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Income Diversification of Rural Households in Pakistan

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Abstract

This article explores diversification patterns among rural households of Pakistan. Using logistic regression analysis of data from Pakistan Rural Household Panel Survey, the relationship of household characteristics, asset endowments and facilitating policy with the choice of diversification of income portfolios is analyzed. The econometric analysis reveals that physical and human capital plays a significant role in defining a household's choice of diversification; information access and growth of infrastructural facilities, however, remain insignificant. These results when compared with those for countries like China reveal significant similarities. The article presses the need for a significant thrust to rural non-farm economy in the policy design; with greater emphasis on network formation and development in human capital, to enable rural households to benefit from improvements in rural infrastructure.

Introduction

Traditionally in Pakistan, like the majority of developing and under developed countries, rural economy has been associated with the agricultural sector, with particular focus on farm activities as the primary driver of rural income. However, a trend analysis of growth of agriculture sector reveals changing dynamics, illustrated by a decline in agricultural growth rate from 5.4% in 1980s to 2.7% in 2010s (Pakistan Economic Survey). This conforms to the recent literature on transition economies which widely accepts that in the structural transformation accompanying economic development, share of farm sector in a country's GDP falls as its GDP increases. Bryceson [1] also discusses the diminishing role of agriculture in household income and livelihood strategies as a phenomenon which he terms as 'Deagrarianization'. As a result, it is not surprising to observe a growing proportion of rural households seeking to depend on activities other than those pertaining to farm only [2].

This change can be attributed to uneven distribution of land, worsening climatic conditions and importantly, to agriculture sector becoming more capital intensive as a result of Green Revolution. Mechanization on farms has increased the marginal productivity of labor, consequently resulting in a lower labor demand [3].

Earlier, in the face of these conditions, rural households probed the opportunity of crop diversification to mitigate the risks of farming and fulfill the need of a sustainable income [4]. However, increasing urbanization, market liberalization and growth of infrastructural facilities have provided rural households the incentive to exploit new opportunities.

Being pushed by variability in agricultural income on one hand and pulled in by opportunities of higher income and improved living standards by other sectors, rural households tend to allocate their assets amongst multiple activities in an attempt at accumulation, risk reduction and consumption smoothing [5]. They do so by constructing a diversified portfolio of income generating activities, a process known as 'Income Diversification', in their struggle for survival and in order to improve their standard of living [6]. Rural households can construct their livelihoods mainly by three strategies: agricultural intensification; diversification through non-farm or multi-activities; and migration. Agricultural intensification may increase inequality among and within rural households while migration exerts pressure on crammed cities, leading to higher possibilities of urban slums. Employment diversification, on the other hand, offers a viable alternative to rural households to manage risks and improve their income, through which rural households explore different opportunities of income generation instead of sole reliance on a single source.

This study aims to analyze the expansion of choice of income generating activities of rural households in Pakistan with a particular emphasis on a set of factors determining a household's decision to diversify. These factors are broadly defined in two categories of "Push" and "Pull" where the former encompasses all the risks and vulnerabilities resulting from reliance on one source of income, while the later includes the incentives of diversification for accumulation and an improved standard of living.

The paper is organized as follows: Section 2 the theoretical framework. Section 3 covers data description and empirical methodology along with the regression results and discussion. The paper concludes with the final section on policy recommendations.

Theoretical Framework and Modeling

With household being the unit of analysis in this study, Agriculture Household Model provides the rationale for diversification wherein a household is considered as a single decision making unit, capturing the preferences of all household members in a joint utility function. According to this model, a household is a producing as well as a consuming unit that, like an individual, sells its labor and output in the market and also purchases inputs and labor services from the market. Functioning partly as commercial units, farms can be assumed to be production units functioning for profit. The household's decisions of consumption and labor allocation depend on income derived from production, while choices of how much to produce are driven by the market prices offered to the household's produce. Singh et al. refers to this as recursive decision making.

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A household thus faces the basic choice between labor and leisure and aims to maximize utility subjected to the constraints of income, time and production.

Singh, Low and Ellis define the utility function of a household as:

$$U=U(X_a, X_m, X_l) \qquad (1)$$

Where X_a is the household's own consumption of agricultural product, X_m is the market purchased good and X_l is leisure.

Singh et al. combines the three constraints by substituting the production constraint into the cash income constraint for agricultural output (Q_a), and then replacing the time constraint into the cash income constraint for family labor input (F). This results in one equation as:

$$P_mX_m + P_aX_a + P_lX_l = P_lT + \pi + E \qquad (2)$$

Where,

P_mX_m=Value of market purchased good

P_aX_a=Value of household's purchase of its own output

$P_l X_l$=Value of household's purchase of its own labor in the form of leisure

P_lT=Value of stock of household's time

π=A measure of farm profit (=P_aQ_a (L,V,A,K)-P_lL-P_VV)

E=Non-farm income.

Constraint optimization of the utility function gives First Order Conditions as follows, which highlight that the household would operate on the principle of equi-marginal utility.

$$P_a(\delta Qa/\delta L)=P_l \qquad (3)$$

$$P_a(\delta Qa/\delta V)=P_l \qquad (4)$$

Taylor and Adelman (2002) show that once the optimal demand for inputs and production function is determined, the output, profits and income can be derived as:

$$Q_i^*=Q_i(L_i^*, K_i^*) \qquad (5)$$

$$\pi_i^*=p_i Q_i^* - wL_i^* \qquad (6)$$

$$Y^*=\Sigma \pi_i^*+wT \qquad (7)$$

Where, π_i^*=the maximum obtainable profit from activity i, Y^*=full income, L_i^*=labor demanded by activity i, and w=wage.

Since income is endogenously determined in the model and depends on the production choices which are driven by profits derived from each of these choices, this framework now establishes a basis for our analysis of labor allocation choices of rural households in Pakistan. The household model theorizes time allocation of a rural household to different activities as a function of relative returns to labor time on each of these activities. It asserts that given a certain level of endowment, households maximize utility by deciding to allocate labor by comparing marginal returns.

Assuming that the returns on time are constant among the bigger majority of rural households, our empirical analysis shifts to income analysis wherein income from different activities is taken as a proxy of time allocation. This is so because PRHPS provides extensive data on time allocated to farm activities but does not do so for non-farm ventures. Thereof, because of clear correlation between time and income for most households, a diversification index is used as the dependent variable which not only measures the choice but also the degree of diversification of a household.

