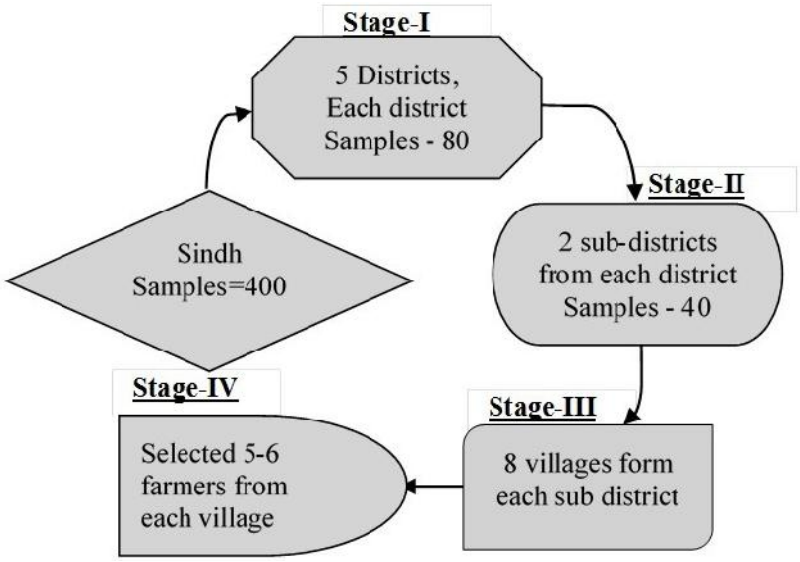

Figure 1: Sampling stages for selecting farmers in the study area

Econometric approach: Hence, exploring the effects of factors in off-farm participation activities, theoretically which originates from the decision-making theory. In accordance to the theory when the strength of the inducements goes beyond the individual's reaction then an action happens (Hill and Kau, 1973). Theoretically, probit model is more appealing than logit model and is applied in a variety of off-farm researches (Beyene, 2008). Due to the binary nature of outcome variable, Ordinary Least Square (OLS) regression cannot be applied (Ullah *et al.*, 2015a). Following Iqbal *et al.,* (2016) here, we apply probit model to investigate the factors influencing the adoption of diversification / off-farm income sources. In the income diversification function in equation (1), the off-farm diversification is measured by the household attributes *(G)*, land resources *(L)*, extra income through availing credit *(E)*, owning farm assets *(A)*, and the regional factors *(R)*. The economic specification of the model can be written as:

$$I^* = H(G, L, E, A, R) + \varepsilon \quad \ldots\ldots\ldots\ldots (1)$$

$$I_i^* = \begin{cases} 1 \; if \; I^* > 0 \\ 0 \; Otherwise \end{cases} \quad \ldots\ldots\ldots\ldots (2)$$

Likewise, I_i is the dependent variable (off-farm diversification) having the binary outcome. It indicates that households adopt off-farm diversification only if

there are some benefits at farm level. Hence, it takes value 1, if I^* is greater than zero and takes zero if I^* does not adopt diversification. Hence, I^* is a latent variable which denotes the benefits that farm household achieved by adopting the off-farm diversification sources. *H* is the vector of descriptive variables that may affect dependent variable, and ε is the error term.

For different observations unit *i* indicates the marginal effects and are different (observed individual farming household). The explanation of the marginal effects then refers to a reference variable. Whereas, the marginal effect of an explanatory variable elucidates that what fraction will change the probability that a reference variable is taking part in off-farm if a value of that explanatory variable is augmented by one unit. Further, we follow the model specified by Xiaoping, *et al.*, (2007) for determining the factors driving the farm household participation in four off-farm categories by applying a multinomial probit model. Although the variables are not the same.

$$Y_i = X_i'\beta + \varepsilon_i, \quad \varepsilon_i \simeq MVN\ (0,\Sigma), \ldots\ldots\ldots\ldots (3)$$

In this case Y_i is a polychotomous variable indicating the off-farm activity combination ($Y_i = 1 \ldots . m$) that the *i*th farmer (*i=1….n*) selects, X_i' is a *1×K* vector of known variables that affects the activity amalgamation preferred. β is a *k ×1* vector of unobserved parameters to be assessed, and unknown error term ε_i. Further marginal effect (ME) technique was applied to assess Eq. (1) and Eq. (3) for unknown parameters in using *Stata* statistical software. The descriptive statistics of variables are depicted in table 4. Though, likewise compositions of off-farm participation are elicited by Ullah *et al.*, (2016).

