PERSONAL EARNINGS IN PAKISTAN: ROLE OF INFORMATION COMMUNICATION TECHNOLOGY (ICT) AND LIVELIHOOD DIVERSIFICATION

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ABSTRACT

The determination of factors explaining personal earnings has remained a matter of great interest among economists. This study explores important socioeconomic and demographic factors affecting personal earnings in Pakistan with a special focus on the contribution of ICT usage and livelihood diversification. Ordinary Least Squares (OLS) regression models have been estimated using the most recent available PSLM (2019-20) data published by the Pakistan Bureau of Statistics (PBS). After careful screening, the data has been restricted to only those individuals who earn either through farm, non-farm, or diversified livelihoods. The results suggest that the use of ICTs has a significant contribution to the earnings in Pakistan. Similarly, livelihood diversification i.e., participating in both farm and non-farm employment activities can greatly improve personal earnings. The non-farm sector also remarkably supports the agriculture-based Pakistan's economy. Especially, the small landholders have to inevitably search for additional livelihood sources as risk coping strategy. Education is found one of the most important determinants of personal earnings. It is suggested that measures should be taken to improve access to ICTs and internet facilities at the national level with a special focus on the most backward areas. Moreover, the government may acknowledge and support the livelihood diversification strategies as a component of the national objective for job creation. Stringent efforts are recommended to ensure the provision of free and quality education for all with equal opportunities.

INTRODUCTION

The assessment of personal earnings has remained a subject of great interest among economists. The most popular model to derive the earnings function was discovered by Jacob Mincer in 1974, who postulated that individuals' earnings depend upon their education and experience levels. Mincer (1974) probed the determinants of earnings distributed across the population and developed a seminal tool to estimate the earnings function called after his name Mincer Earnings Function. The Mincer model has been examined on many datasets by economists with its different modified forms (Gounder and Xing, 2012; Heckman et al., 2003; Lemieux, 2006; Nasir and Nazli, 2010). While referring to the data, typically the log of income is regressed with the years of education and a quadratic form of age or experience (Becker, 1962; Mincer, 1974).

A wide range of literature exists worldwide on the estimation of earnings functions for households and individuals. In Pakistan also, many researchers have attempted to determine the factors affecting earning levels using various datasets such as Pakistan Integrated Household Survey (PIHS), Pakistan Social and Living Standards Measurement (PSLM) survey, Multiple Indicator Cluster Surveys (MICS) and other surveys (Ahmad et al., 1991; Ashraf and Ashraf, 1996; Awan et al., 2011a; Awan and Hussain, 2007; Awan et al., 2011b; Guisinger et al., 1984; Nasir and Nazli, 2010; Shabbir, 1994).

Guisinger et al. (1984) analyzed the data collected from thousands of households in the Rawalpindi district and found that the rate of return to schooling is low especially in case of urban areas of Pakistan due to unstructured wage contracts and skills orientation. Nasir and Nazli (2010) explore the PIHS (1995-96) data and observe large and significant effects of education, technical training, school quality, literacy, and numeracy skills on the earnings of wage earners and salaried persons in Pakistan. Polachek (2008) comprehensively discusses earnings function and its applications, explaining why earnings are enhanced by schooling; why earnings increase at a diminishing rate with the passage of time (age); why females earn less than males (gender gap); why blacks earn less than whites (ethnics); why occupational or professional distribution are affected by gender; why job and geographic mobility dominate amongst young individuals.

Based on the data collected from 200 students, Faridi et al. (2010) conclude that higher education significantly improves the earning potential of individuals. Sarwar and Sial (2012) study the impact of education on earnings distribution using the quantile regression method and find that education produces varying impacts on earnings for different income slabs. Gounder and Xing (2012) study the role of education and health in poverty alleviation in Fiji island

and find that households' income increases with better education, thereby yielding additional positive health outcomes. Shaheen et al. (2012) used the MICS (2007-08) dataset to determine socioeconomic and human capital factors affecting the households' earnings in Sargodha district, and conclude that education, age and gender played important role in the determining the level of personal income.