Data description and empirical methodology data set

This study uses data from Round 1 of Pakistan Rural Household Panel Survey, collected in March-April 2012, as a joint effort of PSSP, IFPRI and IDS. With multi-stage stratified sampling technique, this survey collected data on a total of 2090 households from Punjab, Sindh and KPK. Information collected is considered national representative of the rural areas

Data description

Gender role expectations may impact diversification decisions [7]. Hence, before moving to the household analysis, this section lays statistics highlighting significant insights about the distribution of females and males among the income generating activities under consideration. The following Table 1 shows that among female earners, almost 92% are engaged in exclusively off-farm activities and 4% in exclusively non-farm activities. However, approximately 4% of female earners have diversified their income portfolios into a combination of off-farm and non-farm activities. In Pakistan, a relatively significant proportion of females are engaged in on-farm activities, but this proportion is concealed under 'Hidden Employment'; therefore, it cannot be analyzed with the available data.

Compared to females, males living in the rural areas differ in their choice of income generating activities. 22%, 4% and 27% of male earners derive their livelihood from exclusively farm, off-farm and nonfarm activities, respectively. Almost 47% of male earners derive their income by engaging in multiple income generating activities.

With this information in the backdrop, the analysis in the following sections is taken to a household level since the unit of analysis for this study is a household. Income is categorized into five sources as mentioned below and has been aggregated at household level to give the total household income. The number of sources a household derives income from is analyzed to study whether a household relies on only one source of income completely or engages in constructing a diversified income portfolio.

Collecting the data on income, the sources have been classified into five categories, as follows:

The number of households engaged in deriving income from these sources is shown in Figure 1a below. Mean of Income Shares approach is used to study the income shares of rural households of Punjab,

	Females	
	Number	Percentage
Off-Farm	1453	92%
Nonfarm	70	4%
Both Farm and Nonfarm	56	4%
Total	1578	100%
	Males	
	Number	Percentage
Off-Farm	648	22%
Nonfarm	123	4%
Both Farm and Nonfarm	774	27%
Multiple Sources	1369	47%
Total	2914	100%

Table 1: Distribution of individuals among income generating activities by gender.
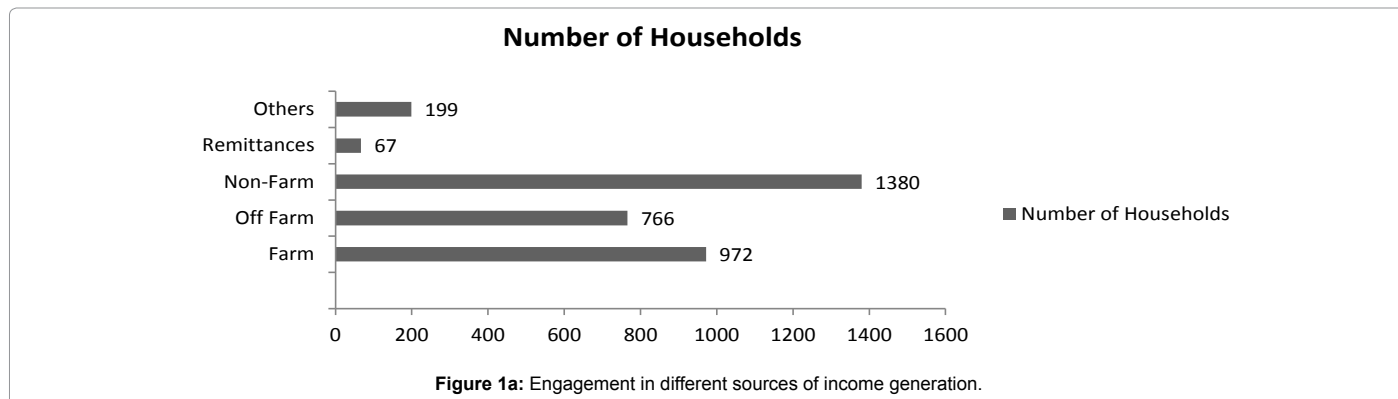
Figure 1a: Engagement in different sources of income generation.

Source	Description
Farm Income	Income from the sale of agricultural output
Off Farm Income	Income from paid farm work
Non-Farm	Income from non-farm paid work and from non-agricultural enterprises
Remittances	Income received as remittances from any member of the household who migrated for employment
Others	Income from building rent, land rent, gifts, rent from equipment, rent from leased-out animals or from any other specified source

Table 2: Description of income sources.

Sindh and KPK. This approach estimates the shares of incomes at the individual household level by finding the share of each income source in total household income. In general, the formula for mean share of income of a household is given as:

$$MS_i = \frac{\sum_{h=1}^{n} y_{ih} / Yh}{n}$$

Where Y=Total Income, y_i=income from particular activity, i=the income source, h=the household, n=the number of households.

Following this approach, the average share of farm, off farm, nonfarm, remittances and income from other sources are given in the following Table 2.

Whether a household diversifies or not is taken as a dichotomous variable where complete reliance on one source corresponds to no diversification while deriving total income from more than one source refers to a diversified portfolio of income.

Our data shows a significant percentage of rural households engaging in income generation from multiple sources.

Decomposition of shares

The respective shares from these sources for households which are diversifying or not diversifying are as shown in Figure 1b and 1c. Not only is the choice of diversification studied, the degree of diversification for every household is also analyzed by calculating the Simpson Index of Diversification.

In the literature on agricultural economics, one dimensional attempt to measure income diversification include the estimation of non-farm income's share in the total household income as an indicator of higher diversification. However, another branch employs one or more two-dimensional indices such as Herfindahl-Hirschman index, its complement 'The Berry' index and the entropy measure of diversification [8].