Variables and their specification

Dependent variables: Since mankind's engagement in agriculture, apparently off-farm diversification is the farmers' sole approach (Ullah *et al.,* 2015a). Farmers' smooth their earnings by diversifying their earning sources and for reducing the negative externalities that effect the earning sources. In the present study, diversification denotes that farmer has adopted any off-farm strategy to manage the farm productivity and/or income discrepancy. For risk management, variable of off-farm diversification is specified as binary, it takes 1 if the farmer adopts off-farm diversification and zero otherwise.

Independent variables: The demographic attributes of farmers depict that age and education significantly affects the farmers decisions (Abid *et al.,* 2015), and potentially contribute to farmers' risk coping decisions (Sherrick *et al.,* 2004). Few researches have also signified that preferences of diversification significantly differ due to educational disparities, age and income (Cohen and Siegelman 2010). At younger age, the off-farm working probability will upsurge. The leisure time demand shall rise and the overall labour hours will diminish at older age. The expected outcome should be product life cycle curve (Beyene, 2008). Similarly, farming experience also significantly effects their decisions to espouse complicated risk coping instruments. A larger share of own land is linked to larger prosperity, more stability of land control, and a bigger asset base and a smaller need for risk management tools (Ullah *et al.,* 2015a). The variables of family size and dependency ratio represent the number of members in the farming households' and number of dependents per earing member. Off-farm participation is more likely where the farming dwelling has more dependents. Relatively, when the dependents are in large numbers, the household has to increase income sources and the marginal value of leisure will diminish, therefore the household may provide additional labour for off-farm. Hence, at priori the insignia cannot be distinguished (Beyene, 2008). The distance to output market variable indicates the farm distance (kilometers) to the closest marketplace. It reduces the likelihood of the off-farm participation. The farming household's involvement in off-farm market not solitarily affects their willingness and capacity to supply labour. But, similarly affects the demand of such labour (Iqbal *et al.,* 2016). The variable of number earning members in farm households indicates that how much the farming household income is diversified (Iqbal *et al.,* 2016). The tractor ownership variable is binary, it divulges the farm asset ownership. If the farmer possess tractor then the variable takes 1 and 0 otherwise.

Livestock heads is a continuous variable, though livestock is commonly considered as an on-farm asset that could either be used for exchange of money or other productive assets or production process. It is hypothesized that livestock holding of a household will affect the decision positively. The possession of large and small ruminants permits a farming household to generate additional earnings in farm activities and dispose in time of need (Bekele and Drake, 2003). The variable of access to credit is binary, it takes 1 if the farmers has access to credit, 0 otherwise. Likewise, Beyene (2008) divulged that, if the farming household has access to credit the likelihood of participating in off-farm is likely to move towards expansion. Moreover, the variable of male to female ratio indicates the proportion of labour force participation in off-farm works. Hence, if there are more females and children under the age of five in the household it is less likely that the household will participate in off-farm (Beyene 2008).

RESULTS AND DISCUSSION

Descriptive statistics of variables: Table-1 elicited the descriptive of the regression variables. The results indicate that more than two third (68.5%) farmers in the study area were participating in off-farm work as income diversification strategy. On an average, the farmer was about 42 years old, with 8 years of formal education and 22 years of farming experience. The farming households had 9 family members averagely. Likewise, the male to female ratio indicates that there were 1:086 gender distribution per farming household. Moreover, the number of earning members per farming household were 2.4 and 1.61 adults were participating in off-farm activities with a dependency ratio of 0.27 members per head. In accordance to farm size, it is likely that farmers with large farms often involve in off-farm works. Results indicate that the mean farm size was of 43 acres, and about 69 percent farmers were having credit access. Furthermore, the farming household averagely possessed 6.54 livestock heads, and about 22 percent farmers had their own tractor. Moreover, the farm lands were more than 9 km from the output market. However, 40 percent farmers indicated the presence of farm land drainage respectively.

Table 1. Description of variables used for regression analysis.

