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What Makes Farmers Exit Farming: A Case Study of Sindh Province, Pakistan

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Abstract: In agriculture based economies like Pakistan, farmers often shift from farming to off-farm activities as part of an apparent livelihood transition strategy, despite the fact that most of the workforce depends upon farming. In this paper, we try to uncover insights into how livelihood assets, such as human capital, natural capital, economic capital, and locational characteristics, affect a household's exit decision from on-farm to off-farm activities as a livelihood transition strategy in rural Pakistan. We analyzed data from 335 farming households from the second largest agricultural producing province in the country, Sindh. Our findings show that more than 19% of households have completely shifted from farming to off-farm activities. Furthermore, we identified that the 'crop input credit' is one of the major constraints to farmers converting their previous input-driven small loans into larger loans, where large markups may be imposed if they fail to pay when the harvest is made. The empirical findings from Binary Logistic Regression provide strong evidence for family labor characteristics, particularly for working-age males, working-age females, and working-age children. Surprisingly, the cultivated land size significantly and positively influences farm exit rather than a continuation of farming. Off-farm employment, exogenous shocks, and urbanization also significantly and positively influenced the decision to transition into off-farm work. In contrast, the age of the household head, livestock ownership, and distance to a commercial zone significantly inhibited the decision to exit farming. However, government assistance, including subsidies, strongly encouraged farmers to continue farming. These findings provide new insights into the factors affecting the drivers of both exit and continuation in the farming sector as part of a long-term livelihood transition strategy.

Keywords: livelihood assets; exit and stay farming; livelihood transition; off-farm and on-farm work; Pakistan

1. Introduction

Agriculture is a major source of income for the majority of the rural population. More than 2.5 billion (out of the 3 billion living rural population) people derive their livelihoods from agriculture all over the world [1]. However, the process of the entry and exit into/from farming activities continues to be a factor in the agricultural sector's efforts to maintain global competitiveness and to allocate resources between agriculture and other sectors in the economy for the purpose of livelihood diversification/transition [2]. As a result, income variability and poverty are issues that appear to compel farming households to diversify their efforts towards off-farm activities as part of a livelihood transition strategy. However, the opportunities for off-farm income have not grown significantly compared to additions to the work-force in agrarian developing countries [3,4]. Therefore, a large number of poor farmers worldwide have no alternative sources of income to farming [5]. This transition,

therefore, remains a challenge for developing countries, particularly in the South Asia region, where the rural population accounts for 75% of the total population, with 55% of this rural population being agriculturalists [6]. However, those living in these regions face a number of challenges, such as food insecurity and poverty, driven in part by exogenous weather shocks, which encourage these workers to seek alternatives to farming and diversify their efforts towards off-farm activities [7,8]. Therefore, the question is: what factors affect the decisions of farmers to continue or exit farming? This question seems to also ignore the millions of marginal people striving to become economically profitable and self-sufficient with their food [5,9,10].

We believe our study is important for the following reasons. First, approximately three-quarters of poor people in developing countries are directly or indirectly dependent upon subsistence agriculture for their livelihoods [11]. Second, the shift from farming to off-farm activities is increasing in Pakistan [12,13]. Third, for the future of farming in this country, the increasing pressures of population growth are exerting an impact on agricultural land, which is leading to lower agricultural productivity as more marginal land is placed under cultivation [14,15]. At the same time, farming households want to move to non-farm employment in the urban sector [4,16–19]. Finally, how will the drive to exit farming impact the food supply as 60% of the population faces food insecurity [20–26]?

More importantly, Pakistan's agriculture sector has been in recession since 2001. After the 9/11 event in the USA in 2001, Pakistan has fought a long war of 19 years against terrorism as an American ally. This war not only closed doors for foreign investments in the country but also cost over $120 billion, which represents a massive loss to the country's economy [27]. Unfortunately, in 2001, the country's agriculture sector entered an ongoing recession and has not gained the attention of policy makers focusing on sustainable growth due to the area's political instability. As a result, the productivity of the agriculture sector decreased gradually due to emerging high input prices, lower output prices, water shortages, and exogenous weather shocks, which eventually affected and reduced the earnings of farming communities [28]. Further, approximately 7% of the agricultural labor force completely relinquished farming and shifted to off-farm sectors over the last two decades [13]. As a result, maintaining adequate food production is becoming a challenge in the country, and more than half of the population is still facing food insecurity [20]. This is a real concern in the wake of high population growth rates, especially as farmers are migrating from the agriculture sector [29,30].