This study uses the Simpson Index of Diversification which is constructed as:

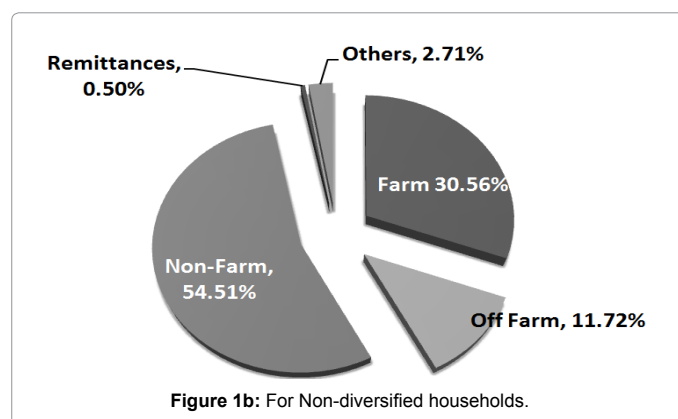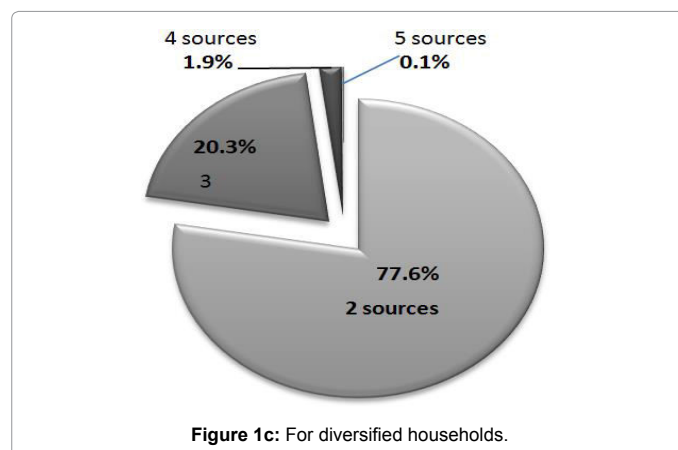**Figure 1b:** For Non-diversified households.

Figure 1c: For diversified households.

$$SID = 1 - \sum_{i=1}^{n}(P_i^2)$$

Where,
SID=Simpsons Index of Diversity,
n=number of income sources and P_i=Proportion of income coming from the source i.

Simpson Index has been widely used to measure the biodiversity of an ecosystem as it calculates the probability that two species selected at random from a sample belong to the same species. With this index, 0 represents infinite diversity whilst 1 indicates no diversity. To make it intuitively sound, Simpson Index is subtracted from 1 to give Simpson's Index of Diversity. The value of this index ranges between 0 and 1 where 0 signifies no diversity while 1 shows infinite diversity.

Many studies have used SID to measure the degree of diversification households engage in. This study chooses SID to measure diversification because this index takes into account the number of species and the evenness in their distribution. Intuitively, SID measures the probability that any rupee taken, at random, from a household's income would have come from two different sources. Thus, a value of SID closer to 1 would indicate higher diversification while a value of 0 would signify deriving income from one source only i.e. specialization.

The value of SID in this study ranges from 0 to 0.764 with a mean of 0.167 where 0 means that a household derives all its income from one source and 0.764 indicates engagement of a household in all the five sources considered.

The histogram below (Figure 1b) shows the frequency distribution of the Simpson Index of Diversification for the sample size taken for research in this study.

The results provide evidence that no less than half of the rural economy of Pakistan relies on income sources other than, and along with, farm activities. However, an important question remains as to whether this diversification at household level can be attributed to individual earners engaging in multiple sources of income or multiple earners in a household engage in deriving income from mutually exhaustive or multiple income generating activities. In order to answer whether it is the sources or earners that lead to diversification at household level, the following stats were calculated from the data set used in the study.

The preceding Table 3 gives a detailed analysis of the income behavior of households with diversified income portfolios. For 53% of these households, diversification is driven by only one earner amongst others, who has multiple sources of income. Diversification among 25% of households is driven by multiple earners, per household, engaged in mutually exhaustive income generating activities. As for the remaining 21%, diversification is driven by multiple earners, per household, engaged in multiple activities. These results draw to an important result that the biggest proportion of diversification in rural households in Pakistan is the diversification observed due to engagement in multiple income sources which gives a sound base to the analysis of how the options available to rural households to generate income have expanded due to need as well as opportunity.

Econometric specification of household diversification model

Econometric models like regressions and quintile regressions have been popularly employed in agricultural economics to study household diversification. Some models like those by McElwee and Bosworth have applied a categorical data model in explaining determinants of diversification, simulated as a binary variable or as a categorical variable whilst some work like that of Agyeman, Brempong and Onumah construct a diversification index and study the determinants of intensity of diversification.

Using the econometric techniques, this study uses two Logit models wherein the first model estimates the determinants of diversification for the entire sample. Households' choice of diversifying or not diversifying is considered in the light of number of sources a household obtains income from.

To enrich the analysis, in the second logit regression, households with a non-zero share of farm income are considered in order to analyze the determinants with the presumption that rural households are farm households. An interesting statistic for this regression is that of all households that choose to specialize from this sample, they specialize into farm. With this in the backdrop, this regression analyzes diversification strictly from farm to the other income sources.

Model I: Determinants of income diversification among rural households in Pakistan

To estimate the impact of the determinants of diversification, the Simpson Index of Diversity is taken as a discrete variable where a value of 0 indicates that a household does not diversify and any value greater than 0 is taken as 1 in the construction of this binary variable. To identify the decision of whether a household diversifies or not, the model is estimated through the logit modeling technique, with the following variables:

$$\log\left(\frac{P_{Diversification}}{1-P_{Diversification}}\right) = \beta_0 + \beta_1\ Dependency\ Ratio + \beta_2\ Household\ Education + \beta_3\ Number\ of\ Earners\ in\ the\ Household + \beta_4\ Migration\ for\ Employment + \beta_5\ Land\ Ownership + \beta_7\ Access\ to\ Information + \beta_8\ Satisfactory\ Access\ to\ credit + \beta_9\ Access\ to\ Electricity + \beta_{10}\ Satisfactory\ Access\ to\ Roads + \beta_{11}\ Access\ to\ Market + \beta_{12}\ Access\ to\ Local\ Transport + \beta_{13}\ Access\ to\ Long\ Route\ Public\ Transport + U_i$$

Construction of the independent variables is described in the following sub section.

Variable description

Description and construction of the variables along with the summary statistics for Regression I are inscribed in Table 4. Variables are categorized into five groups, (i) Household features, (ii) Asset Ownership, (iii) Information, (iv) Financial Capital and (v) Infrastructure.

