RESEARCH ARTICLE

Small Farm Holder's Wellbeing: Evidence From Punjab (Pakistan)

Muhammad Arshad Sakhani [*1], Abdul Jabbar[2], and Arshad Ali Bhatti[3]

[1,2,3] *International Islamic university, Islamabad*

Abstract: The study investigates the impact of income diversification on the well-being of small farm holders in Punjab, the most populated and agrarian province of Pakistan. It benchmarks the levels of well-being of small farm holders who opt income diversification (off-farm) with those who remain exclusively indulged in agricultural farm activities(only-farm). The data of 1607 farm families are retrieved from the PSLM (2015–16) survey to construct a fully representative well-being index using Principal Component Analysis (PCA). Empirical analysis is obtained through the treatment effect model. The results of the treatment effect show that income diversification has positively significant impact on household well-being and cast noticeable improvements in well-being of off-farm strata as compared to that of only-farm income earners. Furthermore, net saving, access to credit, dependence ratio, and farm size are the critical factors that enable land assets to have a favorable and substantial impact on both welfare and income diversification. Importantly improved education drives small farmers' decision to diversify their sources of income.

*arshadsakhani@gmail.com

1   Introduction

Well-being is considered as quality of life comprising both external and internal factors of settings like social security, health system, education system, public goods to leisure, income, education availability of shelter, physical and personal security. Well-being is as simple to understand as complex to measure. There are many factors other than the GDP that contribute to household material well-being. Emotions, work and life balance, capabilities, social connections, and civic engagements, governance all are considered as factors of the well-being, personal factors, and environmental quality (OECD, 2011). It is important to note here that due to multi-dimensionality nature of the concept of quality of life, one or several factors are not able to produce a thorough reflection of issues related to measurement of well-being; thus, scientific literature presents a wide range of factors determining well-being. In general, income and wealth are considered as well-being; in political science it is considered as a system of welfare and in sociology it usually refers to the personal satisfaction (Andreoni & Galmarini, 2016). Broadly, poverty reduction and well-being are alternatively used in literature and in this study too.

For Pakistan, rural population registers at 63.33% of total population which is directly or indirectly engaged with the agriculture for their livelihood (World Bank, 2018). Pakistan's 61 percent of the total private holdings are under five acres. So, a noticeable segment of rural population attached with the agricultural sector is prone to the poverty.

Among developing countries, agriculture is the main employment sector which employs about one third of the total labor force globally (ILO, 2015). Agriculture acts as the major driver of economic activity and productivity. Due focus and consideration also lack among developing and underdeveloped countries. It is also evident that a sizeable portion of agricultural activity in developing world is carried out on small and marginal farms; notably that land holding includes both cultivatable and non- cultivatable land. In Asia, 57.9 percent agricultural holdings are below 2.5 acre, and which accounted for 14.2 of the cultivatable area. If the limit is extended to 5 acres, not less than 85 percent holdings; accounting for nearly 31 percent agricultural land gets covered (APCAS, 2010). Pakistan's 61 percent of the total private holdings are under five acres and ownership of 50 acres and above are only two per cent (Pakistan Agriculture Census, 2000). Farm holders, holding under five acres are referred as small farm holders as per Govt. of Pakistan Definition in Agriculture Census- 2010. Same definition is employed in this research.

The structure of the farm landholding in developing countries like Pakistan is one of the important indicators of social and economic well-being and the size of the farm determines the level of the benefits and well-being in the society (Salam, 1980). Since majority of land holdings are of less than five acres, the income patterns of households owning them, become highly vulnerable to the vagaries of weather and economic shocks — any exogenous shock, unfavorable weather conditions, a bad crop or an adverse economic policy, proves their undoing and they slip below the poverty line as they are already at the edge. Rural poverty is rooted in the asymmetrical distribution of land, as small landholders are striving to put food on tables while landlords are reaping the fruits of their agricultural land.

The small farm holder's livelihood is more prone to shocks arising out of vagaries of both man-made and natural disasters. Due to the subsistence type of agriculture, the small farm holder is more vulnerable to food insecurity situation even in the event of slight drought. Small farm holders have fewer coping strategies than medium or large farmers. Small farm holders usually lack resources to invest in their land or livestock or to create

alternate source of income and have mere skills. Many a type of farm technology and machinery are unsuitable for adoption at small scale (APCAS, 2010).

Economic viability is imperative to focus on non-farm activities which generate employment, income diversification and potential of poverty reduction. Off-farm activities are economically viable which provide the alternative livelihood sources to the rural households and diversification from farm-activities to off-farm activities are considered as the challenges and opportunities of agricultural segment. In off-farm measures, the major concern is focusing on such opportunities that are not directly linked with agriculture sector (like, agriculture crops, forestry livestock and fisheries). On the other hand, off-farm activities comprise trade, processing of agricultural products, employment in off-farms activities, etc., which is helpful in income generation process.

In this paper, the introduction section is followed by the review of the available literature, detail of data, explanation of the variables, methodology & model used to quantify the data.