	Variables	Unit	Mean	SD	Max	Min
Dependent variable	Income diversification	Binary	0.685	0.439	1	0
Independent variables						
Household attributes	Age	Years	42.34	12.715	80	17
	Education	Years	8.34	3.375	16	0
	Farming Experience	Years	22.08	9.582	50	2
	Family members	Numbers	9.04	1.432	13	5
	Male to Female Ratio	Numbers	0.86	0.319	1.75	.33
	Dependency Ratio	Continuous	0.271	0.146	0.875	0.083
	Earning members	Numbers	2.40	1.234	7	1
	Adults in off-farm work	Numbers	1.61	0.952	5	1
Land Resources	Farm size	Acres	43.10	86.647	900	2
Extra income	Having credit	Binary	0.69	0.463	1	0
Assets	Livestock Heads	Numbers	6.54	4.195	19	0
	D Tractor	Binary	0.22	0.411	1	0
Regional Factors	Distance output market	Kilometers	9.22	3.848	16	1
	Presence of drainage system	Binary	0.40	0.491	1	0

Source: own survey 2016

Segment of farmers' participating in off-farm activities: Foremost types of off-farm employments were categorized as, business, government servant, private employment and labour works Table-2. Similarly, the business stratum comprises of farmers participating in fertilizer and pesticide trade, grain trading, general shop keeping and market agents etc. The category of government servant comprises employment such as, doctors, lawyers, teachers, bank employee etc. The labour stratum comprises of wage labour involved in certain works, i.e. hired labour for agricultural mechanics, transportation maneuvers, construction labour etc. Likewise, the private job stratum consists of farmers involved in jobs like, NGO worker, salesman, private security guard etc.

Overall, at least one person from two third of farming households were participating in off-farm activities. The farming households' participation in business activities was 24.8 percent overall. Similarly, 15.5 percent were involved in government services and 15 percent were participating in labour activities. However, 13 percent members from farming households were involved in private employment respectively. In Badin district majority for the farming households were participating in off-farm activities. Likewise, 27.5 percent in Badin district and 28.8 percent in Sanghar and Umerkot districts were involved in business activities. Though households involved in government services were highest in Hyderabad and Badin districts 20 and 17.5 percent respectively. Likewise, highest proportion participating in private employment and labour works were 20 percent from Badin district conclusively. Nonetheless, Yusuf, *et al.*, (2016) also divulged that labour participation as off-farm activities, performs gradually substantial in sustainable development and aids in alleviating poverty as well.

Table 2. Proportion of farming households' participating in different off-farm activities.

Strategies	Badin	Hyderabad	Mirpurkhas	Sanghar	Umerkot	Overall
Agriculture	15.0	23.8	43.8	43.8	31.3	31.5
Business	27.5	23.8	15.0	28.8	28.8	24.8
Govt. Service	17.5	20.0	16.3	8.8	15.0	15.5
Private employment	20.0	13.8	8.8	7.5	15.0	13.0
Labour	20.0	18.8	16.3	11.3	10.0	15.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: own survey 2016

Diversification of income sources of farming households: Farming households' inclusive average annual income obtained from numerous sources are elicited in Table 3. Firstly, the agriculture sources are summarized, inclusive all types of earnings from crops, orchards and livestock attained in a year. The farming households earning comprises of crops, livestock and income gained from off-farm sources such as business, remittances, pensions (Rizwan, *et al.,* 2017b; Babatunde and Leliveld, 2013). Results further indicate that income earned from different off-farm sectors are not higher than agriculture sector in all districts. Results indicate that farmers from district Sanghar involved in business earn higher from off-farm participation. Similarly, farmers involved in government services earned highest in Umerkot district. Likewise, farmers participating in private job in Badin District earned more than other districts. Nonetheless, farmers from Hyderabad districts involved in labour works earned the most than other districts conclusively. This indicates that labour wage or the opportunity for work is higher in Hyderabad district.

Table 3. Households' average annual income obtained from different sources (in PKR).

Occupations	Badin	Hyderabad	Mirpurkhas	Sanghar	Umerkot	Overall
Agriculture* Only	1,052,728	1,254,190	1,369,946	1,378,818	4,674,449	1,980,399
Agriculture &	593,788	1,608,545	1,821,293	1,152,091	1,103,300	1,185,406
Business	445,000	462,316	491,000	500,261	460,174	470,263
Agriculture &	1,091,628	1,053,985	1,947,391	665,468	1,275,336	1,248,789
Govt. Servant	348,714	312,375	381,508	319,714	446,500	361,865
Agriculture &	707,931	557,414	778943,043	1,196,330	2,987,458	1,263,216
Private Job	387,713	294,364	303,429	334,000	331,500	337,450
Agriculture &	858,013	1,154,667	970,810	4,269,339	2,535,136	1,678,260
Labour	163,913	180,080	152,000	142,933	132,450	158,128