Dependency ratio, the number of dependents per earner of the households can lead to diversified income portfolios among households. A number of the variables under consideration represent some sort of capital, which can drive towards some diversification or none (i.e. specialization). For instance, average education of the household is a form of human capital which could lead to specialization into a specific activity or diversification into multiple income generating activities. Ownership of land, for instance, can be indicative of wealth and may favor diversification among rural households. Access to information

Source	Average Statistics (PKR)
Total Household Income	178261.6
Farm Income	81761.43
Off Farm Income	13894.65
Non-Farm Income	70677.33
Remittances	3967.899
Others	7960.319

Table 3: Value of per annum income.

Source	Mean Share of Income
Farm Income	0.289
Off Farm Income	0.15
Non-Farm Income	0.512
Remittances	0.115
Others	0.382

Table 4: Mean shares of income.

is constructed by incorporating ownership of television, radio and computers. Information access can lead to greater knowledge, awareness and connectivity; which in turn can have varying effects on diversification. It may lead toward specialization into a single source of income, or may drive towards diversification of income portfolios. Access to credit is taken as a proxy of financial capital for the household. Literature asserts that access to credit can lead to diversification; however credit market failures can impede this shift. Moreover, Infrastructure entails access to satisfactory roads and transport, both local and long route. Access to adequate infrastructure can enhance the pot of available opportunities and can aid several employment ventures (Table 5).

Results and Discussion

The overall model makes 61% of correct predictions as indicated by the percentage correct predictions, in Table 6. The link test appears to be insignificant; therefore we can assert that the model is correctly specified.

In our analysis, except dependency ratio, market access, and access to local transport, all other variables show that the explanatory variables and the dependent variable are associated with each other i.e. they have a significant relationship with the dependant variable, ($p > 0.5$). Individuals in the rural setting choose among different income generating employment options. The opportunity and endowment set of the rural household determine the employment choice of an individual. Our results indicate that with an increase in the number of dependents per worker, rural households are more likely to diversify their income sources. Dependency ratio affects diversification positively, but insignificantly. Rural household with greater dependency ratios i.e. more dependants per earner in a household, are expected to diversify their income sources, to earn better incomes. Number of Earners in the household also has a positive and statistically significant relationship with diversification. The amount of labor available per household, impacts the activity choice, and leads to an increase in the range of income generating activities. The more earners there are in a household, the greater is the probability of engaging in, and receiving higher returns from activities. Thus, households diversify with an increasing labor endowment. Household education level affects income diversification significantly and negatively. Education, as human capital motivates individuals to specialize into nonfarm employment. The model results are consistent with Agyeman's [9] study of income diversification in India, in which he establishes that education is a key determinant of income diversification, and educated household have a much higher likelihood of adopting strategies involving nonfarm employment (wage and self-employment). Hence showing, that increase in average education leads to specialization into nonfarm activities. Moreover, results also show that with an increase in number of household members who have migrated for the purpose of

employment, income diversification increases, as migration is positively and significantly associated with diversification. Households with individuals who migrate, explore greater and better job opportunities, and hence diversify into multiple income generating activities. Satisfactory access to credit is negatively and significantly related to the dependant variable. Greater access to credit facility increases the likelihood of specialization. Credit is a proxy for availability of financial credit; therefore households that are satisfied with the available formal bank services have a better opportunity of fulfilling their investment requirements and overcoming capital constraints that are necessary to help households specialize into nonfarm activities. Investing the borrowed funds into one source helps the households yield maximum profits; therefore households tend to specialize with increased access to credit. The impact of credit access for Pakistan is similar to that for China, India and Indonesia. Credit institutions have a significant positive impact on the share of non-agricultural income [10]. For instance, in the case of rural households in Northern China, constrained access to credit is likely to reduce the likelihood to participate in any off-farm activity, both at the household.

The link test is used after a logit regression to test for a specification error. If the model is correctly specified then _hat should be astatistically significant predictor, since it is the predicted value from the model. If the model is properly specified, the variable _hatsq and individual level [11]. Information availability through information technology or cellular facility influences the diversification significantly and negatively in the model. Information through access to radio, television and computer provides opportunities to rural households to respond to changing market trends, and specialize more into nonfarm activities, gaining high returns. The results suggest that land ownership is positively and significantly associated with diversification. Land ownership is an indicator of wealth, and typically there is a positive correlation between wealth and diversification as wealthier individuals have a wider range of options to choose from, than the poor. Thus, this suggests that when a household is endowed with assets (land), it is likely to diversify its income sources. Inclusively, ownership of land increases the probability of household participation into multiple income generating sources, as land ownership allows households to obtain credit by offering land as collateral. Only satisfactory access to roads promotes diversification, whereas access to electricity, access to market and access to local and public transport has a negative impact on diversification patterns. With an increase in satisfactory access to roads the likelihood of diversification increases significantly. Improved roads access is most desirable by rural households, as it reduces the costs incurred on all types of transactions, and increases connectivity between farm and nonfarm activities. Thus this ensures that individual get greater accessibility and opportunity of engaging into multiple income generating activities. Access to market is negatively, but insignificantly related to diversification. Inclusively, our results show that with satisfactory access to local and long route public transport, households tend towards specialization into nonfarm activities. This may be attributed to reduction in transportation costs die to satisfactory access, leading into higher values at which output can be sold. This conforms to the pattern explored in China by Janvry, Sadoulet and Zhu (Tables 7 and 8).

Model II: Income diversification among farm households in rural Pakistan

To analyze the determinants of diversification behavior among farm households in rural Pakistan, The specification of the dependent variable is retained. The model is estimated through logit modeling

	Number of Households	Percentage of Households
Diversify	1058	0.5146
Not-Diversify	998	0.4854

Table 5: Diversification statistics.

Total Number of Diversified Households: 1058			
		Sources	
Earners		**Single**	**Multiple**
	Single	(Non-Diversified)	565 (53.4%)
	Multiple	262 (24.76%)	231 (21.83%)

Table 6: Detailed statistics of households with diversified income portfolios.