2   Literature Review

Poverty has traditionally been defined by unidirectional characteristics that are integrated with monetary measures such as income and spending methods. The proponent of the uni-directional money-metric method observes that prospective buying power leads to families enjoying richer and healthier lives as a result of having greater income or more efficient purchasing power (Townsend, 1970; World Bank, 2000). Even if a family is focusing on living over the defined poverty level, strategies related to income have failed to assure the quality life. The second disadvantage of this money-metric (income/expenditure calculation) method is that a household may not be poor in terms of income or consumption, but it may be lacking in certain fundamental living needs, with few members of that household (Thorbecke, 2005).

The emerging role of off-farm incomes in reducing poverty has been emphasized in studies on livelihood diversification in the developing countries (Bryceson, 1996). Numerous studies (like Serra, et al., 2005; Kijima, et al., 2006; Haggblade et al., 2007; Jan et al., 2009; Iqbal, et al., 2014) showed that theory of livelihood and diversification or broadening of income are beneficial to reducing household poverty unpredictability by providing an alternate income source. The phrase "income diversification" is used in the literature to depict four inter-related but different ideas (Minot et al., 2006). Diversification of income refers to a growth in income sources or a balance between them (Joshi et al., 2003; Minot et al., 2006). Revenue diversification, according to a second definition, is the increase in income of non-farm or non-crop (Reardon, 1997). The third concept of diversification of income emphasizes the transition from the basic subsistence to commercial and sustainable agriculture (Delgado and Siamwalla, 1997). However, the last definition of income diversification is moving from crops with lower-value production to crops with higher-value production, livestock, and industries other than farm (Minot et al., 2006). The second definition described above is used for the diversification of income in this research.

Causes of diversification are constantly contested. Income diversification is a popular and widely used strategy for risk management or dealing with unexpected events. According to the research on livelihood sustainability, a number of families avoid becoming too reliant on a single or many sources of income for an extended length of time (Reardon

1997; Bryceson 1999; Toulmin et al. 2000). Income diversification sources, as given from numerous methods, are often used by families to reduce revenue volatility and provide a minimal level of economic security (Alderman and Paxson, 1992). Households and individuals often diversify income, their assets, and their activities for a variety of reasons. The causes are separated into two groups: "push factors" and "pull factors" (Barrett et al., 2001). New revenue possibilities produced by market growth and improved infrastructure for asset accumulation are examples of pull forces (Davis and Pearce, 2001).

The terms meaning poverty (Faqr and Faqir, plural form of fuqra) are referenced twelve times in the Holy Quran from an Islamic viewpoint on poverty. Ten of the twelve lines deal with material destitution (Iqbal, N., et al., 2019). Same has been discussed by Gait (2010); and Raheem, et al. (2020). While it is mentioned twice in the Holy Quran for spiritual poverty. Poverty is also referenced in Ahadith, which are the sayings of the Holy Prophet (PBUH). Poverty is a major risk and threat to both people and society, according to the Ahadith. The Holy Prophet (PBUH) makes it plain that poverty is an adverse condition and every Muslim should seek refuge from it (Ibn Hanbel, II/231, 250, 410). Indeed, although He prayed, "O my Allah I seek refuge for you from the evils of poverty" (Ibn Hanbal, VI/57, 207; Abu Dawud, Adab, 101), He also advised his friends to pray, "Refuge to Allah from the evils of poverty, famine, degradation, oppressing and oppressed" (Ibn Hanbal, II/540).

In Pakistan, Adams (1993) discovered a link between off-farm income and poverty and economic disparity. A three-year study of 727 rural families was conducted between 1986 and 1989 with the goal of identifying the variables that influence poverty in Pakistan. Non-farm income, livestock, farm revenue, rent income, and transfer payment income were all identified as significant sources of income in the research. Non-farm income was most prominent from a list of sources of income for rural families, which helped to reduce poverty and income disparity. Furthermore, income from non-farm sources accounted for about 40% of total family income, which was more than double the other rural revenue streams.

Escobal (2001) focused on the reasons of off-farm income diversification among rural families in Peru, utilising data from Living Standard Measurement Studies (LSMS) for rural communities with 2284 households from 1995 to 1997. He looked at the factors that affect household diversification choices and discovered that both public and private assets, such as access to finance and education, had a substantial impact on diversification decisions. He believes that improving access to these assets would boost rural families' self-employment and wage employment in the sector other than agriculture sector. Erasdo (2003) looked at the effects of diversification of income on changes in macroeconomic policy and droughts. Data from two similar national income, spending, and consumption surveys showed that the number of families getting their income from private sources increased significantly while the number of households obtaining their income from government sources decreased. In comparison to families with a single source of income, households with numerous income sources were far better at resisting the negative effects of weather shocks and macroeconomic policy changes, according to the findings.

Kapunda (2003) looked at the relationship between poverty reduction and diversification. He examined two local "income and spending surveys" from 1985-86 and 1993-94. He noticed that inequality in income did not change substantially throughout this time. He concluded that the main barriers to diversification were a lack of infrastructure, insufficient labor incentives, ineffective policy formations, technical inadequacies, and sluggish devel-

opment in the producing sector. Similarly, according to Eakin (2005), families with less assets had more diverse income portfolios. He utilized data from six villages in the Indian state of Andhra Pradesh. He also discovered that families with asset holdings over a certain threshold had higher diversification, implying that there was a U-shaped connection between the asset holding and diversification of income.

