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HOUSEHOLD- DECISIONS OF TIME ALLOCATION AND WAGE DETERMINATION IN PAKISTAN

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ABSTRACT

This study was conducted at the Institute of Agricultural and Resource Economics, University of Agriculture, Faisalabad, Pakistan during the year 2013-14. The underlying research investigated the labor supply decisions and jointly determined earnings of male and female members of household using cross-sectional data of 341 rural households of Punjab province. Data were collected from six districts of Punjab (Sahiwal, Lahore, Layyah, Muzaffargarh, Sialkot and Khushab). Heckman's two step method was used to correct selection bias for wage and labor supply equations. In first step, bivariate probit model was used to determine the probability of participation of male and female in non-farm work. The participation equation revealed that education, experience, adult household size and physical infrastructure tended to positively and significantly influence the probability of participation of both male and female in non-farm work. On the other hand, lack of access to physical assets such as land, livestock, non-labor income and the presence of children in household, decreased their participation in non-farm work. In the second step, wage and labor supply equations were estimated. Education, experience, infrastructure, distance to market, land appeared to be important determinants for wage and labor supply of both male and female. For instance, infrastructure development increased the earnings of male and female upto 25.9 and 13.9 percent respectively. The labor supply equation revealed that average weekly hours in non-farm work were around 30 and 5.42 for males and females, respectively. It was observed that men spent more time in non-farm activities than female. The study revealed that policy makers should emphasis to overcome the obstacles of participation in non-farm earning activities which were essential to improve the economic conditions of farm households.

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INTRODUCTION

The labor activities are key determinants in describing the welfare of rural households in developing countries. In rural labor force, women accounts about 43 percent of the agricultural labor force and is responsible to meet basic needs in developing countries. Alongside of family needs, they are also engaged in other productive tasks like agricultural work, livestock caring, processing, and marketing of agricultural products, handicrafts and other small scale non-farm work. Despite of wide spectrum of their duties, their access to productive resources is limited. The literature suggested that with the equal access of women to productive resources as men, they can raise farm productivity by 2.5 to 4 percent and can reduce hunger persons by 12 to 17 per cent (6). Hence, sustainable rural development depends upon the efforts of women labor force.

In the past few decades, agriculture was thought to be the most common way of earning in rural areas of developing countries. With the rapid increase in population coupled with inherent risks such as non-predictable weather conditions, economic as well as household shocks, the agriculture sector now has a lower growth potential. There is need to focus on the other sectors of rural economy. The

emergence and expansion of non-farm sectors can be proved valuable in creating employment opportunities, lessening poverty, stabling farm income, ensuring food security and increasing household welfare (1).

In rural areas of Pakistan, like other developing counties, poverty is widespread. Recent HDI indicates that rate of poverty is increasing day by day in Pakistan and the rate of rural poverty is much higher than urban poverty. For instance, people living below the poverty line in urban areas are 18 percent and ratio of the people living below the poverty line in rural areas is 46 percent (4).

Women are playing significant role in rural economy of Punjab, Pakistan but they are facing discrimination towards wages, social status and ownership of resources. For instance, 50 percent of rural women are working as farm and family labor while 93 percent of them do not own land and 75 percent do not receive payment for their labor work (5). Among agricultural work, 40 percent are involved in hoeing, weeding and picking of the vegetables like peas, garlic, onion and ladyfinger (26). Although the females are actively participating in agriculture and livestock activities but there are some limiting factors like, low literacy, social security, lack of information hinder their participation (25).

Several empirical studies have investigated the involvement and role of rural women in crop activities (20), meeting food requirement of family (15), participation in decision making in agriculture (7, 17), inequality in resource access (10, 22), and linkages between agrarian change and gender relations (9, 16).

To the best of our knowledge, there is no empirical study that has examined the gender based labor supply and wage determination of farm-households in Pakistan. The purpose of this study is to fill this gap and to make contribution to scarce empirical literature by investigating gender based labor supply and wage determination.

The objectives of the study were to identify the factors/determinants that influence the probability of participation of household males and females in non-farm work and to estimate the determinants of non-farm earnings and hours worked in case of men and women participating in income-oriented non-farm work.

MATERIALS AND METHODS

This study was conducted at the Institute of Agricultural and Resource Economices, University of Agriculture, Faisalabad Pakistan during the year 2013-14. Data for this study were collected through a cross sectional survey of rural households in Punjab province. Due to its largest rural society, Punjab province was selected for data collection. It has three broad agro-climatic zones named as lower, central and upper. Two districts from each zone were selected for survey i.e. Sahiwal, Lahore, Layyah, Muzaffargarh, Sialkot and Khushab. Information was collected from 341 households through stratified random sampling technique.