This study puts emphasis on highlighting the role of ICTs and livelihood diversification in improving personal earnings. The use of ICTs has greatly increased during the ongoing century in most parts of the world. In the existing modern era, ICT development plays a pivotal role in the economic growth and technological advancement of any country (Ghosh, 2017; Hussain et al., 2021; Kallal et al., 2021; Niebel, 2018; Palvia et al., 2018). ICTs enable the community to access the competitive labour and goods markets and to enhance their exposure to high-remunerating earning activities which improves their personal income levels (Pénard et al., 2012; Pradhan et al., 2021; Pradhan et al., 2013; Saba et al., 2023; Sawng et al., 2021). Livelihood diversification into farm and non-farm employment activities is also an important determinant of personal earnings. Supplementing the agricultural sector, the non-farm sector greatly contributes to the households' welfare, especially in rural areas of developing economies including Pakistan (Habib et al., 2023b; Malik, 2008; Mellor and Malik, 2017). Livelihood diversification leads to the societies' well-being in terms of enhancement in income levels, reduction in poverty, improvement in food security, development of stronger social networks, and mitigation of risks, etc., (Habib et al., 2023a; Kassegn and Endris, 2021; Mulia et al., 2021; Salam et al., 2019).

The study shall be a valuable contribution to the existing literature on evaluating the nexus of ICT development and livelihood diversification to personal earnings in Pakistan. Objectives of the study are: 1) to overview the socioeconomic and demographic profile of Pakistani individuals, 2) to empirically evaluate the role of ICTs and livelihood diversification in determining personal earnings, and 3) to suggest some policy measures for improvement of personal earnings. The next section describes the data and methodology, followed by the results and discussion section and finally, the last section concludes the paper.

METHODOLOGY

Data

The study uses the Pakistan Social and Living Standard Measurement PSLM (2019-20) dataset which contains comprehensive information on 195000 numbers of sample households' demographic and socioeconomic characteristics as well as their living-standard indicators. The data was carefully examined, cleaned, and filtered as per requirement. After validation and screening of the data, a sample of 92603 households with 117091 individuals was extracted for final estimations. Instead of summarizing the data at the household level, the study uses individual-level data in order to have deeper insights into livelihood patterns and resultant earnings. The individuals not earning any amount of income were discarded from the dataset, which resulted in the final sample of individuals with age of 10 years and above. It also significantly curtailed the number of female individuals from the sample because they are mostly non-earners and perform at their homes as house-ladies. Data were analyzed using STATA v. 14 and R-Software v4.3.3 (Team, 2024). The data was restricted to only earning individuals with age of 10 years and above.

Methods

In literature, numerous studies estimated different earnings functions through various regression techniques. Following the literature (Awan and Hussain, 2007; Awan et al., 2011a; Awan et al., 2011b; Becker, 1962; Faridi et al., 2010; Khan et al., 1985; Nasir and Nazli, 2010; Sarwar and Sial, 2012; Shabbir and Khan, 1991; Shaheen et al., 2012), this study uses OLS regression method to estimate the personal earnings models.

The general form of the regression model is:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots \ldots \ldots + \beta_n X_{ni} + \in_i \qquad (1)$$

Where, Y_i denotes annual income in natural log form or in thousand PKR for ith individual. X_{ni} is the ith observation of nth explanatory variable, β_0 is the intercept term, β_n is the coefficient of nth explanatory variable and $\in_i$ is the error term. Variables used in the models are described in Table 1.

Table 1. Description of variables used in empirical analysis.

Variables	Description
Income	= Annual income in '000' PKR or in natural log form
D_Info Tech	= 1 if used desktop/laptop/tablet during last 3 months, 0 otherwise
D_Mobile phone	= 1 if the individual holds a smart/mobile phone, 0 otherwise
D_Internet use	= 1 if used internet during last 3 months, 0 otherwise
D_Agri	= 1 if the individual earns only from agriculture, 0 otherwise
D_Nonfarm	= 1 if earns only from non-farm source, 0 otherwise
D_Diversified	= 1 if earns from both farm & non-farm sources, 0 otherwise
Land owned	= Land owned by individual's household in acres
Small landholder	= [0 < Landholding ≤ 5]
Medium landholder	= [5 < Landholding ≤ 20]
Large landholder	= [Landholding >20]
Education	= Highest number of schooling years
Education (Primary)	= Zero to five years of schooling
Education (Secondary)	= Six to ten years of schooling
Education (Graduate)	= Eleven to fourteen years of schooling
Education (> Graduate)	= Above fourteen years of schooling
Gender	= 1 for Male and, 0 otherwise
Age	= Age of individual in years

RESULTS AND DISCUSSION
Descriptive Statistics
Table 2 summarizes the socioeconomic and other characteristics of individuals with age ten years or above. The results indicate that average values of age and schooling are 35.7 and 9.2 years, respectively. The average annual income is Rs. 345.83 thousand with significant differences among farm, non-farm, and mixed employment types. It is obvious that those who have diverse patterns of livelihoods earn the highest average income followed by farmers and then non-farmers. According to the ANOVA results, age, income, education, and size of land ownership are distributed among three livelihood categories with significant differences as indicated by F-statistics. The younger individuals were mostly employed in non-farm work whereas, the older ones were mostly agriculturists. Similarly, the highest average education (9.40) is also attributed to the non-farm category of employment, followed by diversified and farm livelihoods. More than 70% of individuals possess a maximum of ten schooling years, whereas only about 7% are equipped with education above the graduation level.