Minot et al. (2006) investigated the relationship between poverty and income diversification in Vietnam using both primary and secondary data. The availability of land and labor has a significant impact on livelihood diversification, according to regression analysis. They concluded that in order to alleviate poverty, output should be increased in order to improve people's incomes so that they can endure any economic shocks.

Micevska and Rahut (2008) looked at data from 520 rural families and found that off-farm activities accounted for 60% of overall income for rural households. They discovered that education was the most important factor in a family's choice to diversify their income. Women with a greater level of education were more likely to be self-sufficient by engaging in non-farm activities. They recommended that the public sector required greater attention, and that wage jobs, rather than depending only on traditional agriculture and self-employment, should be prioritized. In rural Nigeria, Babtunde and Qaim (2010) looked at several types of income diversification. They utilized survey data to find that a significant proportion of families have fairly diversified their income sources, with non-farm income accounting for 50% of total income. Surprisingly, better-off families were found to be more diverse, suggesting that diversity may be utilized to improve total income rather than simply as a risk management strategy. Diversification may be promoted, they said, by resolving all market-related problems.

Ibrahim et al. (2009) used an arranged interview to gather data from 100 rural families to examine the drivers of income diversification. They utilized the Simpson index of variety to determine whether families have diversified their income sources and the evenness of each source of income. They discovered that education of household head, age, the availability of physical assets, and the value of agricultural production output were the most important predictors of crop diversification. They also found that, depending on their demographic characteristics, the majority of families were eager to diversify their income. Similarly, Iqbal, N., & Akhter, M.R., (2015) discovered predictors of poverty. They devised a survey to gather information from with a sample size of 330 homes. Using HIES data, this research tracks poverty as defined by the Pakistani government (1998-99, 2006-07, and 2007-008). According to the Head Count Ratio method, 23.4 percent of urban families are poor, but the poverty gap indicator shows that 7.9 percent of individuals in Sargodha are poor. Further empirical findings revealed that household size, age, education, infrastructural indicators, and experience were all important factors in determining urban poverty.

In the same vein, Abro and Sadaqat (2010) examined Pakistan's diversification toward high-value crop production and poverty reduction. They discovered that most of the people lived in rural regions and that agriculture was their primary source of income. Agriculture made for almost 21.8 percent of the country's GDP. As a result, he recommended that farmers diversify their crop output to include high-value crops to maximize profits. Crop diversification would result in greater job possibilities, women's empowerment in agriculture, and a decrease in poverty.

Using data from the Multiple Indicator Cluster Survey of Punjab (MICSP) for the years 2003-2004, Awan et al. (2012) calculated the poverty level in Punjab. This research uses the Alkire and Foster (2007) method to assess poverty by using eight proxies such as (i) educa-

tion, (ii) land, (iii) household assets, (iv) health, (v) expenditures, (vi) sanitation, (vii) water and (viii) electricity availability. Land deprivation, poor health and sanitation, spending, and educational deprivation are the main factors that create multidimensional poverty in Punjab, according to the findings of this research.

Jan et al. (2012) investigated the variables influencing livelihood decisions in rural northwest Pakistan. They used a multinomial Logit model to analyze data from 1101 families in two Peshawar villages. They discovered that if household heads have no education and are young in age, they are more likely to diversify their income sources more. Likewise, size of household had a favorable and substantial effect on livelihood diversification, as adding a family member decreased the likelihood of exclusively relying on agricultural labor. As a result, it was determined that rural developmental strategies should be given importance and attention in order to enhance the non-farm sector in rural areas.

In a similar vein, Awan et al. (2012) used PSLM data from 2004 to 2005 to investigate multidimensional poverty in Pakistan. To assess multidimensional poverty, they used Alkire and Foster's (2007) method. Empowerment, expenditures, land, sanitation, health, water, housing, and assets are the nine factors used for this research. Based on the findings of this research, a pitiful spectrum of poverty has been seen in Baluchistan. Following her, the province of Khayber Pakhtun Khuwah (KPK) was determined to be the poorest, while Punjab fared considerably better than the other of Pakistan's provinces. Land, empowerment, sanitation, housing, and assets are all shown to be significant variables in this research.

Rahman (2013) investigated the variables that influence decisions of people to engage in non-farm sector in Bangladesh. A survey of 150 farmers was conducted for this aim. The services sector was one of the biggest contributors, according to descriptive data. The variables were experimentally assessed using logistic regression. Low farm income was cited as a factor for participating in off-farm activities in this research. Non-farm labor force participation was negatively linked to education and farm size. Small business activities were common among lower-income families. Farm size, household organizational involvement, and infrastructural improvements have all been shown to be important drivers of non-farm income in empirical studies.