*Source: own survey 2016; Note: * Agriculture includes returns from crops, orchards and livestock*

Parameter estimates for probit model:
Table-4 divulges the parameter estimates of the probit model to conclude the factors influencing the farmer's decision related to participation in off-farm diversification. The goodness of fit test was highly significant, and the Hosmer-Lemeshow $\chi^2(8)$ was (11.20). The significant and positive value of likelihood ratio (LR) test of ρ_{kj} validates the estimation of the probit and the hypothesis H_0 nullity of ρ_{kj} can be rejected. Thus, also allows us to reject the H_0 hypothesis of nullity of variable coefficients included in the estimation. The factors significantly affecting the adoption of off-farm income diversification as risk coping strategy are age, education, farming experience, distance to output market, livestock heads and access to credit. The coefficient of age had negative impact on off-farm participation, this might be due to less participation of farmers at older age. Similar results were reported by Yusuf *et al.,* (2016) that age had negative association with off-farm participation. Hence, educated farmers are more likely to adopt off-farm diversification as they have additional capacity to evaluate the merit of diversification as a strategy to cope with the negative shocks resulting from unfavorable conditions. Marginal effect clarifies that an increase in one year of education level would results in 2.5% escalation in the probability of farmer to go for off-farm income sources. Moreover, Ping *et al.,* (2016); Ullah *et al.,* (2016) concluded that farmers with more education may be more capable of managing their farm and off-farm income sources as compared to farmers with low education. Further, farm size is another important factor for deciding the off-farm activity participation. The coefficient of farm size is positive and significant. Therefore, indicates that farmers with more land are more likely to adopt off-farm diversification sources of income. This may be due to their leisure time for participating in

other businesses as they spent their less time in farming and the farmers might feel that likelihood by adopting off-farm income sources increases with more farm size. The marginal effects of farm size indicate that an increase of one percent in farm size would increase 0.4 percent chances of involvement in off-farm jobs. Hence, Beyene (2008); Ullah and Shivakoti (2014) divulge that higher off-farm incomes fascinate and provoke farmers to diversify their income sources and smooth their consumption. This deciphers into a positive and significant relationship of farming household income and the adoption of off-farm diversification for farm risk management. Likewise, the coefficient of dependency ratio revealed positive and significant effect on off-farm participation. Similarly, Mamo *et al.* (2007) also indicates that large households are constrained by income opportunities but households with more worker–consumer ratios are well able to utilize such options. Likewise, the coefficient of number of earning member was positive and highly significant. Thus, the marginal effect indicates that one percent increase in earning members would enhance the off-farm income sources by 24.9%. Furthermore, the coefficient of possession of tractor was also significant but negative. However, Watto and Mugera (2016) indicated that farm assets lessen the associated uncertain production risks respectively.

Table 4. Probit model parameter estimates and its marginal effects.

Independent Variables	Probit		Marginal Effect	
	Coefficient	SE	Coefficient	SE
Age	-0.0038	0.0072	-0.0007	0.0012
Education	0.0143	0.0316	0.0025	0.0054
Farming Experience	0.0011	0.0103	0.0002	0.0018
Farm size	0.0022*	0.0011	0.0004*	0.0002
Dependency Ratio	5.7777*	2.8043	0.9961*	0.4752
Distance output market	0.0164	0.0243	0.0028	0.0042
Number of earning members	1.4472**	0.3504	0.2495**	0.0564
Adults in off-farm	-2.1437**	0.2245	-0.3696**	0.0217
Livestock Heads	0.0263	0.0230	0.0045	0.0040
DTractor	-0.5290*	0.2367	-0.0912*	0.0398
DCredit	0.2289	0.1956	0.0395	0.0335
Constant	-0.7200	0.6090		
LR χ^2	*216.92*			
Prob>χ^2	*0.00*			
Pseudo R^2	*0.473*			
Log-likelihood	*-120.76*			

Note: Standard errors are given in parenthesis, ** and * indicate the significance levels at 1 and 5 %, respectively

Table 5. Composition of farmers adopting different amalgamations of income management strategies.

Occupation		N	%
1.	Agriculture only	126	31.5
2.	Agriculture & Business	99	24.8
3.	Agriculture & Govt. Servant	62	15.5
4.	Agriculture & Labour	61	15.3
5.	Agriculture & Private employment	52	13.0
Total		**400**	**100.0**

Note: The different amalgamations of risk management strategies above serve as the basis for coding the dependent variable in the probit model. The dependent variable is coded such that Y_i = 1, …, 5 and only one amalgamation (between the five) is selected by the farmer.