In rural areas, about 76% of our sample individuals are non-farm earners whereas, in urban areas, the proportion is 97%. Furthermore, about 6% of rural people have diversified their livelihoods into farm and non-farm activities as compared to 0.5% of urban residents. Most of the individuals are landless (>75%),

followed by smallholders (15.7%) and medium holders (7%). The large farmers possessing more than 20 acres of land are only 1.8% in proportion. Most of the smallholders (56.3%) are involved in non-farm employment which proves the importance of a non-farm economy for smallholders (Mellor and Malik, 2017).

It is pertinent to explain that individuals with non-farm livelihoods also own an average land of 1.32 acres, which is apparently confusing but not incorrect. Actually, in PSLM data, the landholding information is recorded at the household level instead of the individual level. All the members of households can be owners of land, but they all may not necessarily be involved in agricultural employment. Land ownership is not solely attributed to an individual, and rather it is the land of a household to which a particular individual belongs. Similarly, some landless individuals (4.4%) are involved in farm work by renting in the agricultural land.

The descriptive analysis shows that Information Communication Technology devices (ICTs) are mostly used by individuals involved in non-farm activities. Mobile or smartphones are held by more than 90% of individuals. About 94% of the individuals are males in our valid sample out of which 83.8% are involved in non-farm livelihoods. On the other hand, females are 6%, but the majority of them are involved in non-farm work. The figures of socioeconomic characteristics are in line with the literature (Faridi et al., 2010; Nasir and Nazli, 2010; Shaheen et al., 2012).

Table 2. Socioeconomic and demographic profile of the sample individuals grouped by livelihood category.

Characteristic (Average)	Overall Mean or percentage (N=117091)	Farm livelihood (N=13867)	Non-Farm livelihood (N=98758)	Diversified livelihood (N=4466)	F-Statistic
Annual income ('000' PKR)	345.83	354.84	342.52	391.07	15.70***
Age (years)	35.69	41.58	34.68	39.60	2246.85***
Region	-	-	-	-	-
Rural (%)	39.08	17.91	76.16	5.93	-
Urban (%)	60.92	2.38	97.1	0.52	-
Gender	-	-	-	-	-
Males (%)	93.88	12.15	83.82	4.02	-
Females (%)	6.12	7.07	92.30	0.63	-
Education (years)	9.20	8.06	9.40	8.24	931.92***
Up to Primary (%)	23.70	16.20	78.62	5.17	-
Prim. to Secondary (%)	49.13	12.77	83.30	3.93	-
Sec. to Graduation (%)	19.77	7.74	89.86	2.40	-
Above graduation (%)	7.06	2.54	95.06	2.40	-
Landholding (acres) by HH	2.05	6.43	1.32	4.55	2481.04**
Landless (or only rented-in) (%)	75.49	4.40	94.12	1.49	-
Small land holder (%)	15.73	31.52	56.32	12.16	-
Medium land holder (%)	6.95	40.73	49.84	9.43	-
Large land holder (%)	1.83	40.07	53.15	6.77	-
Use of ICT	-	-	-	-	-
D_Info Tech	13.52	3.15	94.77	2.08	-
D_Mobile phone	91.41	11.41	84.66	3.93	-
D_Internet use	35.85	5.83	91.86	2.31	-
Province	-	-	-	-	-
KPK	17.42	7.25	86.98	5.77	-
Punjab	54.33	13.73	82.31	3.96	-
Sindh	20.67	10.28	87.22	2.50	-
Baluchistan	7.58	13.16	84.98	1.86	-

Source: Author's Own Calculations using PSLM (2019-20) survey data.