Rabial et al. (2013) conducted a scholarly debate on Pakistan's rural impoverished families' socio-economic situation. They instinctively believed that education and health were significant variables in affecting poverty. This research utilizes the brick business as a sample set and focuses on brick industry employees. This work creates a survey and performs theoretical research in this respect. They carefully covered the topic using intuitions and logical arguments. The findings of this research indicate that the owners' attitudes and society's conduct are to blame for the bad working conditions of the employees. They lacked adequate educational and health-care options, which harmed their economic situation. Poverty was caused by a combination of causes including a lack of access to finance, inadequate health care, education, and unemployment. Bhatti, et al., (2015) discussed income of Pakistan accompanied by high budget deficits, corruption and political unrest cause a widening gap between the rich and poor. And suggested that Government should work for the alleviating poverty and redistribution of income fairly. Tawah, et al., (2020) found a positive effect of production and exports on household welfare, except for urban farm households. A lot of researchers found positive relationship between poverty, socio-economic status, education, health, and energy consumption in rural household like (Janjua, P. Z. et al., 2014; Iqbal, N. et al., 2021; Sun, H., 2021; and Mohsin M., et al. 2021).

After reviewing some of the key studies from the current literature covering issues related to poverty, one can find most of the study with multidimensional poverty measurement and observation methods but as per the knowledge, no study is available which covers the relationship of income diversification and multidimensional poverty, particularly in rural Punjab, Pakistan. However, there is a scarcity of research on the socio-economic indicators of poverty and farmers' well-being, particularly in rural Punjab. Existing empirical research on income diversity have several flaws, such as a lack of attention to the functions of income diversification in relation to socio-economic contexts. As a result, the present research fills a gap in the existing literature by examining the effect of income diversification on the wellbeing of small farm holders in Punjab, Pakistan as well as the variables that may influence households' decisions to diversify their income. This research might be useful in developing a strategy to alleviate poverty, particularly in rural regions, since income diversification is an essential method to combat poverty.

3 Methodology

3.1 Data and Variables

The primary emphasis of this research is on the effect of socio-economic indicators and income diversification on farm family wellbeing in rural Punjab. As a result, data of 1607 household belonging to Punjab were retrieved from the Pakistan Social and Living Standards Measurement Survey (PSLM) 2015-16. These household were fulfilling the definition of the small farm holders having 5 acres of land according to the Pakistan Agriculture Census 2010. 650 of these farm families are active in both farm and non-farm activities, while the remainder homes are only interested in farming.

The welfare index, household age, head's gender, dependence ratio, ratio of female, diversification of income diversification, households (HH) education, loan access, net savings, involvement in committee, land assets, holding of livestock, and dimensions of poverty were all utilized in the research. Household wellbeing: Our construct of rural household wellbeing is based on the following eight factors: livestock ownership, commercial landownership, residential landownership, access to washrooms, home toilet facilities, availability of rooms: one room for two family members, brick house facilities, vaccinated children.

Many studies are employing the PCA (like Alemzero, D.A., et al. 2021). We use principal components analysis (PCA) to calculate the weights of our WBI (wellbeing index), as recommended (Filmer and Pritchett, 2001). It performs an orthogonal transformation of a collection of potentially correlated data into a set of linearly uncorrelated observations known as principal components. It's also worth noting that the total number of original variables is fewer than or equal to the number of main components. Under the restriction that it is uncorrelated with previous components, the initial component may pertain to the greatest deviation, and each consequent component may include the highest variation. To create our index of household wellbeing, we utilize the factor loadings of the first component.

Income Diversification: For farm families, income diversification entails identifying sources of revenue other than agricultural income, i.e., non-farm income. Simpson's index has been used in the literature to measure total family income diversity, including farm

and non-farm (Minot et al., 2006; Babatunde and Qaim, 2010); therefore, we employ income from off-farm activities as a proxy for farmer's income diversification. Off-farm income is described as a farmer's income earned through non-farm income sources like public and private services, businesses and enterprises, and other sources including remittances. To account for this, we employ a dummy variable that is set to '1' if families are involved in non-farm activities and '0' if they are exclusively engaged in agricultural activities.

3.1.1   Household (HH) Head Age

This is a continuous variable with a range of 16 to 99 years in our data.

3.1.2   Household Head's Gender

This is a dummy variable that takes the value "1" if the household head is male and "0" otherwise.

3.1.3   Farm Size

This is a continuous variable that refers to the amount of agricultural land owned in acres.

3.1.4   Dependency Ratio

This is the percentage of a household's members who are jobless compared to those who are employed. To understand socio-economic growth, the dependence ratio is indicator of possible changes in age structure of population. Normal dependence ratio (a value of dependency ratio less than 0.5); medium dependency ratio (a value of dependency ratio between 1 and 0.5); and severe dependency ratio (a value of dependency ratio higher than 0.5) are the three categories (a value of dependency ratio equal to or greater than 1). This research estimates it as the ratio of employed families with ages ranging from 18 to 64 years old to employed households with ages ranging from 15 to 64 years old, which is consistent with empirical literature (Sultana and Kiyani, 2011; Rehman, 2013). Three dummies are used, one for each group. The poll divides education into five categories: no education, elementary, matric, graduation, and above graduation. We utilize four dummies, with the exception of one for above graduation.

3.1.5   Ownership of livestock

This is a dummy variable that is set to '1' if a household possesses animals and '0' otherwise.

3.1.6   Access to Credit

Access to Credit is a dummy variable that takes on the value of '1' if a household attempts and gets a loan from formal or informal institutions, and '0' if he attempts but does not receive one.

3.1.7 Committee Participation

Committees are informal methods of investing or saving, especially in rural cultures, and their impacts on family welfare need more study. As a result, we include it as a dummy variable in our analysis, with a value of '1' if a family participates in any kind of committee and zero otherwise.