Parameter estimates of multinomial probit regression: Table-5 provides proportion of respondents using different combinations of the risk management tools measured in this study. The multinomial probit estimates provides inference/information that is different from the probit model, because it emphases on factors affecting the amalgamation of risk coping tools that a producer selects (Ullah *et al.*, 2015a).

Results obtained from multinomial probit regression are presented in Table-6. The test of goodness of fit was realized satisfactory. Majority of the variables revealed significant results in all activities of off-farm. Except, education, family size, distance to output market, male to female ratio, livestock heads, credit and drainage respectively. The coefficient of age was significant and negative effect in labour, although no effects were revealed in business, government servant and private job as off-farm activities. Thus, indicates that age is a significant factor in labour works and performance. However, these results coincided with Iqbal *et al.*, (2016) whom revealed negative association of age with adoption

of diversification. The coefficient of farming experience was (0.032) significant and positive in labour strategy. This indicates that one-unit increase in farming experience will raise the predicted probability in labour activities by 0.25%. Similarly, Ullah *et al.*, (2015b) reported that farming experience on farmers' decisions of adopting diversification to manage farm risk affected negatively. Furthermore, the coefficient of farm size was negative but significant in business strategy. Likewise, coefficients of male to female ratio were positively significant in business and labour activities. Likewise, the coefficient of earning members was significant in all four strategies. Similarly, the coefficient of dependency ratio was significant and positive in business and marginal effect of labour strategy.

Table 6. Multinomial Probit model estimates for different income coping strategies.

	Dependent Variable = Participation in Off-farm income coping strategies **Base outcome = 1-Agriculture only**							
Independent variables	**Business**	Marginal Effects	**Govt Servant**	Marginal Effects	**Labour**	Marginal Effects	**Private Job**	Marginal Effects
Age	0.0051	0.0022*	-0.0018	0.0000	-0.0155	-0.003**	-0.0020	0.0000
	(0.0116)	(0.0016)	(0.0118)	(0.0014)	(0.0127)	(0.0013)	(0.0121)	(0.0014)
Education	0.0068	0.0041	-0.0117	-0.0011	-0.0033	0.0007	-0.0291	-0.0046
	(0.0497)	(0.0062)	(0.0501)	(0.0054)	(0.0524)	(0.0050)	(0.0508)	(0.0053)
Farming	0.0142	-0.0013	0.0219	0.0010	0.0322*	0.0025	0.0172	-0.0002
Experience	(0.0171)	(0.0023)	(0.0172)	(0.0020)	(0.0183)	(0.0019)	(0.0174)	(0.0019)
Farm size	-0.002*	-0.0002	-0.0025	-0.0003	-0.0003	0.0002	-0.0007	0.0001
	(0.0021)	(0.0003)	(0.0022)	(0.0003)	(0.0020)	(0.0002)	(0.0019)	(0.0002)
Family size	0.3025	0.0445	0.2559	0.0236	-0.1046	-0.048*	0.1390	-0.0023
	(0.2697)	(0.0323)	(0.2686)	(0.0288)	(0.2937)	(0.0293)	(0.2853)	(0.0303)
Dependency	17.8642*	1.9777**	14.0358	0.7106	4.0671	-1.330*	10.6045	-0.0818
Ratio	(10.3473)	(0.8576)	(10.4622)	(0.8322)	(10.9969)	(0.8468)	(10.7360)	(0.8496)
Male to Female	1.0494**	0.0881	0.6965	-0.0047	1.066**	0.0573	0.4540	-0.0589
Ratio	(0.4738)	(0.0635)	(0.4889)	(0.0584)	(0.5153)	(0.0531)	(0.5133)	(0.0593)
Distance to	-0.0148	-0.0010	0.0019	0.0028	-0.0182	-0.0012	-0.0204	-0.0019
output market	(0.0386)	(0.0051)	(0.0392)	(0.0045)	(0.0417)	(0.0043)	(0.0406)	(0.0045)
Earning	1.6097*	-0.0768	1.6602*	-0.0269*	3.106**	0.2271**	2.231**	0.0828
members (No.)	(1.1607)	(0.1000)	(1.1716)	(0.0964)	(1.2374)	(0.0987)	(1.2056)	(0.0987)
Adults in off-	-3.555***	-0.105***	-3.431***	-0.080***	-3.670**	-0.084**	-3.583***	-0.0915
farm work (No.)	(0.3653)	(0.0307)	(0.3722)	(0.0271)	(0.3861)	(0.0260)	(0.3770)	(0.0271)
Livestock Heads	0.0521*	0.0052	0.0236	-0.0021	0.0575*	0.0042	0.0161	-0.0037
(No.)	(0.0355)	(0.0048)	(0.0357)	(0.0043)	(0.0381)	(0.0039)	(0.0369)	(0.0042)
DTractor	-0.8674**	-0.0420	-0.5826	0.0241	-1.165**	-0.080*	-0.6166	0.0197
	(0.4134)	(0.0558)	(0.4117)	(0.0476)	(0.4701)	(0.0507)	(0.4206)	(0.0470)
DCredit	0.2801	-0.0026	0.4376	0.0353	0.2533	-0.0066	0.321*	0.0075
	(0.3235)	(0.0433)	(0.3333)	(0.0395)	(0.3452)	(0.0352)	(0.3354)	(0.0375)
DDrainage	-0.3016	-0.0465	-0.2960	-0.0352	-0.2681	-0.0230	0.287*	0.0891
	(0.3144)	(0.0423)	(0.3227)	(0.0385)	(0.3368)	(0.0345)	(0.3226)	(0.0356)
Constant	-6.430***		-5.048***		-2.3599		-3.7644	
	(2.6549)		(2.6533)		(2.8602)		(2.8171)	
Wald χ^2	179.94							
Log-likelihood	-438.13							
Prob > χ^2	0.000							