	Variables	Construction	Expected Outcome (+/-)	Mean	SD
Dependent Variable	Household's Income Diversification	Dummy Variable constructed from the Simpson's Index 1: Diversification; 0: No Diversification			
Independent Variables Household Features	Dependency Ratio	Number of dependents (Age 0-16, 65 and above) per earner, of each household	(+)	1.04	0.9
	Household Education Level	Average years of schooling for each household Classified into			
		Primary Education (Up to Grade 6)			
		Secondary Education (Grade 7 to12)	(+)	2.39	2.43
		Tertiary Education (More than 12 years of Schooling			
	Number of earners in the Household	Number of people per household working:			
		On-farm			
		Off-farm, and	(+)	2.17	1.27
		Non-farm			
	Migration for Employment	Whether any household member has migrated for employment			
		Dichotomous Variable 1: Yes; 0: No	(+/-)	0.1	0.3
Asset Ownership	Land Ownership	Dichotomous Variable 1: Yes; 0: No	(+/-)	0.35	0.35 0.48
Information	Access to Information	Access to			
		Television			
		Radio			
		Computers	(+/-)	0.04	0.2
		Dichotomous Variable 1: Yes; 0: No			
Financial Capital	Satisfactory access to credit	Dichotomous Variable 1: Yes; 0: No	(+)	0.27	0.44
Infrastructure	Access to Electricity	Dichotomous Variable 1: Yes; 0: No	(+/-)	0.87	0.34
	Satisfactory Access to Roads	Dichotomous Variable 1: Yes; 0: No	(+)	0.47	0.5
	Access to Market	Dichotomous Variable 1: Yes; 0: No	(+/-)	0.53	0.5
	Satisfactory Access to Local Public Transport	Dichotomous Variable 1: Yes; 0: No	(+/-)	0.52	0.5
	Satisfactory Access to Long Route Public Transport	Dichotomous Variable 1: Yes; 0: No	(+/-)	0.26	0.44

Table 7: Description and construction of the variables.

technique, with the following variables:

$$\log\left(\frac{P_{Diversification}}{1-P_{Diversification}}\right) = \beta_0 + \beta_1 \, Dependency \, Ratio + \beta_2 \, Household \, Education + \beta_3 \, Number \, of \, Earners \, in \, the \, Household + \beta_4$$
$$Land \, Ownership + \beta_5 \, Licestock \, Ownership + \beta_7 \, Size \, of \, cultivated \, land + \beta_8 \, Relative \, Value \, of \, falm$$
$$Assets + \beta_9 \, Access \, to \, Information + \beta_{10} \, Access \, to \, Agricultural \, credit + \beta_{11} \, Access \, to \, credit + \beta_{12}$$
$$Migration \, for \, Employment + \beta_{13} \, Average \, Distance \, to \, place \, of \, Scale \, of \, Agricultural \, Output + \beta_{14}$$
$$Electricity + \beta_{15} \, Satisfactory \, Access \, to \, Roads + \beta_{16} \, Access \, to \, Market + \beta_{17} \, Access \, to \, Local \, Transport$$
$$+ \beta_{18} \, Access \, to \, Long \, Route \, Public \, Transport + U_i \, .$$

Variable description

This regression has been undertaken to particularly analyze the diversification pattern among the households which derive at least some proportion of their income from farm activities. Compared to the first regression, 'Land Resource' is added as an additional category. Some categories 'Asset Ownership' 'Financial Capital' are enhanced by additional variables. These variables are expected to drive the relevant households under consideration, towards specialization in a way that they would be driven to derive their income from particularly farm activities (Table 9).

Results and Analysis

This regression, undertaken to explore the impact of factors on likelihood of income diversification, amongst particularly farm households, signifies that these households, if specialize, then they do so in the farm sector. The pattern of diversification, hence analyzed, is one which establishes the movements from farm to other sources of income. If we take a holistic view of the regression results we are able to imply, that amongst the rural households in Pakistan, those who are somewhat engaged in farm activities tend to have a higher

inclination towards income diversification. Data shows that amongst these households almost 69% engage in income diversification. This reasserts prior statements that mechanization of agriculture, changes in agro-climatic conditions and landholdings have indeed initiated the need to adopt diversification as a livelihood strategy among rural households engaged in agricultural activities.

The results of the regression are somewhat in accord with the relevant literature [12,13] written for other countries. For the farm households in the representative sample, as the number of dependents per earner increases, the likelihood of diversification increases. This independent variable is significant at 1% for farm households. In rural households deriving a significant share of their income from farm activates, dependency ratio tends to be higher. As a consequence there arises a need to explore new opportunities to engage in and derive income from. The number of earners positively impacts diversification amongst farm households in Rural Pakistan, and is significant at 1%. As the number of earners in any household increases, there is an increased likelihood that the earners may engage in multiple sources, thereby increasing diversification of the household's income portfolios. There are some households which comprise of one or more individuals who have migrated for the purpose of employment and send back remittances. As indicative of this, a variable 'Migration for Employment' is added into the model specified. For households with migrated members, results show that the households don't necessarily rely on the remittances alone but instead have diversified income portfolios. Inclusively, the results establish a very important link between the impact of education, an imperative variable in the

Variables	Odds Ratio	Marginal Effects
	0.21**	
	(0.117)	
Dependency Ratio	(1.033)	0.00812
	(0.0347)	(0.00838)
Household Education Level	0.931***	-0.0179***
	(0.0198)	(0.0053)
Migration	2.121***	0.178***
	(0.508)	(0.0517)
Number of Earners in the Household	1.490***	0.0996***
	(0.0698)	(0.0117)
Land Ownership	1.283**	0.0621**
	(0.129)	(0.0248)
Access to Information	0.592**	-0.129**
	(0.14)	(0.0566)
Satisfactory Access to Credit	0.828*	-0.0470*
	(0.0869)	(0.0262)
Access to Electricity	0.792	-0.0577*
	(0.112)	(0.0348)
Satisfactory access to Roads	1.314***	0.0680***
	(0.131)	(0.0248)
Access to Market	0.893	-0.0283
	(0.0879)	(0.0246)
Access to Local Transport	0.987	-0.00339
	(0.102)	(0.0259)
Access to Long Route Public Transport	0.667***	-0.101***
	(0.0776)	(0.0288)
Percentage of Correct Predictions		
	Freq.	**Percent**
0	797	38.86
1	1,254	61.14
Total	2,051	100
Link test		
	Coefficient	P-Value
_hat	1.037948	0
_hatsq	-0.0930126	0.22
_cons	0.0275075	0.59

Notes: ***p<0.01, **p<0.05, *p<0.1; Standard errors in parentheses.