3.1.8 Household Saves

Savings play a significant role in determining the wellbeing of families, particularly in rural regions where individuals have gold, jewelry, cash, and other types of savings. Households often save for their children's weddings as well as any bad event or shock. This research employs a dummy that assumes a value of '1' if a family saves, and '0' if it does not.

3.1.9 Land Assets

There are two kinds of property assets included in this study: residential and commercial buildings/land. These factors are used to evaluate their effect on family wellbeing and income diversification decisions. A fake variable is utilized to capture this feature once again.

After discussing independent variables, we now define poverty measurement. We would assess multidimensional poverty as follows: According to Sen (1985), multidimensional poverty is a problem that must be addressed due to a lack of human skills and basic requirements. This definition demonstrates that poverty may be accurately assessed using a variety of wellbeing indicators. As a result, the goal of this research is to determine the impact of diversification of income on the multidimensional poverty or wellbeing of the vulnerable segment of society, namely farm families. Using the statistical process of main components, this research creates a wellbeing index (PCA). Household wellbeing will be utilized as an antithesis to poverty throughout this article.

3.2 Econometric Model

To examine off-farm income and poverty problems, the majority of the current research utilizes Logit, Probit, Heckman's two-step technique for the correction of selection bias, or the method of propensity score matching (Fan, 2012; Zearai and Gebreegziabher, 2011; Ouwsu et al., 2011). The 'switching regression or treatment effect,' which is an extension of Heckman's method, is a relatively recent discovery in this area. This research uses a treatment effect model to look at the effects of income diversification on farm families' wellbeing as well as conduct a counterfactual analysis.

In two ways, the Treatment Effect Model (TEM) differs from the Sample Selection Model (SSM): first, a binary variable denotes the treatment condition, which is directly included into the result equation. Second, the outcome equation's dependent variable (dv) is computed for both treated and non-treated members.

$$OutcomeEquation : Y_i = \beta' X_i + \delta t + u_i \tag{1}$$

Where Yi is the outcome variable, which in our case is the well-being index, and Xi is the explanatory variables' vector, such as age of household head, gender, lower dependency

ratio, medium dependency ratio, female ratio, access to loan, and savings. It shows substantial disparities between treated and non-treated families, as well as a counterfactual analysis. The dependent variable/selection variable in a selection equation is in dummy form: t=1 if the farmer has diversified his sources of income, and t=0 otherwise. The estimated Probit model is comparable to the Heckman model in the selection equation; the unobservable is estimated from the selection equation; and selection biasness is seen using the IMR (Inverse Mills Ratio), which is utilized as an explanatory variable in the outcome equation. It's worth noting that the TEM handles both the treatment effect score and the selection at the same time.

$$Selection Equation : t_i^* = z_i\gamma + u_i \tag{2}$$

where, t_i=1 if t_i^*>0 and t_i=0 otherwise

$Prob(t_i = 1|z_i) = \phi(z_i\gamma)$ and $Prob(t_i = 0|z_i) = 1 - \phi(z_i\gamma)$

The dependent variable is dichotomous, with a value of 1 for off-farm income and a value of 0 otherwise. It's expressed in the following equation, in which t is regarded as a discrete variable. If t=1 (participated in non-farm income), otherwise t= 0 (just farming involvement), and t^* may be calculated if t^*>0 and t= 0 otherwise.

z i' is a vector of explanatory variables in the above selection equation, such as the HH Heads' age, HH Heads' gender, medium dependency ratio, lower dependency ratio, access to credit, assets of household, no education (illiterate), primary education, matric education, graduation, livestock ownership, participation in committee, savings, commercial land, residential land, and provincial dummies which are independent. The selection bias is measured using the Lambda or inverse mills ratio (IMR), which is computed here as a density function for the normal distribution. In TEM, IMR is derived from the selection equation and is automatically included in the result equation, while in a traditional selection model, it is used as an extra variable or explanatory variable. If the IMR is statistically significant, it means that there was some kind of selection bias in the data that was addressed in the model.

4   Results

Table 1 shows that the model is generally significant, and that selection bias has been addressed, as shown by a substantial inverse Mills ratio (Lambda). Furthermore, at the 1% level, the direct inclusion of the income diversification dummy in the result equation is very significant. When comparing small farm holders with agricultural income exclusively to those with diversified income sources, the treatment score of 0.8387 indicates that those with diversified income had a positive and greater feeling of wellbeing. These findings are similar to those of De-Janvry et al. (2005) and Ali, A., & Khan, M.A, (2013).

We note that although 'age' does not play a major role in determining family wellbeing, it is critical to make an income diversification choice. Gender, low dependence ratio, and savings all have negative but little effects on happiness; however, low dependency ratio and savings have a positive and substantial influence on the choice to diversify income.