*Note: Standard errors are given in parenthesis. ***, ** and * indicate the significance levels at 1, 5 and 10%, respectively*

Likewise, Iqbal *et al.* (2016) observed that households earning members and dependency ratio increases the probability of member's attraction towards different off-farm activities. Similarly, coefficient of adults in off-farm work were negative, but were highly significant in all four strategies. Furthermore, coefficient of livestock heads was non-significant in business and labour off-farm activities. Likewise, Iqbal *et al.,* (2016) indicated that livestock animals have significant impact on excessive rainfall risk. Although, the coefficient of total household income is significant in business, government and private job activities except labour activity. Additionally, the

coefficient of tractor ownership as farm asset were negative but significant for business and labour strategies. Also, Watto and Mugera (2016) observed that farm assets lessen the associated uncertain production risks. Furthermore, the coefficient of access to credit was positive and significant in private job strategy. This divulges that if one-unit change in coefficient credit occurs the predicted probability increase in off-farm private job activities. Likewise, Watto and Mugera, (2016) indicated that farmers having access to credit were technically more efficient. Similarly, the coefficient for access to drainage were negative in most of the activities but significant in private job strategy. This may be due to the variances in geographical attributes and development level of infrastructure in rural segments respectively.

Conclusion: The conclusion drawn from the present study of determinants of farmers' participation in off-farm activities in Sindh, Pakistan. The participated off-farm activities were characterized in five sections namely agriculture only, business, government servants, labour and private employment. Results divulge that business was the most preferred off-farm activity amongst farming households. In sequence, the second most participated activity was government service followed by labour and private employment. These findings portray that farming households in the study area prefer to have their own business besides agricultural works. Number of adults involved in off-farm has significant influence on all four categorize of off-farm activities. It consolidates that people like to participate in off-farm activities. Furthermore, households owning more farming area also involved in off-farm activities. Though, households with more family member are more likely to participate in activities like government services and other business activities. Nonetheless, farmers had significant leisure time due to well mechanized farming and had opportunity to increase their income by engaging in off-farm activities. Also, the adoption decisions of risk coping strategies are prejudiced by assortment of factors together with farm and farm household attributes and their access to credit sources. In determining the risk management strategies using multinomial probit approach. Which delivers better understandings, better implications, and more evidence that may further progress the understanding of the risk coping decisions of farmers. Based on the information from the results the agricultural extension services can also progress their services to educate the farmers in an improved manner and target farmers who need information regarding diversification strategies the most. It is suggested that, if the government and other line organizations provide opportunity for off-farm activities to the farmers within the region. The farmers may gain better outputs and alleviate poverty and also raise farm productivity of different crops as well as improve the household living standard. Furthermore, low interest credit arrangement should be introduced for the farmers, specifically for the small and marginal farmers to fabricate their own off-farm income producing sources. These findings encourage for future research to assess the risk and efficiency amongst the households engaged in off-farm activities respectively.

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