Using a structured questionnaire, detailed information about farm, non-farm, personal, village level, and locational aspects was collected. Data on agriculture sector comprised farm size, crop output, price of output, family and hired labor, capital assets, own consumption, sale of produce. Information on livestock activities included number of animals and poultry birds. Information about the time spent by labor on farm and non-farm activities was collected in detail. For both self-employed and wage workers, total non-farm hours worked were calculated by summing the monthly hours that males and females worked in non-farm sector. Almost 59 percent males and 9 percent females were working in non-farm sector. In case of wage employment, non-farm earning was calculated by dividing monthly income by total worked hours, while non-farm earnings for self-employment includes non-farm income from all sources minus the non-labor cost.

Estimation of earnings and labor supply equations require deleting some variables that are used in the participation equations to allow the identification of model and variables left out therefore, serve as identifying instruments. The instruments used in

earning functions are gender of household head, family type, number of children, number of adults, access to credit, non-labor income, presence of livestock, distance of village from city, and two interaction terms. The Wald test statistics for joint significance of these variables for male and female are 40.20 and 24.53 respectively which are significant at 1 and 2.5 percent level against a critical value of x^2 (11) = 24.72 and x^2 (11) = 21.92Since predicted male and female wages were used in the labor supply equations, identification also requires that there be at least one variable in the earnings function that does not appear in labor supply function. Variables like district dummies, multiplicative interaction terms, number of adults, family type and access to credit served as identifying instruments. The Wald test statistics for the joint significance of these variables are 20.88 and 12.20 for male and female labor supply functions which are significant against a critical value of $x^2(11) = 19.67$ and $x^2(11) = 10.34$. It shows that instruments do enter the first stage estimation and are therefore appropriate instruments (24).

To investigate the work decision of rural household, we start by specifying a simplified allocation model. Consider a household consists of two income earners-the head of household and his or her spouse, and household allocate its labor across three main activities: farm, non-farm, and leisure. Given this, the household utility function maximizes utility over consumption of goods *C* and leisure, *N*, i.e.;

U = U (C, N,; Z) i = 1, Male, i = 2 female …. (i)

Here U is the household utility function which is assumed to be strictly concave, possess continuous second partial derivatives (5). Z is the individual and household characteristics. Utility is maximized subject to time, budget, production, liquidity, and non-negativity constraints:

Household's time constraint is:

$$L_i = L_{iA} + L_{iNF} + N_i \text{ ……. (ii)}$$

Here L_i is the sum of household labor allocated to farm (L_{iA}), non-farm (L_{iNF}) and leisure (N_i). Household also faces non-negative, production function and budget constraints:

$$L_{iA} \geq 0 \quad L_{iNF} \geq 0 \text{ ….. (iii)}$$

$$Q = Q(L_{iA}, H_i, X; Z) \text{ ……. (iv)}$$

F $Y_{iA} + Y_{iNF} + Y_{iO} - P_X X = P_C C$ ……(v)n 5 can be written as:

$$P_C C = PQ(L_{iA}, H_i, X; Z) - P_X X - W_H H_i + WL_{iNF} + Y_{iO} \text{ ……. (vi)}$$

Here Q is the quantity of agricultural production, X represents vector of purchased inputs, Y_{iA}, Y_{iNF}, Y_O represents income from farm, non-farm and other sources respectively, P_x, P_c, P represents vector of prices of variable inputs, purchased goods, farm output, H_i represents amount of hired labor, W_H represents wage paid to hired labor, W represents non-farm wage.

The Lagrangian of the household's maximization problem is:

$$\int = U(C, N_i; Z) + \lambda(L - L_{iA} - L_{iNF} - N_i) + \varphi\begin{bmatrix} PQ(L_{iA}, H_i, X; Z) - P_X X \\ - W_H H_i + WL_{iNF} + Y_{i0} - P_C C \end{bmatrix} \text{……} \quad \text{(vii)}$$

Here λ is the Lagrangian multiplier associated with the inequality constraints on each type of labor participation, φ is the Lagrangian multiplier associated with income inequality constraint. The Lagrangian function ($\int$) is maximized with respect to $L_{iA}, L_{iNF}, H_i, X, \lambda, \varphi$ for maximizing the utility (U) across gender of household members as shown below:

$$\partial \int / \partial L_{iA} = -\lambda + \varphi p \frac{\partial Q}{\partial L_{iA}} = 0 \quad \text{(vii-a)}$$

$$\partial \int / \partial L_{iNF} = -\lambda + \varphi W = 0 \quad \text{(vii-b)}$$

$$\partial \int / \partial H_i = \varphi p \frac{\partial Q}{\partial H_i} - \varphi W_H = 0 \quad \text{(vii-c)}$$

$$\partial \int / \partial X = \varphi p \frac{\partial Q}{\partial X} - \varphi p_X = 0 \quad \text{(vii-d)}$$

$$\partial \int / \partial \lambda = L - L_{iA} - L_{iNF} - N_i = 0 \quad \text{(vii-e)}$$

$$\partial \int / \partial \varphi = PQ(L_{iA}, H_i, X; Z) - P_X X - W_H H_i - W L_{iNF} + Y_{i0} - P_C C = 0 \quad \text{... (vii-f)}$$