Table 8: Regression 1: Determinants of income diversification among rural households in Pakistan.

analysis of income diversification patterns among rural households, on choice of diversification of farm households. Education builds human capital, so the capability of a well-educated person may very well be higher in other sectors, such as small scale enterprises or certain other wage employments. Therefore, households with higher years of schooling on average tend to diversify their income portfolios out of farm activities only. The results confirm this assertion and show that an increase in the average education level of the household drives the farm household to diversify their income portfolios. For similar studies done for India and Indonesia, education significantly encourages out of farm activities. Land ownership amongst rural households is a vital asset, even more for those households engaged in on-farm activities. The results show that land ownership of these households has a significant and negative impact on the likelihood of diversification. Compared to the landless households, landowners tend to have a higher degree of specialization into farm activities. This result is plausible because landowners would be inclined towards own land and would generate income out of possible activities on their land, such as crop farming or livestock rearing. Studies for a number of countries such as China

and India assert a negative relationship between land size and nonfarm employment. As an additional variable indicative of assets, ownership of livestock, although appears to be slightly insignificant, creates an inclination towards specialization in on-farm activities. The value of farm assets held by the households as a percentage of the total value of assets tends to have a significant and negative relationship with the likelihood of diversification. As the relative value of farm assets increases, the likelihood of specializing into on farm activities increases. Access to information increases awareness about possible employment opportunities and earning ventures. It can therefore drive agricultural rural households towards diversification of income portfolios, as asserted by the regression, although the variable is insignificant. Inclusive to access to credit, an additional variable incorporated here is the access to agricultural credit. Households with access to general credit, tend to be inclined towards diversification. This is because the available credit is available for several activities. The significant and positive relationship between access to credit and the likelihood of diversification implies fungibility of credit i.e. credit is used for the purpose it is borrowed for. The access to agricultural credit decreases the likelihood of diversification and instead increases specialization in on-farm activities. This factor, however, appears to be insignificant. Households reaching out for agricultural credit are those who maybe landless and less privileged. In the case of Pakistan, inclusive to formal financial markets, the criterion for credit worthiness is followed to decide on extension of loans in informal financial markets too. Hence, the households which lack assets and could be less fortunate do not come at the receiving end [14-19]. Access to electricity tends to drive households towards diversification. The rationale for this relationship can be judged based on the fact, that access to electricity implies ease of use of agricultural assets which can increase productivity of land while decreasing the demand of labor on land. Likewise, access to electricity can generate multiple employment options which were otherwise unexplored. Satisfactory access to roads significantly impacts diversification out of farm. This is because access to good infrastructure, creates a bigger push towards local construction and related variables. This can generate new options for income generation. Satisfactory access to market, access to local and public transport lead households into specialization of income portfolios. Some studies conclude that access to markets and urban centres can create new opportunities, and can therefore lead into diversification out of agricultural activities [20-25]. However in some instances, like our results indicate, proximity to markets can influence agricultural activities leading to high value crops for the local urban market, which with the availability of local transport, may generate a good return on farm output, and hence these households specialize. Availability of long route public transport can increase specialization, if the transport cost is higher and makes it infeasible for the household to use it on a regular basis. A vital determinant of the decision to diversify or not amongst rural farm households is the average distance to place of sale of agricultural output. This variable is significant at 5% and increase the likelihood of diversification. As the distance to the place of sale increases, the household faces a higher transport cost and maybe discouraged to sell his perishable agricultural produce at a larger distance. This would in turn drive the households towards diversification of their income portfolios [26-30]. Hence, over larger distances, the agricultural output, which is mostly perishable and can degrade over large distances, is not likely to be sold by the households. Moreover, dealers may agree to buy the output from the farmers and give them a price lower than the price at which the output is actually sold in far off markets. This further discourages the farmers to participate in farm activities only and hence they engage in multiple sources of income (Table 10).

	Variables	Construction	Expected Outcome (+/-)	Mean	SD
Dependent Variable	Household's Income Diversification	Dummy Variable constructed from the Simpson's Index 1: Diversification; 0: No Diversification			
Independent Variables Household Features					
	Household Education Level	Average years of schooling for each household Classified into			
		Primary Education (Up to Grade 6)	(+)	2.41	2.42
		Secondary Education (Grade 7 to12)			
		Tertiary Education (More than 12 years of Schooling			
	Dependency Ratio	Number of dependents (Age 0-16, 65 and above) per earner, of each household	(+)	1.07	0.93
	Number of earners in the Household	Number of people per household working:			
		On-farm			
		Off-farm, and	(+)	2.17	1.27
		Non-farm			
	Migration for Employment	Whether any household member has migrated for employment			
		Dichotomous Variable 1: Yes; 0: No	(+/-)	0.12	0.32
Asset Ownership	Land Ownership	Dichotomous Variable 1: Yes; 0: No	(+/-)	0.61	0.49
		Access to			
Information	Access to Information	Television			
		Radio		0.04	0.2
		Computers	(+/-)		
		Dichotomous Variable 1: Yes; 0: No			
		Dichotomous Variable 1: Yes; 0: No	(+)	0.27	0.44
Financial Capital	Satisfactory access to credit	Dichotomous Variable 1: Yes; 0: No	(+/-)	0.87	0.34
Infrastructure	Average Distance to Place of Sale of Agricultural Output	In Kilometers (km)	(-)	11.03	24.20
	Access to Electricity	Dichotomous Variable 1: Yes; 0: No	(+/-)	0.84	0.37
	Access to Market	Dichotomous Variable 1: Yes; 0: No	(+/-)	0.48	0.50
	Satisfactory Access to Roads	Dichotomous Variable 1: Yes; 0: No	(+)	0.44	0.50
	Satisfactory Access to Local Transport	Dichotomous Variable 1: Yes; 0: No	(+/-)	0.46	0.50
	Satisfactory Access to Long Route Public Transport	Dichotomous Variable 1: Yes; 0: No	(+/-)	0.22	0.42

Table 9: Independent variables household features.

Comparison of the models

The results of the two models give an insight into the diversification pattern of households. Deriving income from farm has been considered as a cut off to narrow the analysis down to farm households in comparison to all the rural households, regardless of whether they were involved in farm activities or not [30-32].