Livelihood Patterns of Sample Individuals

Figure 1 illustrates the livelihood patterns of earning individuals across Pakistan. About 12% of individuals are purely farmers, 84% are non-farm earners and 4% have diversified employment i.e., a mix of farming and non-farm work or business. The analysis has excluded the unearned incomes received from other sources e.g., pensions, government transfers, and remittances as our focus is on individuals' employment and the resultant earnings.
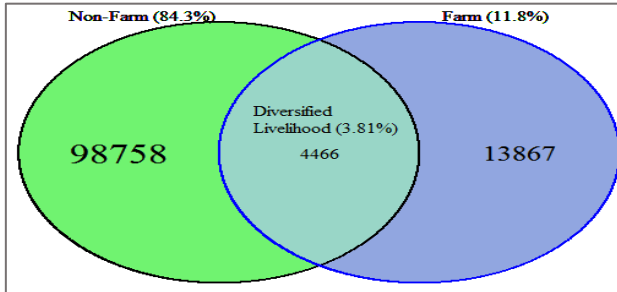

Figure 1. Livelihood patterns of sample individuals.

Estimating the Effect of ICTs and Livelihood Diversification on Personal Earnings

The regression results of four different econometric models are presented in Table 3. The first two are estimated through simple linear OLS models, whereas, the last two are the results of log-linear models. The natural logarithm of income is incorporated on the left side of the equation following the literature e.g., (Hartog and Gerritsen, 2016; Heckman et al., 2003; Mincer, 1974). The second and fourth models involve the breakdown of landholding size and education in sub-categories.

The results suggest that all the explanatory terms hold significant statistical associations with the personnel earnings of individuals. People using ICT devices e.g., laptops, computers, and tablets significantly earn more than those who do not use such gadgets. Similarly, individuals with possession of smartphones and using internet services are also characterized by greater levels of annual earnings as compared to their counterparts who do not have access to such facilities. In comparison to the possession of mobile phones, the use of IT devices (computers and laptops, etc.) and internet services have a greater effect on annual earnings as depicted from linear OLS models. The likely reason is that variation with respect to the first indicator (mobile phone) is smaller among the sample individuals, as compared to the other two indicators of ICT. As depicted from previous Table 1, only a small proportion of people (8.6%) do not possess a mobile phone, whereas large proportions of individuals are deprived of other IT devices (86.5%) and internet facilities (64.2%). The use of ICTs has greatly increased during the ongoing century in most parts of the world. ICT development has been proved very effective for economic growth which is characterized by improved per capita income and GDP (Aker and Mbiti, 2010; Ghosh, 2017; Hussain et al., 2021; Kallal et al., 2021; Niebel, 2018; Palvia et al., 2018; Pénard et al., 2012; Pradhan et al., 2021; Pradhan et al., 2013; Saba et al., 2023; Sawng et al., 2021).

Farm and non-farm sectors are very important parts of the economy. As noted earlier, most of the sample individuals (84.3%) are associated with non-farm work or entrepreneurs followed by 11.8% farmers and 3.8% with diversified livelihoods. The regression results in Model 1 and Model 2 reveal that the individuals with diversified livelihoods (i.e., a mix of farm and non-farm employment) earn roughly Rs. 45 thousand more than their farming counterparts. However, these two models suggest that non-farm earners receive not very different amounts than the farmers. Here,

the log-linear models show a significant contribution of non-farm employment to personal earnings as compared to farming. It signifies the non-farm sector's contribution to the agriculture-based Pakistan's economy especially for rural areas which is consistent with the previous literature (Habib et al., 2023b; Malik, 2008). Even within rural areas, about 76% of our sample individuals are non-farm earners and this proportion is 97% in urban areas.

Furthermore, a greater proportion of rural people have diversified their livelihoods into farm and non-farm activities as compared to urban people. Livelihood diversification enables the rural community to expand their income sources beyond farm activities to fortify economic resilience, increase household income, reduce poverty, foster skills development, and improve food security (Habib et al., 2023a; Kassegn and Endris, 2021). It also strengthens social cohesion, mitigates risks, improves market access, and leverages local resources with more inclusive and sustainable development outcomes (Mulia et al., 2021; Salam et al., 2019).

The large landholding leads to greater earnings as depicted by all the models. Small landholders are at great disadvantage with no or least opportunities for risk management. The second and fourth models suggest that individuals with a land area of less than 5 acres earn significantly less income as compared to the reference category of non-farmers (landless class). However, the medium and large farmers earn more than the landless non-farm earners.

Education has shown a significant positive relationship with annual earnings as also proved by a large body of literature including the famous Jacob Mincer's model of earnings (1974). Being an integral component of human capital, education significantly enhances the earning potential of people thereby providing them large exposure to the competitive labour market. According to the results of Model 2, the individuals educated up to secondary, graduation and above graduation level earn more than zero-to-primary passed ones by amounts Rs. 36, Rs. 129, and Rs. 308 thousand, respectively per annum.