When household allocate their time to all three activities, equations vii-a, vii-c, and vii-d4 can be solved to obtain the structural demand functions for leisure, farm and non-farm labor.

$$N_i^* = N_i(w_i, Y; Z) \quad \text{(viii)}$$

$$L_{iA}^* = L_{iA}(w_i, Y; Z) \quad \text{(ix)}$$

$$L_{iNF}^* = L_{iNF}(w_i, Y; Z) \quad \text{(x)}$$

The reservation wages for non-farm work is the value of marginal product of non-farm labor when all is allocated to farm and leisure. It is obtained by equating non-farm hours equal to zero in equation (10)

$$w_i^* = w^*{}_i(w_i, Y; Z) \quad \text{(xi)}$$

It is assumed that participation decision of the individual is influence by a comparison between the reservation wage (w_i^*) and potential market wage (w_i^m) in the non-farm sector. Participation in non-farm activities $(L_i = 1)$ occurs if $(L_i = 0)$ and non-farm hours will be zero $(L_i = 0)$ if $w_i^m \le w_i^*$ .The reduced-forms of non-farm labor supply and wage functions are specified as:

$$L_{iNF}^* = \alpha X_i + \mu_i \quad \text{(xii)}$$

$$w_i = \beta X_i + \varepsilon_i \quad \text{(xiii)}$$

Here (X_i) is a vector of individual and household characteristics, (μ_i, ε_i) are error terms. Here Households are not randomly distributed; rather participation in non-farm activities may be dependent on the benefits from participation. Thus, selection bias occurs. The implication of this is that the use of standard regression techniques [ordinary least square (OLS)] to estimate the parameters of the equation would result in biased and inconsistent estimates. So in this study, Heckman two-step model was employed. The first step used the bivariate probit model to estimate the joint probabilities of participation for male and female. These estimates are then used to calculate inverse Mills ratio (λ) which is added to labor supply and wage equation to correct selection bias. The structural labor supply and wage functions are specified as:

$$L_{iNF}^* = \alpha X_i + \gamma\lambda + \mu_i \quad \text{(xiv)}$$

$$w_i = \beta X_i + \gamma\lambda + \varepsilon_i \quad \text{(xv)}$$

RESULTS AND DISCUSSION

The definitions and sample statistics of variables used in the analysis for males and females are given in Table 1. There are six endogenous variables: male and female participation in non-farm activities, non-farm earnings per hour and non-farm labor supply of male and female in a household. The endogenous variables include age, age-squared, headship, non-farm work experience, education, family caste and type, number of children, household size, access to credit and non-labor income.

Determinants of non-farm participation

The results of bivariate probit model showing the probability of participation of male and female members of rural households in non-farm work are given in Table 2. These estimates are important because of insights into the male's and female's joint non-farm work decisions and for constructing estimates of selection term for the wage and labor supply equations. Hence marginal effects of regressors on the probability of participation in non-farm work are evaluated at the sample mean and are also reported in Table 2 as marginal probabilities.

Table 1. Data definition and descriptive statistics

Variable	Description	Mean	St. Deviation
	Independent variables		
AgeHead	Age of the household head in years	48.47	11.54
HAgeSq/100	Square of head age/100	24.01	11.75
Head	I if Head of household is male,0 otherwise	0.74	0.44
HeadEdu	Level of education of household head	2.12	1.18
MF0cast	1 if upper caste, 0 otherwise	0.57	0.50
F0typ	1 if family is nuclear,0 otherwise	0.59	0.49
Tland	Total owned farming land in acres	16.91	49.27
Livstk	1 if household has livestock,0 otherwise	0.83	0.38
Ch0L05	No. of children under age of 5 years	1.01	1.41
Child14	No. of children between age 6-14 years	6.25	6.46
HHSizOver14	No. of household members above 14 years	4.99	2.76
NONLAB	Non-labor income in Rs	5.55	15.74
BorowMon	1 if household takes credit,0 otherwise	0.25	0.43
location1	1 if Lahore district, 0 otherwise	0.15	0.36
location2	1 if Sahiwal district, 0 otherwise	0.20	0.40
location3	1 if M.Garh district, 0 otherwise	0.30	0.46
location4	1 if Layyah district, 0 otherwise	0.02	0.13
location5	1 if Sialkot district, 0 otherwise	0.25	0.43
Dis0vill	Distance of village from city in km	18.05	12.69
Dis0Ou0M	Distance of output market in km	15.62	20.10
Fac0Mil	1 if village has factory/mill, 0 otherwise	0.36	0.48
	Dependent variables		
MNFpart	1 if male participate in nonfarm work	0.59	0.49
FNFParti	1 if female participate in nonfarm work	0.09	0.29
MearnperHr	Average males net nonfarm earning per hour	10.15	143.89
FearnperHr	Average females net nonfarm earning per hour	-66.74	68.81
AvHrsMale	Total No. of hours of males in nonfarm work	30.05	27.12