It is interesting to note that while similar results can be observed for most of the variables considered, significant differences can be seen in case of the relationship of average education, land ownership, access to information and in particular, the variables considered for measuring access to infrastructural facilities with the choice of diversification.

The regression results show that with the entire rural households as the sample size, an increase in average education leads households towards specialization i.e. the likelihood of households switching completely to non-farm activities increases [33-36]. Contrasting results can be observed in regression II where an increase in education promotes diversification. This is because, as mentioned above, for the second model, all households when choose to specialize, they do so in farm activities. Promoting diversification in this case implies that with higher education, rural household seek new opportunities out of farm and are more likely to engage in income sources other than strictly farm. Similar difference in the results can be seen for the variable of access to information. For rural households, access to information would mean knowledge transmission and awareness, enabling households to invest more of their time and effort in activities other than farm that they are initially engaged in. However, for farm households inclined towards specializing in farm, access to information implies exposure to new opportunities that will promote farm households towards diversification. Interestingly, however, the insignificance of this variable in both the models draws to a conclusion that the access to information in rural areas does not complement the choice of employment by members in a household. The insufficient availability of information sources, such as internet and computers, limit the capacity of rural households to timely respond to emerging market trends [37,38].

Surprisingly, the negative and insignificant impact of market link as well as access to local transportation in both the models draws attention to the diversification behaviour of rural households. In the estimated models, access to these infrastructural facilities leads households towards diversification, showing complete reliance on one source of income. A possible implication can be a complete switch of households towards one particular, high-yielding income source with an increase in access to these facilities. However, insignificance of these variables in explaining income diversification calls to attention the lack of their role as facilitating policy for rural households. The inability of development in local transport services and market linkages to affect the income generating choices of rural households calls to need a stronger policy

Variables	Odds Ratio	Marginal Effects
Dependency Ratio	1.292*** (0.0844)	0.0572*** (0.0145)
Household Education Level	1.106** (0.0433)	(0.00875) 0.135***
Number of Earners in the Household	1.826*** (0.175)	0.135*** (0.0208)
Land Ownership	0.472*** (0.0931)	-0.158*** (0.0387)
Livestock Ownership	0.689 (0.181)	-0.0791 (0.0525)
Size of Cultivated Land	0.943*** (0.0157)	-0.0132*** (0.00373)
Relative Value of Farm Assets	0.392** (0.171)	-0.210** (0.0975)
Access to Information	1.008 (0.400)	0.00173 (0.0885)
Satisfactory Access to Agricultural Credit	0.840 (0.234)	-0.0396 (0.0647)
Satisfactory Access to Credit	1.464* (0.304)	0.0825* (0.0434)
Migration for Employment	25.16*** (28.18)	0.345*** (0.0316)
Average Distance to Place of Sale	1.011** (0.00442)	0.00248** (0.000973)
Access to Electricity	1.399 (0.353)	0.0774 (0.0596)
Satisfactory access to Roads	0.816 (0.248)	-0.0456 (0.0399)
Access to Market	0.892 (0.148)	-0.0257 (0.0406)
Access to Local Transport	0.815 (0.168)	-0.0464 (0.0424)
Access to Public Transport	(0.182) 0.497*	(0.0518)
Constant	(0.202)	
Percentage of Correct Predictions		
	Freq.	**Percent**
0	262	26.95
1	710	73.05
Total	972	100
Link test		
	Coefficient	**P-Value**
_hat	0.9908498	0.00
_hatsq	0.0100695	0.884
_cons	-0.0035534	0.97

Notes: ***p<0.01, **p<0.05, *p<0.1; Standard errors in parentheses.

Table 10: Regression II: Determinants of income diversification among rural households in Pakistan.

framework to encourage network formation and connectivity among rural Pakistan for the rural households to be able to reap maximum benefits from improvements in infrastructure.

Conclusion

This study explored the income generation in rural households of Pakistan and analyzed the expansion of choices of these households regarding the sources of income that they do, can, and would engage in to drive total household income in order to maximize household's utility. With time, income and production constraint equally imposed on these households, the discretion of this choice is based on their initial endowment set, opportunities and the facilitating policy that households have access to.

Under the conditions of farm sector's decreasing capacity of labor absorption due to mechanization, worsening climatic conditions and changing land distributions, the conventional wisdom of agriculture being the sole driver of growth of rural economy is questioned. Engagement in other off and non-farm activities is seen as a survival strategy in this case, especially for the poor. For the wealthier rural households, constructing a diversified portfolio of income generating activities is a deliberate investment in the anticipation of higher returns offered by increasing urbanization, market liberalization and growth of facilitating policies.

With this in the backdrop, results of our research highlight important policy implications. The presumption that rural households

are primarily farm households stands questionable by the larger size of rural non-farm sector as shown by our data from IFPRI. With an ever increasing size of non-farm rural economy, a rural policy that recognizes the significance of this emerging sector needs to be designed. Traditionally, eradication of rural poverty in Pakistan has been dominated by policies directed primarily on the farm sector. However, the results above signifying the importance of rural non-farm sector call for a significant thrust to this sector in the policy design. The non-farm rural economy has immense potential of growth leading to poverty eradication and improvement in living standards of the rural population. It is also important because alternatively, an exodus of unemployed farm labor to cities can be catastrophic in terms of the pressure on increasingly cramped cities and growing urban slums.

The results of econometric estimation of determinants of diversification on households' choice of diversifying or not draw attention to the significance of human, physical and social capital owned by a household. This implies a need for policy that focuses on improvement of human capital in rural economy of the country for which education can serve as a key tool. Effective measures to provide education and training to rural population will lead to engagement in better choices of employment. Vocational training especially to females will increase their participation in small and medium enterprises, enabling households to mitigate risks associated with complete reliance on farm sector.

Surprisingly insignificant role of rural infrastructure and information access in explaining the diversification choice of households draws to the implication that higher amount of focus needs to be paid to development of network formation and improvement of social capital. Only when knowledge and idea sharing is encouraged in rural areas can awareness enable the population to reap advantages of developments of transport services and market links to make better employment choices.