Education and skills are important factors in human capital formation leading to improved efficiency and productivity. The increased income and productivity are the potential outcomes of the improved education levels (Gounder and Xing, 2012). Economists consider education as an input in the production process as well as the consumer and capital goods (Faridi et al., 2010). Training and the education are main sources of human capital accumulation (Becker, 1962; Mincer, 1974).

The results further suggest that males earn about Rs. 147 thousand annually more than their female counterparts on average which depicts a significant gender gap in terms of annual earnings. Age factor is also very important which suggests a quadratic association with the annual personal earnings which is largely supported by the literature. For example, Akay and Uyar (2017) explained that workers above 40 years of age are less preferred due to their diminishing productivity; therefore, they are hired at lower wages. However, this phenomenon is true for private workers and not for public employees.

The provincial level breakdown in all the models shows that the residents of KPK (taken as a reference category) are significantly earning less as compared to other provinces. However, the comparison with Baluchistan may not be regarded as free of uncertainty because only a small proportion (7.6%) of the sample individuals belongs to Baluchistan province which may not be an excellent representative of the whole provincial population. The results of all the models are almost consistent and in compliance with the literature e.g., Nasir and Nazli (2010), Faridi et al. (2010), and Gounder and Xing (2012).

Table 3. Results of estimated earning models for sample individuals.

Variables	(Income '000' PKR)		(Natural log of Income)	
	Model –I	Model –II	Model –III	Model –IV
Use of ICT				
D_Mobile phone	22.083***	29.106***	0.33***	0.344***
D_Info Tech	144.826***	77.848***	0.193***	0.126***
D_Internet use	118.385***	126.047***	0.275***	0.292***
Employment Type				
Ref. (Farm only)				
D_Nonfarm	2.299	1.418	0.156***	0.175***
D_Diversified	44.664***	45.553***	0.23***	0.236***
Land owned by HH	4.303***	-	0.006***	-
Ref. (zero land holding)				
Small land holder	-	-16.747***	-	-0.025***
Medium land holder	-	71.189***	-	0.188***
Large land holder	-	228.391***	-	0.319***
Education	19.016***	-	0.052***	-
Ref. (upto primary)				
Secondary	-	36.383***	-	0.158***
Graduation	-	128.664***	-	0.374***
Above graduation	-	308.024***	-	0.678***
Province				
Ref. (KPK)				
Punjab	59.44***	59.721***	0.135***	0.136***
Sindh	33.446***	32.499***	0.085***	0.096***
Baluchistan	54.204***	50.076***	0.178***	0.18***
Control variables				
Gender (1=Male)	139.539***	147.06***	0.642***	0.644***
Age	12.365***	13.005***	0.065***	0.067***
Age_sq	-0.060***	-0.067***	-0.001***	-0.001***
Constant	-453.428***	-362.073***	9.119***	9.318***
Observations (No.)	117091	117091	117091	117091
Adjusted R²	0.090	0.090	0.330	0.328
F-Statistic	606.54***	480.28***	3582.46***	2721.22***

Note: Robust estimates of coefficients are given in the above table. Significance Codes: '***' = 0.01 '**' = 0.05 '*' = 0.1.

CONCLUSIONS AND RECOMMENDATIONS

The assessment of earnings has remained an area of great interest among economists. The study aims to estimate the earnings function in Pakistan for the year 2019-20 using PSLM data with a special focus on the use of ICTs and livelihood diversification. OLS regression technique has been used to estimate four different earning models at the individual/personal level. The data was screened and restricted to only those individuals who were earning through farm, non-farm, or diversified livelihoods. The results suggest that the use of ICTs has a significant contribution to the earnings in Pakistan. Similarly, livelihood diversification can greatly enhance the income levels of individuals in Pakistan. Non-farm sector employment also remarkably supports the agriculture-based Pakistan's economy. Especially, the small landholders have inexorably to find their way into additional livelihood sources. Education has been observed as a very important determinant of personal earnings. A significant income variation has been witnessed among provinces of Pakistan. KPK has been found at a greater disadvantage as compared to other provinces. It is suggested that measures should be taken to improve access to ICTs and internet facilities at the national level with a special focus on the most deprived parts of the country. Moreover, the government may acknowledge and support the livelihood diversification projects as a component of the national objective for job creation. Stringent efforts are recommended to ensure the provision of free and quality education along with the skills and technical knowledge for all classes of society with equal opportunities.

Conflicts of Interest: The authors declare no conflict of interest.

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