Table 2. Bivariate Probit estimates of the non-farm labor participation of males and females

Variable	Coefficient	Std. Err	Z	M probability	Coefficient	Std Err	Z	M. Probabi-lity
AgeHead	0.054*	0.027	1.96	0.003	0.076***	0.029	2.65	0.0001
HAgeSq/ 100	-0.044*	0.027	-1.63	-0.003	-0.062**	0.026	-2.41	-0.0001
Head	-0.831***	0.233	-3.56	0.168	-0.604*	0.346	-1.74	-0.0088
HeadEdu	0.626***	0.130	4.82	0.027	0.400**	0.170	2.36	0.0007
MF0cast	-0.290*	0.171	-1.69	-0.047	-0.806**	0.314	-2.57	
F0typ	-0.243	0.204	-1.19	-0.019	-0.326	0.312	-1.05	-0.0007
Tland	-0.035**	0.014	-2.44	-0.003	-0.084**	0.036	-2.38	-0.0001
Livstk	-0.591**	0.272	-2.17	-0.051	-0.096	0.389	-0.25	-0.0012
Ch0L05	0.027	0.067	0.40	-0.005	-0.264**	0.127	-2.07	-0.0002
Child14	-0.010	0.014	-0.76	-0.001	-0.023	0.026	-0.87	0.0000
HHSiz-Over14	0.070*	0.039	1.83	-0.006	0.173**	0.068	2.54	0.0002
NONLAB	-0.017***	0.006	-2.94	-0.001	-0.005	0.008	-0.60	0.0000
BorowMon	-0.169	0.195	-0.86	-0.005	-0.023	0.310	-0.08	-0.0001
location1	0.546	0.388	1.41	0.003	-0.612	0.732	-0.84	0.0001
location2	1.126***	0.389	2.89	0.055	-0.548	0.699	-0.78	0.0002
location3	0.787*	0.431	1.83	0.003	-0.450	0.718	-0.63	0.0001
location4	7.520	738454	0.00	0.996	-0.862	1.142	-0.75	0.0013
location5	0.655*	0.388	1.69	0.013	-0.452	0.681	-0.66	0.0000
Dis0vill	-0.034**	0.014	-2.46	0.001	-0.044*	0.025	-1.76	0.0000
Dis0Ou0M	-0.009*	0.005	-1.73	0.000	-0.016*	0.009	-1.78	0.0000
Fac0Mil	0.003	0.187	0.02	0.023	0.689**	0.301	2.29	0.0016
LandH-HSize	0.003**	0.001	2.07	0.000	0.004*	0.003	1.65	0.0000
LandEdu	0.005*	0.003	1.92	0.000	0.013*	0.007	1.88	0.0000
DistEdu	-0.010*	0.005	-2.10	0.001	-0.019*	0.011	-1.71	0.0000
_cons	-2.064**	1.003	-2.06		-3.447**	1.452	-2.37	
/athrho	-1.116**	0.478	-2.34		0.019	-2.052	-0.179	
Rho	-0.806	0.167						
Log likelihood ratio		-219.5806						
Wald $chi^2(48)$		132.12						

Correlation coefficient (rho) between the errors that maximized the bivariate probit likelihood function was -0.81 and significantly different from zero at one percent level. This result suggests that non-farm work participation decisions of male and female in a household are not statistically independent. Thus, inefficient estimates of parameter may be obtained if the equations are estimated separately. The log-likelihood ratio is -219.58 and significant at one percent level against a critical value of x^2 (24) = 42.98 (Table 2). This suggests that the independent variables taken together influence participation decisions and therefore the model implemented is reasonable.

The empirical results for the probability of non-farm participation are consistent with the previous studies. Age variable is positive and statistically significant for both male and females, which represents general experience that increases the marginal value of time in each activity. Number of years of schooling of household head significantly increases the participation decision since most of the activities in non-farm work require a certain level of education. Households without well-educated heads are consequently excluded from non-farm activities which mostly offer higher returns and less risk.