The goal of the study is, therefore, to identify the particular issues driving farmers to exit agricultural activities, thereby closing a significant gap in the existing literature. A significant number of studies have investigated the factors affecting farm exits in developed countries due to occupational choice [31–35], but very few studies exist on developing countries due to the fewer available alternatives [7,8]. Therefore, understanding the dynamics of farm exit behaviors will provide insights into farmers' decisions to exit from farming. This study could be helpful for the revival of agriculture and food security by attracting new and young educated individuals with new job prospects, particularly in agriculture-based countries like Pakistan, where 60% of the population still faces food insecurity [20]. In particular, we consider the factors contributing to 'sustainable livelihood' to estimate the influence of 'livelihood assets', including human capital, natural capital, and economic capital, in the decisions made in transitioning from on-farm to off-farm activities in rural Pakistan. We further estimate the locational characteristics and exogenous weather shock impacts on farming households transitioning out of farming. Our findings suggest possible policy responses for overcoming the resulting problems of off-farm transitions, along with other relevant constraints, to attract farmers. Moreover, livelihood transitions involving farm-exits often appear not to mitigate poverty but instead increase poverty [18]. Finally, we also suggest a policy mix for both those who want to exit or those who want to remain farming.

2. Conceptual Framework

To better understand the Pakistani agriculture sector and the related literature, we hypothesized and classified the factors that could be linked to "exit and stay" farming, into four groups:

(i) Human capital, including family labor, age, and education; (ii) Natural capital, including land, livestock, irrigation, and agricultural technology; (iii) Economic capital, including loans or credit, subsidies or assistance, off-farm employment, and its sources; and (iv) Locational characteristics, including community services, home remoteness, the extent of commercialization and urbanization, and exogenous shocks (heavy rainfall, floods, and uncontrolled crop diseases). Farmers exiting farming does not mean that agricultural production will have a negative impact. However, this paper wants to identify those factors that drive farmers exiting farming and will have a negative effect on agricultural development and farmers' livelihood.

Labor is a key factor that determines whether a family will continue farming as 'more hands' on the farm facilitate fertilizing the crops, weeding, taking out infested plants, and transplanting and harvesting during the appropriate seasons. Family labor in developing countries is considered mostly unskilled due to farmers' low education levels, limited knowledge about farming, and traditional practices with no other alternatives; thus, such workers are temporarily limited to farm activities [14,15,36–40]. In this case, we assume that available family laborers, particularly working-age males, working-age females, and working-age youth, might prefer to seek jobs other than farming (H1). Younger farmers may be more likely to change their occupation by exiting farming due to having more aspirations for other job options [41,42]. Studies from developed countries tend to find positive relationships between age and exiting farming, as a farm becomes closed when the operator reaches his or her retirement age if no successor is available within the household [31,32,34,43]. However, Pakistan has no retirement plans that enable farmers to continue farming if they are able to work. Although elderly people may have the opportunity to seek off-farm employment in the case of an exit, they cannot easily make that transition due to their old age. Therefore, we assume that labor age can hinder the decision to seek or participate in off-farm activities by exiting farming (H2).

The impact of education on this "exit or continue" decision is difficult to predict. Overall, an increase in income encourages farmers to continue farming. Better education increases farm income by, for example, improving the use of technology, providing innovative information, and allowing farmers to interact with the output and input markets [44,45]. On the other hand, some better-educated people appear to have little interest in farming due to their aspirations towards an off-farm profession [9]. Therefore, education increases the opportunity for off-farm employment because farming is a seasonal occupation with fewer rewards compared to off-farm work. Thus, off-farm jobs are expected to have a higher return compared to on-farm jobs, so educated individuals will want to quit farming and engage in off-farm jobs [46]. Furthermore, education leads to perceptions of agriculture as a '3D job' (difficult, dirty, and dangerous), which may encourage educated people to avoid traditional farming as an occupation [47]. Thus, we assume that an educated household head is more likely to leave farming and move to off-farm activities as part of a livelihood transition strategy (H3).