Table 1: Estimation of Treatment Effect Model for small farm holders (Punjab)

N=1607 Wald $Chi^2(21)$=1145.71 Prob>Chi^2=0.000

Outcome Equation

Dependent variable: Index of household's wellbeing

	Coefficient	SE	z-stat.	P>z
Age	0.0003	0.0009	0.34	0.801
Gender	-0.0277	0.0663	-0.52	0.711
Low dependency ratio	-0.0482	0.0317	-1.52	0.218
Medium dependency ratio	-0.0977	0.0317	-3.68	0.003
Committee participation	-0.1176	0.0507	-1.99	0.031
Savings	-0.0242	0.0385	-0.83	0.601
Loans	-0.0645	0.0261	-2.47	0.013
Commercial land	0.4113	0.0495	8.7	0.001
Residential land	0.9547	0.0351	29.2	0.001
Livestock	0.2645	0.0393	6.53	0.001
Income diversification	0.8387	0.1373	6.41	0.001
Constant	-1.3236	0.1002	-11.3	0.001

Selection Equation

Dependent variable: Income diversification

	Coefficient	SE	z-stat.	P>z
Age	0.009019	0.00374	3.31	0.002
Gender	-0.18998	0.179031	-0.99	0.288
Low dependency ratio	0.240311	0.079884	3.02	0.012
Medium dependency ratio	0.214998	0.081126	2.79	0.016
Committee participation	0.421101	0.119401	3.65	0
Savings	0.398211	0.090598	4.57	0
Loans	0.072989	0.07192	1.12	0.31
Commercial land	0.067984	0.133107	0.61	0.613
Residential land	0.04105	0.096005	0.52	0.678
Livestock	-0.36999	0.088169	-4.23	0
No education	-1.25107	0.340036	-3.6	0
Primary education	-1.13488	0.344621	-3.21	0.002
Matric education	-1.05236	0.339196	-3.02	0.011
Graduation	0.96106	0.355185	-2.61	0.016
Household assets	0.201902	0.071619	2.97	0.013
Land size	-0.01801	0.004179	-4.7	0
Constant	0.678652	0.408895	1.78	0.089
Lambda	-0.50027	0.08567	-5.75	0

5   Discussion

5.1   Findings

The findings of the study indicate that families with a severe or lower dependence ratio are less happy since non-productive members of the family may put a strain on the family's working members. Normally, it is believed that having access to credit would enhance the lives of farmers, but our results indicate that having access to credit has a negative and substantial impact on family well-being. It may be because when farmers obtain loans to meet their demands, which are frequently non-productive, they have difficulty repaying their debts, which has a detrimental impact on their well-being. Simply put, negative consequences are a plague of loan abuse, particularly in rural regions.

Small farm holders who participate in informal investment or committee involvement are used as a variable in this research. We discovered that it had a negative but substantial impact on household wellbeing. Land asset factors such as residential and commercial land ownership have been shown to have a positive and substantial impact on family wellbeing. Land assets are essential since they may put farmers in a position to live comfortably. At a 1% level, the variable of cattle ownership has a positive and substantial effect. When compared to families who do not have any animals, those that do have livestock have a higher level of happiness. Livestock is a significant source of food as well as a source of revenue for farmers, which contributes to a better quality of life.

Our findings from the 'selection equation,' which employs Probit estimation, show that 'age' plays a significant impact, with older families being more likely to decide on income diversification as a consequence of their extensive knowledge and resources. Furthermore, it has been shown that the gender of the family head is a negative and negligible predictor of income diversification. It implies that female-headed families are more likely to diversify their income since they are more eager to avoid vulnerability. In terms of dependence ratio, it has a favorable and substantial impact on the choice to diversify income, which may be attributed to increasing pressure from non-productive family members. Small farm holders having access to finance (as compared to others) are more presumably to diversify their income, however, these results aren't statistically significant. Savings and committee involvement, on the other hand, have been shown to have a favorable and substantial impact on the probability of diversifying family income. Committee involvement is a kind of informal investment, and although its effect on happiness is unknown, it has a major impact on the choice to diversify income.

Ownership of commercial and residential structures are used as independent variables in this research, with farmers who only own agricultural land as the reference group. In terms of education, the results indicate that all categories of education, with the exception of graduation, are negative and significant, with graduation serving as a reference category. It seems that highly educated families holding small farms are more likely to engage in off-farm activities, while illiterate or undereducated families are less likely to diversify their income. These results are in line with Babatunde, R., Qaim, M., (2010) findings. The effect of livestock ownership on income diversification is negative and substantial, implying that families with livestock are less likely to diversify their income and are more likely to remain on farm-related activities. Finally, land size has a negative relationship with income diversification, implying that farm families with larger land holdings are less likely to shift away from agricultural occupations and are less justifiable for diversification of their income.

5.2 Conclusion and Policy Implication

The study is aimed to assess the effect of income diversification on the wellbeing of small farm holders in Punjab, which make up the majority of rural households in Pakistan and have enough vulnerability to warrant focus of policymakers. The study's second contribution is to utilize the statistical technique of main components to construct an indicator of farm household happiness. Our findings indicate that income diversification and commercial building or land ownership have a beneficial effect on the wellbeing of rural families, with commercial building or land ownership having a positive and substantial impact on income diversification throughout our study. The dependence ratio has a negative impact on happiness, but it has a favorable impact on the choice to diversify income. The size of the farm is shown to be a significant predictor of income diversification. Families with larger plots of land are less likely to diversify their income. In case of higher education, we found that it has a favorable impact on the choice to diversify income when compared to families with less than a high school diploma or those who are illiterate. We see that target household savings have a negative and small effect on income diversification, but a positive and substantial impact on the choice to diversify income. Furthermore, access to loans has a negative and substantial effect on small farm holders' wellbeing, whereas it has a favorable but little impact on income diversification. Our findings support the existence of selection bias in our model, which was addressed using the selection equation.