The coefficient of gender shows that probability of participation in non-farm activities for both male and female increases under the female headship. Headship exerts highest marginal effect (-0.167 for male and -0.009 for female) among the explanatory variables. Majority of household in Pakistan is headed by males, while female household heads are mostly caused by the death of the husband. Although Islamic and Pakistani state law entitled women to inherit property but inheritance practices emphasize on the male-headed family. Thus, the households headed by female are pushed towards non-farm employment to generate the household income. These results are in accordance with the study of Corral and Reardon (11).

The presence of young children (<5 years) in the household impede the probability of female work in non-farm sector. Caring for young children is compatible with non-farm in rural areas of Pakistan. Further, we found that males and females from the upper caste households work less in non-farm sector than the lower caste households which represents the inequal distribution of land ownership among rural people.

Males and females belonging to households endowed with valuable physical capital like farm land or livestock decreases the probability of participation in non-farm activities. Perhaps they often capitalize their valuable assets to smooth consumption in times of income shortfalls (1). Since endowment with valuable assets also represents the household's wealth, these findings also support the theory of decreasing risk aversion. Households endowed with valuable physical capital are less risk-averse and therefore less likely to participate in non-farm employment.

Non-labor income decreases the likelihood of participation in non-farm work for both males and females because of income effect resulting in increasing marginal value of consumption of leisure. Lack of credit served as a constraint to potential participation into non-farm economic activities which is also highlighted in the literature (12; 18).

The physical infrastructure like presence of factory, mill or small scale industry in a village increases the chances of households to participate more in non-farm activities. The coefficient for the presence of factory is significant in the case of female. This indicates that mobility of rural female is less than the rural male. These results are consistent with the study of Rosenzweig (19) in India.

Location characteristics like distance to market and distance to city from village represent access to and availability of employment opportunity. Participation in non-farm work increases if households are located closer to a cities or output markets due to less transportation cost. To further stress the impact of several entry barriers to non-farm employment, three interaction terms were included in the model. On one hand, the

educational level of male and female in years was multiplicated with the area of the farm land to examine the marginal impact of education and wealth on participation in non-farm work while acre of land was taken as proxy for the household's wealth. This interaction term had a significantly positive impact on the probability of participating of both male and female in non-farm activities. The second interaction term includes the household size and farm size. Households with the same wealth level but a higher amount of family members and households of equal size but with more area farm land, respectively, were more likely to participate in non-farm activities. The multiplicative interaction term for distance and education is negative and significant for both male and female non-farm participation, thus suggesting that there is less return to education for households living in remote areas perhaps due to the fact that there are more opportunities to work in nearby big towns.

Wage functions

Parameter estimates of non-farm wage equations of male and female are given in Table 3. For the estimation, robust standard terms were employed to test for potential heteroskedasticity that may be induced by the two stage estimation procedure. The inverse Mills ratio was also included to correct for possible bias. This was found to be significant for both male's and female's wage equations which shows that sample selection bias would have resulted if the wage equations had been estimated without taking into account the decision to participate in non-farm work.

The estimated determinants of wage shows that experience had positive and significant impact on wage rate for both male and female. It exhibited diminishing marginal effects on the wage rate, with maximum effect occurred at 34 years for males and at 22 years for females. As experience is an indicator of skills so with the passage of time, people gain experience, developing skill and chances of their earnings increase in non-farm sector. Males may also make larger investments in experience during their early work-life than females.

Education has significant and positive impact on wage of both male and female which indicates that investment in human capital in the form of education has more gross returns if the opportunity cost of time is not high. These findings are supported by many studies (5, 8, and 21). Additional year of schooling caused more impact on the wage of male as compared to female.

The coefficient of land (0.089) is insignificant in wage equation of male shows that land lord cannot use market power to get higher wages. In the case of female wage, the coefficient of land is negative and significant (-0.114). It indicates that labor in the same geographical labor market belongimg to different gender group faces discrimination in wages (Table 3).

Caste represents the wage discrimination among lower and upper caste groups. The coefficient was positive and significant for male (36.615) and insignificant for female (-4.565). It reported that upper caste males get more wages as compared to lower caste as contrast to females.

The coefficient of infrastructure factor such as road has positive and significant effect in both wage equations thus indicating that infrastructure development such as road increases the earning of male and female upto 22.9 and 14.8 percent, respectively. Well-developed roads and infrastructure tend to lessen transport and other input costs while increase the employment opportunities through increasing access to markets. This supports previous findings (2), that infrastructure has positive impact on employment.

District dummies represent local market conditions and impact of labor market on observed wages. The regional differences in wage rate of male and female show that labor is less mobile and there is division of labor market on regional basis.