Operated land size and land ownership also play an important role in the farming decision and could have negative impacts on the 'continuing farming' decision in some cases. For example, in the case of access to credit or agricultural loans, land is used as collateral, and only land owners can benefit from these services. Large farms could have better access to extension services, farm advisory services, and input services than small farms [48,49], while small farms may have more constraints on their access to financial service, as well as low income, which is why many farmers dislike farming [9]. Indeed, studies from developed countries conclude that an increase in operational land reduces the tendency to exit farming [8,32,50,51] because large farms can produce higher income, which enables farmers to invest more in farming to facilitate farm survival [32]. However, in Pakistan, various landlords and large farmers do not like farming and rent out or share out their land, while small and marginal farmers are more likely to leave farming due to the various constraints of their farming activities. Therefore, we assume that land ownership and farm size are important factors that determine whether households continue or leave farming, but not in a simple linear way (H4).

Livestock ownership could encourage households to carry on farming activities instead of exiting farming as mixed-crop livestock production is an integral part of farming, closely linked to livelihood

strategies, and a major source of food and income [52,53]. Approximately 35–40% of the Pakistani population are dependent on livestock as their main source of income and provide food for over 8 million rural families [54]. Therefore, livestock ownership could encourage households to continue farming [7]. Thus, we might expect that access to and ownership of livestock will increase the tendency of households to continue farming rather than exit the practice (H5).

The availability of water is a major constraint on agriculture. Pakistan has one of the best canal systems in the world, and ground water is still considered a reliable source of irrigation. However, ground water use has several constraints, including its quality and high pumping cost (due to high fuel prices). The adoption of technology in agriculture (e.g., improved farm implements, bio-chemicals and fertilizers, and improved seeds) can influence a farmer's decision to continue farming due to the resulting increase in yield and income [55,56]. As a result, advanced technology adopters may choose to continue farming more often than non-adopters [7,9]. Hence, we expect that better access to irrigation water sources and the adoption of technology can encourage farmers to continue farming (H6).

Access to loans can make farming households economically strong, thereby encouraging farmers to continue farming [57]. Meanwhile, longstanding loan and debt pressure could distress farmers and make them dislike farming [58]. Thus, we assume that any markup imposed on using crop inputs (fertilizer, pesticide, seeds, etc.) as credit due to financial constraints could push farmers to exit farming (H7). Conversely, government subsidies or support prices on agriculture could encourage farmers to continue farming [31,50]. Alternatively, off-farm income along with farming activities can stabilize and increase a household's overall income, which is favorable for farming activities, but off-farm income can also encourage farmers to leave farming activities in case of consistent farming losses [50]. Therefore, we assume that the farmers who receive assistance or subsidies for agriculture, would like to continue farming (H8).

Better access to community or non-family services could also encourage households to consider more off-farm work [59–61]. Therefore, we assume that better access to school, health, transportation, employment sources, and rural development programs can influence the decision to "exit or continue" farming (H9). On the other hand, the geographic proximity of a household to urban environments can compel that household to shift from farming to non-farming activities. Therefore, we assume that farmers living near urban areas and commercial zones are more likely to exit farming than those living in remote areas (H10). As the study province is flood prone due to heavy rain-fall and overflow from the Indus River, which frequently affects its agricultural areas, we hypothesize that floods and heavy-rainfall (natural disaster events) discourage farmers from continuing farming [62] and engaging in livelihood diversification due to their livelihood's vulnerability [63](H11).

3. Methods and Data

3.1. The Data

The data for this study were drawn from the Pakistan Rural Household Panel Survey (PRHPS) 2012–2014. The survey was conducted by the International Food Policy Research Institute (IFPRI) over several rounds (2012–2014). This paper took Sindh province as a case study. Sindh province has the second largest economy and the second largest population among all four provinces in Pakistan. Karachi is the capital of the province and also the largest city of the country. Sindh, remarkably, has a high Gross Domestic Product (GDP) per capita, which is three times that of the other provinces of the nation. In Sindh province, cotton, rice, wheat, sugar cane, bananas, and mangoes are the most important crops. The area's rice, sugarcane, and wheat outputs account for 41%, 31%, and 21% of the national total, respectively. Its manufacturing sectors account for 36.7–46.5% of the national total. In addition, Sindh is the richest province in the natural resources of gas, petrol, and coal.