Small farm holders' wellbeing may be improved, according to this research, by extending rural microfinance programs that provide convenient access to loans along with loan spending awareness programs. In addition, new initiatives to educate small farm holders about their issues and needs must be developed.

References

Abro, A. and Sadaqat, M. (2010). Poverty alleviation through diversifying towards high value crops in pakistan. *Int. J. Buss. Mgt. Eco. Res*, 1(1):1–8.

Adams, R. H. and He, J. J. (1995). *Sources of income inequality and poverty in rural Pakistan*. International Food Policy Research Institute.

Alderman, H. and Paxson, C. H. (1992). Do the poor insure? a synthesis of the literature onrisk and consumption in developing countries. *Discussion Paper*, 164.

Alemzero, D. A., Sun, H., Mohsin, M., Iqbal, N., Nadeem, M., and Vo, X. V. (2021). Assessing energy security in africa based on multi-dimensional approach of principal composite analysis. *Environ. Sci. Pollut. Res. Int.*, 28(2):2158–2171.

Ali, A. and Khan, M. (2013). Livestock ownership in ensuring rural household food security in pakistan. *J Anim Plant Sci*, 23(1):313–318.

Alkire, S. and Foster, J. (2007). Counting and multidimensional poverty. counting and multidimensional poverty measures. *OPHI Working Paper Series*.

Andreoni, V. and Galmarini, S. (2016). Mapping socioeconomic well-being across EU regions. *Int. J. Soc. Econ.*, 43(3):226–243.

Awan, N. and Ahmed, S. (2012). Measuring multidimensional poverty in pakistan. *Journal of Elementary Education*, 21(1):77–89.

Babatunde, R. O. and Qaim, M. (2010). Impact of off-farm income on food security and nutrition in nigeria. *Food Policy*, 35(4):303–311.

Barrett, C., Reardon, T., and Webb, P. (2001). Nonfarm income diversification and household livelihood strategies in rural africa: Concepts, issues, and policy implications. *Food Policy*, 26(4):315–331.

Bhatti, A. A., Batool, Z., and Naqvi, H. A. (2015). Fiscal policy and its role in reducing income inequality: a CGE analysis for pakistan. *The Pakistan Development Review*, pages 843–862.

Bryceson, D. F. (1996). De-agrarianization and rural employment in Sub-Saharan africa. a sectoral perspective. *World Development*, 24(1):97–111.

Davis, J. and Pearce, D. (2001). The rural nonfarm economy in central and eastern europe. In *The Challenge of Rural Development in the EU Accession Process*. Washington DC.

De Janvry, A., Sadoulet, E., and Zhu, N. (2005). *The role of non-farm incomes in reducing rural poverty and inequality in China*. UCB.

Delgado, C. and Siamwalla, A. (1997). *Rural economy and farm income diversification in developing countries. Market and structural studies division*.

Eakin, H. (2005). Institutional change, climate risk, and rural vulnerability: Cases from central mexico. *World Dev.*, 33(11):1923–1938.

Erasdo, L. (2003). *Income Diversification in Zimbabwe: Welfare Implications from Urban and Rural Areas. IFPRI and FCND Discussion Paper No*.

Escobal, J. (2001). The determinants of nonfarm income diversification in rural peru. *World Dev.*, 29(3):497–508.

Fan, L. (2012). *The effects of agricultural market liberalization and commercialization on household food security in rural China(Doctoral dissertation)*.

Filmer, D. and Pritchett, L. H. (2001). Estimating wealth effects without expenditure data-or tears: An application to educational enrollments in states of india. *Demography*, 38(1):115.

Gait, A. H. A. (2010). Impact of demographic and socioeconomic profile on libyan firms' attitudes towards islamic methods of finance: Libyan firms' attitudes towards islamic methods of finance. *Journal of Business & Economics (JBE)*, 2(1):114–132.

Haggblade, S., Hazell, P., and Reardon, T. (2007). *Transforming the Rural Non-farm Economy*. Johns Hopkins University Press, Baltimore.

Ibrahim, H., Rahman, S. A., Envulus, E. E., and Oyewole, S. O. (2010). Income and crop diversification among farming households in a rural area of north central nigeria. *Agro-Sci.*, 8(2).

Iqbal, N., Ahmad, N., and Riaz, Z. (2014). The relationship between working capital management and profitability: Evidence from pakistan. *Int. lett. soc. humanist. sci.*, 20:14–25.

Iqbal, N. and Akhtar, M. R. (2015). Statistical evaluation, measuring and managing poverty in rural pakistan. *Pak. J. Statist*, (6):709–716.

Iqbal, N., Sakhani, M. A., Khan, A. R., Ajmal, Z., and Khan, M. Z. (2021). Socio-economic impacts of domestic biogas plants on rural households to strengthen energy security. *Environmental Science and Pollution Research*, 28(21):27446–27456.