The distance to market appears also to influence the wage rate of both male and female in a sample. This shows that individuals closer to output markets were likely to earn higher wages than those who live farther away. Multiplicative interaction term

between distance and education shows marginal impact of distance on gross return to education to be negative and significant for both male and female in a sample. The implication of this result is that returns to education in remote areas are less because of more non-farm opportunity in areas nearby cities.

Table 3. Non-farm wage functions for males and females

Variable	Male wage			Female wage		
	Coefficient	T	p>|t|	Coefficient	t	p>|t|
ExpMale	19.297***	6.41	0.000	25.635***	6.99	0.000
ExpMSq100	-63.258***	-5.31	0.000	-90.381***	-5.20	0.000
Education	26.925***	4.41	0.000	1.616**	1.68	0.0373
MF0cast	36.615**	2.75	0.006	-4.565	-0.71	0.477
Tland	0.089	0.56	0.575	-0.114**	-2.62	0.009
location1	-53.450	-1.26	0.207	11.343	1.01	0.313
location2	-136.770**	-3.10	0.002	-17.653	-1.64	0.102
location3	-143.268**	-3.32	0.001	-20.306*	-1.85	0.066
location4	-142.855**	-2.75	0.006	-51.496**	-2.67	0.008
location5	-93.961**	-2.21	0.028	2.129	-0.23	0.820
Dis0utMkt	-0.995*	-1.73	0.084	0.206*	-1.67	0.111
DistEdu	-0.517**	-2.20	0.029	-0.217**	-2.21	0.028
Road	25.847**	2.09	0.037	13.902**	2.00	0.046
Invmills	-37.291**	-2.20	0.028	-42.471***	-5.23	0.000
_cons	-6.678	-0.13	0.898	-40.169**	-2.87	0.004
R2	0.3130			0.4578		

Labor supply functions

The results of gender based non-farm labor supply of farm households are given in Table 4. Average number of hours per week worked in non-farm activities represents the male and female labor supply variables. The average weekly hours in non-farm work are 30.04 and 5.42 for males for females respectively, suggesting that men spent more time in non-farm activities than females.

As non-farm wages are calculated by dividing earnings by time worked, so any mistake in time worked depends upon wage rate estimation. Hence, the estimated elasticity of labor supply with respect to wages will be biased toward minus one if we use observed wages (21). Thus, predicted wages are employed in the labor supply equations (19, 23). In labor supply functions, the predicted wage rate is used that was calculated by deleting the district dummies, DisEdu (interaction term) from the wage equation. The Wald statistics for the joint significance of these variables is 14.41 for male and 3.47 for female. The inverse mills ratios were positive and significant for both male and female. Consistent with Abdulai's findings (2) and in contrast with Rosenzweig's findings (19), own own wage effects were positive and significant for both male and female, showing substitution effects are greater than income effects due to higher wages. This leads to increase the non-farm labor supply, an upward sloping labor supply that is closely related to utility maximization hypothesis.

Cross male wage effect is negative and significant on the market labor supply, showing any change in the male wage has significant impact on female work. This is probably due to the fact that with the increase income of male, female spend more time in non-earning activities like parties, death, and other social events. This also indicates that there is substitutability of leisure activities between male and female. The cross female wage effect was positive but non-significant for male labor supply, indicating that female's non-farm income does not reduce the labor supply of male.

Looking at the role of caste, the households belonging to lower castes are more likely to send members to perform non-farm work. This result is consistent with earlier findings (13, 14) for India. We also found that non-labor income has a negative effect on non-farm labor supply, indicating that leisure of the households is a normal good.