Some areas of further research can include better understanding of intra-household decision making by a sharper focus on social institutions and dynamics of rural households. Moreover, impact evaluation of public policies designed for rural economy of Pakistan can enable policy makers to identify areas demanding higher attention. An analysis of entry barriers to non-farm activities for future research can lead to a deeper insight into the operating environment of rural households and can complement the picture of income generation potential. Moreover, a system of measurement of risk attitudes and behavior of rural households can enrich the analysis of choice of risk mitigation strategies that rural households undertake.

References

1. Bryceson D (2002) The Scramble in Africa: Reorienting Rural Livelihoods. World development 30: 725-739.

2. Abraham C (1996) Agriculture and Rural Employment. Canadian Journal of Agricultural Economics 44: 497-505.

3. Khan M, Zhang J, Hashmi M, Fahad S (2011) Land distribution, technological changes and productivity in pakistan's agriculture: some explanations and policy options. International Journal of Economics and Management Sciences 1: 51-74.

4. Birthal PS, Joshi PK, Roy D, Thorat A (2012) Diversification in Indian Agriculture toward High-Value Crops: The Role of Small Farmers. Canadian Journal of Agricultural Economics 61: 61-91.

5. Bessant KC (2007) Multiple Discourses on Crisis: Farm, Agricultural, and Rural Policy Implications. Canadian Journal of Agricultural Economics 55: 443-457.

6. Ellis F (2000) The Determinants of Rural Livelihood Diversification in Developing Countries. Journal of agricultural economics 51: 289-302.

7. Gilbert PJ (1991) Gender and Off-Farm Employment in Two Farming Systems: Responses to Farm Crisis in the Cornbelt and the Mississippi Delta. Canadian Journal of Agricultural Economics 593-610.

8. Janvry (2005) The Role of Non-Farm Incomes in Reducing Poverty and Inequality in China. Department of Agricultural and Resource Economics 1-29.

9. Agyeman B (2014) Determinants of Income Diversification of Farm Households in the Western Region of Ghana. Quarterly Journal of International Agriculture 53: 55-72.

10. Schwarze S (2005) Income diversification of rural households in Central Sulawesi, Indonesia. Quarterly Journal of International Agriculture 44: 61-74.

11. Démurger SM (2010) Rural households' decisions towards income diversification: Evidence from a township in northern China. China Economic Review 21: S32-S44.

12. Barrett CB (2001) Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications. Food policy 26: 315-331.

13. Lanjouw P, Shariff A (2002) Rural Nonfarm Employment in India: Access, Income, and Poverty Impact. Economic and Political Weekly 39: 4429-4446.

14. Irfan M, Arif GM (1999) The Structure of Informal Credit Market in Pakistan. Research report series, 168.

15. Adepoju AO, Obeyelu (2013) Livelihood diversification and welfare of rural households in Ondo State. Nigeria. Journal of Development and Agricultural Economics 5: 482-489.

16. Adler P, Kwon SW (1999) Social capital: the good, the bad, and the ugly. Working paper.

17. Alderman H, Paxson C (1994) Do the Poor Insure? A Synthesis of the Literature on Risk and Consumption in Developing Countries. Economics in a Changing World 48-78.

18. Barrett C, Reardon T, Webb P (2001) Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications. Food Policy 26: 315-331.

19. Becker GS (1965) A Theory of the Allocation of Time. The Economic Journal 75: 493-517.

20. Berdegue JA, Ramirez E, Reardon T, Escobar G (2001) Rural Nonfarm Employment and Incomes in Chile. World Development 29: 411-425.

21. Carletto G, Covarrubias K, Davis B, Krausova M, Stamoulis K, et al. (2007) Rural income generating activities in developing countries: re-assessing the evidence. Journal of Agricultural and Development Economics 4: 146-193.

22. Clay D, Byiringiro F, Kangasniemi J (1995) Promoting food security in Rwanda through sustainable agricultural productivity: Meeting the challenges of population pressure, land degradation, and poverty. Technical Paper No. 28.

23. Deininger K, Olinto P (2001) Rural nonfarm employment and income diversification in Colombia. World Development 29: 455-465.

24. Dercon S (2002) Income Risk, Coping Strategies, and Safety Nets. WPS/2000.26.

25. Ellis F (2004) Occupational Diversification in Developing Countries and the Implications for Agricultural Policy. Project No. WB0207.

26. Estudillo J, Quisumbing A, Otsuka K (2001) Income Distribution in Rice growing Villages during the Post-Green Revolution Periods: The Philippine Case, 1985 and 1998. Agricultural economics 25: 75-81.

27. Haye QM, Wizarat S (2011) Impact of financial liberalization on agricultural growth: a case study of Pakistan. China Agricultural Economic Review 3: 191-209.

28. Hossain M (2004) Rural Non-Farm Economy in Bangladesh: A View from Household Surveys. Center for Policy Dialogue (CPD).

29. Javed S, Nadeem A, Rafique M, Kamran M (2015) Determinants of Income Diversification among Rural Households of Pakistan. Journal of economics and sustainable development.

30. Liao C, Barrett C, Kassam KA (2014) Does Diversification Translate into Improved Livelihoods? Evidence from Pastoral Households in the Altay and Tianshan Mountains of Xinjiang, China.

31. Niehof A (2004) The significance of diversification for rural livelihood systems. Food policy 29: 321-333.

32. Poapongsakorn N (1994) The decline and recovery of Thai agriculture: causes, responses, prospects and challenges.

33. Reardon T (2000) Rural Non-Farm Employment and Incomes in Latin America: Overview and Policy Implications. World Development 29: 395-405.

34. Reardon T, Berdegue JB, Barrett C, Stamoulis K (2006) Household Income Diversification into Rural Nonfarm Activities.

35. Smith DR, Gordon A, Meadows K, Zwick K (2001) Livelihood diversification in Uganda: patterns and determinants of change across two rural districts. Food Policy 26: 421-435.

36. Taylor J, Yunez-Naude A (2000) The Returns from Schooling in a Diversified Rural Economy. American Journal of Agricultural Economics 82: 287-297.

37. Yunez-Naude A, Taylor E (2001) The Determinants of Non-Farm Activities and Incomes of Rural Households in Mexico, with Emphasis on Education. World Development 29: 561-572.

38. Zhao J, Barry JP (2014) Income Diversification of Rural Households in China. Canadian Journal of Agricultural Economics 62: 307-324.