Iqbal, N., Tufail, M. S., Mohsin, M., and Sandhu, M. A. (2019). Assessing social and financial efficiency: The evidence from microfinance institutions in pakistan. *Pakistan Journal of Social Sciences*, (1).

Jan, I., Khattak, M. K., Khan, M. A., Hayat, S., and Rahim, T. (2012). Factors affecting rural livelihood choices in northwest pakistan. *Sarhad Journal of agriculture*, 28(4):681–688.

Jan, P., Robert, R., Stephan, K., Julian, W., Imam, S., and Nunung, N. (2009). *Rural Income Dynamics in Post-Crisis Indonesia*.

Janjua, P. Z. and Sakhani, M. A. (2014). Determinants of infant mortality: A case study of lady health workers program in rural areas of district dera ghazi khan (pakistan). *Pensee*, (4).

Joshi, P. K., Gulati, A. A., Birthal, P. S., and Twari, L. (2003). Agriculture diversification in south asia: Pattern, determinants, and policy implications. discussion paper no. 57. market structure studies division. *Food Policy Res. Institute. Washington DC*.

Kapunda, S. M. (2003). Diversification and poverty eradication in botswana. *Botswana Journal of African Studies*, 17(2):51–57.

Kijima, Y., Matsumoto, T., and Yamano, T. (2006). Non-farm employment, agricultural shocks, and poverty dynamics: evidence from rural uganda. *Agricultural Economics*, 35(s3):459–467.

Micevska, M. and Rahut, D. B. (2008). Rural nonfarm employment and incomes in the himalayas. *Econ. Dev. Cult. Change*, 57(1):163–193.

Minot, N., Epprecht, M., Anh, T. T., and Trung, L. Q. (2006). *Income diversification and poverty in the northern uplands of Vietnam*.

Mohsin, M., Iqbal, N., Taghizadeh-Hesary, F., and Iram, R. (2021). Measuring the performance of poverty reduction programs in rural pakistan. In *Economics, Law, and Institutions in Asia Pacific*, pages 165–182. Springer Singapore, Singapore.

Owusu, V., Abdulai, A., and Abdul-Rahman, S. (2011). Non-farm work and food security among farm households in northern ghana. *Food Policy*, 36(2):108–118.

Rabial, P. and Noor, R. (2013). Socio-Economic conditions of the poor: A case study of bricks industry. *Journal of Glob. & Sci*, 1(3).

Raheem, F., Sakhani, M. A., and Iqbal, N. (2020). The role of microfinance institutions in increasing well being of their clients. *Discourse*, 6(01).

Rahim, M. F. A., Chew, K. W., Zainuddin, M. N., and Bujang, A. S. (2020). Motivation to become agropreneurs among youths in malaysia. In *Understanding Digital Industry*, pages 350–353. Routledge.

Rahman, M. S. and Department of Management and Finance, Faculty of Agribusiness Management, Sher-e Bangla Agricultural University (2013). Socio-economic determinants of off-farm activity participation in bangladesh. *Russ. j. agric. socio-econ. sci.*, 13(1):3–7.

Reardon, T. (1997). Using evidence of household income diversification to inform study of the rural non-farm labor market in africa. *World Development*, 25(5):735–747.

Salam, A. (1980). Structure of farm holdings, land tenure and fragmentation in pakistan. *Pakistan Economic and Social Review*, 18(3/4):112–126.

Sen, A. (1985). *Commodities and Capabilities" North Holland Amsterdam Rao DSP*. Brisbane, Australia.

Serra, T., Goodwin, B. K., and Featherstone, A. M. (2005). Agricultural policy reform and off-farm labor decisions. *Journal of Agricultural Economics*, 56(2):271–285.

Sultana, A. (2011). Determinants of food security at household level in pakistan. *Afr. J. Bus. Manag.*, 5(34).

Sun, H., Awan, R. U., Nawaz, M. A., Mohsin, M., Rasheed, A. K., and Iqbal, N. (2021a). Assessing the socio-economic viability of solar commercialization and electrification in south asian countries. *Environ. Dev. Sustain.*, 23(7):9875–9897.

Sun, H., Awan, R. U., Nawaz, M. A., Mohsin, M., Rasheed, A. K., and Iqbal, N. (2021b). Correction to: Assessing the socio-economic viability of solar commercialization and electrification in south asian countries. *Environ. Dev. Sustain.*, 23(8):12659–12660.

Toulmin, C., Leonard, R., Brock, K., Coulibaly, N., Carswell, G., and Dea, D. (2000). *Diversification of livelihoods: Evidence from Mali and Ethiopia*. IDS Research report. Institute of Development Studies, Brighton, England.

Twaha, K., Bhatti, A. A., and Naqvi, H. A. (2019a). Impacts of oil discovery on households in uganda: A CGE analysis. *Rev. Econ. Dev. Stud.*, 5(1):41.

Twaha, K., Bhatti, A. A., and Naqvi, H. A. (2019b). Impacts of oil discovery on households in uganda: A CGE analysis. *Rev. Econ. Dev. Stud.*, 5(1):41–48.

Zerai, B. and Gebreegziabher, Z. (2011). Effect of nonfarm income on household food security in eastern tigrai, ethiopia: An entitlement approach. *Food Science and Quality Management*, 1(10):1–23.