Table 4. Labor supply equations of males and females

	Male				Female			
	Coeffici-ents	Robust Std. Error	t	p>|t|	Coefficients	Robust Std. Error	t	p>|t|
PwagM	0.307***	0.028	10.88	0.000	-0.026**	0.013	-2.01	0.045
PwagF	0.014	0.030	0.45	0.651	0.213***	0.023	9.34	0.000
AgeHead	0.575*	0.309	1.85	0.074	0.411*	0.211	1.95	0.052
HAge-Sq100	-0.516*	0.309	-1.67	0.096	-0.369*	0.204	-1.81	0.071
Head	-14.152***	4.115	-3.44	0.001	-9.902***	2.814	-3.52	0.000
AvEdMale	5.295***	1.194	4.43	0.000	1.299*	0.745	1.74	0.086
AvEdFemale	0.475***	0.206	2.31	0.022	0.151*	0.086	1.76	0.087
MF0cast	-11.149***	2.526	-4.41	0.000	-1.445	1.405	-1.03	0.304
TLand	-0.034*	0.019	-1.77	0.087	-0.021*	0.010	-1.96	0.050
Livstk	-1.621	3.245	-0.50	0.618	-0.633	1.871	-0.34	0.735
Ch0L05	-1.242	1.021	-1.22	0.225	-0.945*	0.442	-2.14	0.033
Child14	-0.198	0.195	-1.02	0.310	.094	0.108	0.87	0.385
HHSizver14	0.974*	0.556	1.75	0.081	0.592**	0.279	2.12	0.035
NONLAB	-0.099*	0.058	-1.73	0.085	-0.072**	0.036	-2.01	0.046
Dis0Ou0M	-0.090**	0.043	-2.09	0.037	-0.050**	0.021	-2.34	0.020
Fac0Mil	7.784**	2.941	2.65	0.009	2.703*	1.434	1.88	0.060
Invmills	8.089**	3.347	2.42	0.016	6.003**	1.851	3.24	0.001
_cons	59.126***	8.478	6.97	0.000	-5.219	5.572	-0.94	0.350
Wu-Hausman	14.41				3.47			
X^2 statistics for over identification	0.57				0.62			

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Looking at the role of caste, the households belonging to lower castes are more likely to send members to perform non-farm work. This result is consistent with earlier findings (13, 14) for India. We also found that non-labor income has a negative effect on non-farm labor supply, indicating that leisure of the households is a normal good.

Farm size decreases the non-farm labor supply of both male and female members of the sample households. This may be due to income and substitution effects. This variable increases agricultural output and hence the marginal value of farm labor. When the value of farm labor increases, households substitute farm work for non-farm work (substitution effect). When agricultural income increases, due to increment in farm size, the household demand for leisure time increases (income effect) and hence the supply of non-farm labor decreases.

The effect of distance to nearest output market also serves as a variable measuring both local market conditions and transaction costs involved in searching for employment. The negative coefficient in both equations supports the view that there are higher costs of labor force participation for households living in more remote areas.

The own-and cross-person effects of education are positive and significant. This is an indication that education was found to be better positioned to mobilize capital through non-farm work participation. The significant positive own education effects confirmed to the findings Abduali and Delgado (5) and contrast to Skoufias (23).

Household composition and characteristics show some influence on the non-farm labor supply. Family size and number of dependents have impact on non-farm labor supply of both male and female. Additional young children (age less than 5 years) tend to reduce non-farm hours both in the case of male and female but the effect is statistically weak in the case of male. Households with more members would be able to undertake variety of non-farm work in addition to rural agriculture. Household size has positive and significant effect on the labor supply of both male and female. The coefficient of age, representing the experience and life cycle effects, is positive and significant, suggesting that higher experience tends to increase the market labor supply of household, although at decreasing rate.

CONCLUSION

Bivariate probit estimates showed that education increased the probability of engaging in non-farm activities, suggesting that investment in human capital was crucial for improving the welfare of the household. Caste played a significant role in overthrowing the autonomy of female. Socially backward castes had higher constraints to enter in non-farm sector in the sense they faced higher transaction costs. Non-labor income and physical assets spurred to increase the probability of participation in non-farm work. The proximity of physical infrastructure, like factory or small-scale industry in village could enable households to get engaged in high returning activities. Lack of credit access served as a constraint to non-farm participation.

The estimated determinants of wage function showed that education and experience had a positive and significant impact on wage rate for both male and female. It indicated that investment in human capital had more gross returns if the opportunity of cost of time was not high. Infrastructure development increased the earnings of male and female upto 25.9 and 13.9 percent, respectively which suggested that well developed infrastructure had a crucial role to create high return employment opportunities by reducing transport and other costs and expanding earnings opportunities. Proximity of market tended to influence the wage rate of both male and female.

Results of non-farm labor supply for male and female of farm households showed that higher own-wages led to increase labor supply to non-farm employment. Cross male wage decreased the labor supply of female due to the reallocation of time from non-farm to non- income generating personal matters while the cross-wage effect for female was positive, but not significant. It indicates that males did not reduce their labor supply even when females earned more from non-farm activities.

Both, own- and cross-person effects of education were positive and significant indicating that literacy served as an entry barrier into high return non-farm work. Household composition and characteristics were important to explain the non-farm labor supply. Presence of young children reduced non-farm labor, especially in case of female showing that non-farm work and child care were competing activities in rural areas of Pakistan. Households with more members would be able to undertake variety of non-farm work in addition to rural agriculture.

The findings suggest that policy makers should target the poor rural people to improve the access to non-farm opportunities which is critical to improve welfare and reduce poverty. They should concentrate to overcome existing social and economic barriers to get education and easy access to credit. Particularly, in rural areas where farm households find it difficult to obtain credit, improving non-farm work opportunities could provide a substitute for credit as a mechanism to facilitate investment in productive work.

REFERENCES

1. Abdulai, A. and A. CroleRees. 2001. Determinants of income diversification among rural households in Southern Mali. Food Policy. 26:437–452.
2. Abdulai, A. and C. L. Delgado. 1999. Determinants of time spent in non-farm

employment by farmers in Northern Ghana, Ameri. J. Agri. Eco. 81 (1999):117–130.
3. Abdulai, A. and P. P. Regmi. 2000. Estimating labor supply of farm households under non-separability: Empirical evidence from Nepal, Ameri. J. Agri. Eco. 22:309–320.
4. Anon. 2016. Economic Survey of Pakistan. Government of Pakistan, Finance Division, Economic Advisory Wing, Islamabad.
5. Anon. 2009. Women in Agriculture in Pakistan. Food and Agriculture Organization. United Nations.
6. Anon. 2014. Women's Key Role in Agricultural Production Emphasized. United Nations (UN).
7. Atta, N. 2000. Involvement of Rural Females in Decision Making Process in Faisalabad, M.Sc. Rural Sociology Thesis, University of Agriculture, Faisalabad, Pakistan.
8. Behrman, J. R. and B. L. Wolf. 1984. Labor force participation and earnings determinants for women in the special conditions of developing countries. J. Dev. Eco. 15(1-3):259–288.
9. Carney, J. 1992. Peasant women and economic transformation in the Gambia. Development and Change. 23 (2):67–90.
10. Chaudhry, I. S. and S. Rahman. 2009. The impact of gender inequality in education on rural poverty in Pakistan: An empirical analysis, Eur. J. Eco. Fina. Admi. Sci. 15:174–188.
11. Corral, L. and T. Reardon. 2001. Rural non-farm incomes in Nicaragua. World Dev. 29 (3):427–442.
12. Ellis, F. 1998. Household strategies and rural livelihood diversification. J. Dev. Stu. 35 (1):1–38.
13. Ito, T. 2009. Caste discrimination and transaction costs in the labor market: Evidence from rural North India, J. Dev. Eco. 88:292–300.
14. Ito, T. and T. Kurosaki. 2009. Weather risk, wages in kind, and the off-farm labor supply of agricultural households in a developing country, Ameri. J. Agri. Eco. 91(3):697–710.
15. Jamali, K. 2009. The role of rural women in agriculture and it's allied fields: A case study of Pakistan, Eur. J. Soc. Sci. 7(3):71–77..
16. Kabeer, N. and T. V. A. Tran. 2000. Leaving the rice fields but not the countryside: Gender livelihood diversification and pro-poor growth in rural Vietnam. United Nations Research Institute for Social Development (UNRISD), Geneva, Switzerland. Occasional Paper 13:01-52.
17. Rasheed, S. 2004. Women Participation in Decision Making Process Regarding Agricultural Business and Family Matters: A Case Study in Tehsil Gojra, M.Sc Rural Sociology Thesis, University of Agriculture, Faisalabad, Pakistan.
18. Reardon, T. 1997. Using evidence of household income diversification to inform study of the rural nonfarm labor market in Africa. World Dev. 25(5):735–747.
19. Rosenzweig, M. R. 1980. Neoclassical theory and the optimizing peasant: An econometric analysis of market family labor supply in a developing country. Quarterly J. Eco. 94(1):31–55.
20. Saghir, A., M. Zakaria, Y. Hassan and A. Javed. 2005. Gender participation in crop production activities. J. Agri. Soc. Sci. 42(1):343-345.
21. Sahn, D. E. and H. Alderman. 1988. The effects of human capital on wages and the determinants of labor supply in a developing country. J. Dev. Eco. 29(2):157–183.
22. Sen, A. 2001. Improving Gender Equality in Pakistan: Small Steps to Date, Large Strides Ahead. The New Republic.
23. Skoufias, E. 1994. Using shadow wages to estimate labor supply of agriculture households. Amer. J. Agri. Eco. 76(2):215–227.
24. Staiger, D. and J. H. Stock. 1997. Instrumental variables regression with weak instruments. Econometrica. 65(3):557–586.

25. Munawar, M., U. Safdar, M. Luqman, T. M. Butt, M. Z. Y Hassan and M. F. Khalid. 2013. Factors inhibiting the participation of rural women in livestock production activities. J. Agric. Res., 51(2):213-220.

26. Taj, S., M. K. Aujla, M. Sharif and Z. Yasmin. 2009. Gender dimensions of labour participation in vegetables farming system in district Attock of Punjab, Pakistan. J. Agric. Res., 47(1):91-100

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Aqeela Saghir	**Helped in conducting survey**