The following five districts were surveyed in the study province using random sampling; the district locations are displayed in Figure 1. Furthermore, four mouzas (the mouza is a subunit of the Union council, the Union council is a subunit of the Tehsil, and the revenue village/dehs is a subunit

of the mouza) within each district were chosen as the Primary Sampling Units (PSU) using equal probability systematic selection. In this context, the lists of revenue villages/mouzas/dehs was used as a sampling frame, as provided by the Population Census, 1998. In each mouza, the enumeration teams conducted reconnaissance. These teams sectioned each mouza into enumeration blocks according to the prepared village map. Each block consists of a maximum of 200 households. Then, one enumeration block was randomly chosen from each mouza. Households within the PSU were considered the Secondary Sampling Units (SSU). A complete list of households was prepared for this chosen block, and then 28 households were randomly selected from this list.

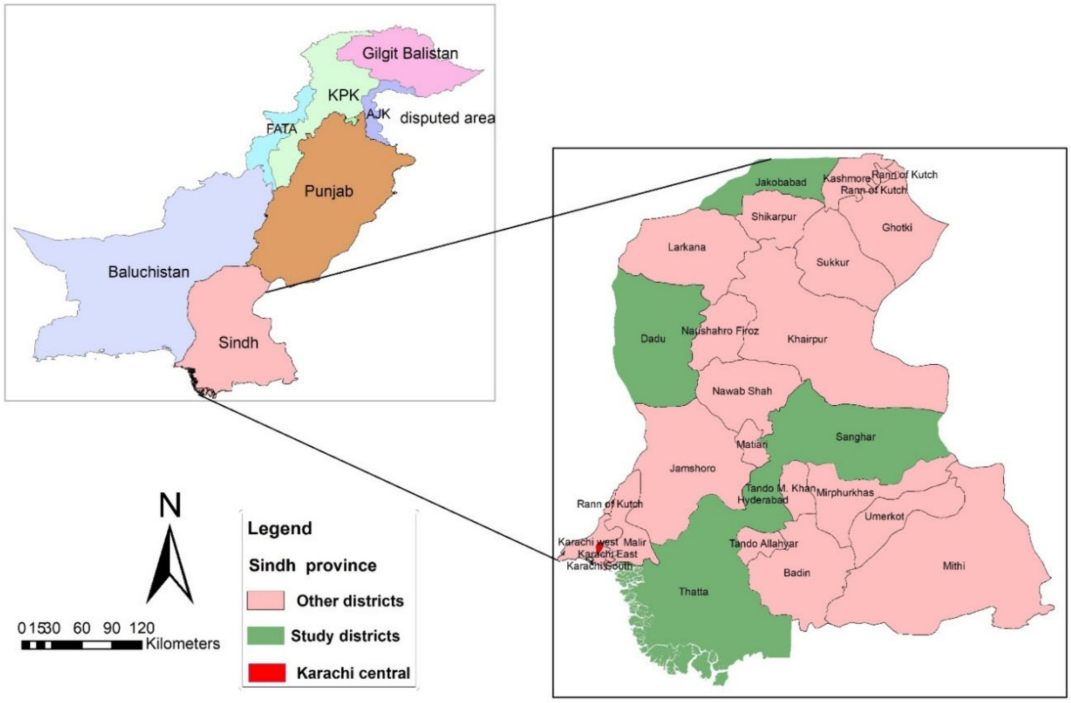


Figure 1. Study districts in Sindh, Pakistan.

The survey includes various types of information on livelihood assets, including human capital, natural capital, economic capital, and locational characteristics, as well as household demographics and socioeconomic characteristics, crop cultivation, and farming practices. This paper defines a farmer as one who has been engaged in farming activities during any one of the Rabi seasons (October–March), whose major crops include wheat, rapeseed, barley, and mustard, and the Kharif season (July–October), whose major crops include cotton, rice, maize, sugarcane, and millet. Further, the farming households, for each round of the survey (2012–2014), were asked for their agricultural land details, including their actual cultivated land, land ownership, rented-in, rented-out, shared-in, shared-out, and fallow land for every season. This information helped us to differentiate whether the farmer exited or continued farming during the survey period of 2012–2014. For example, we asked the households: did you (household) farm during the Rabi and Kharif season in 2012 and 2014? We noted several responses to this question. Some farmers said that they cultivated land in one of the (Rabi or Kharif) seasons, but, for the rest of the season, they did not cultivate land and left the land fallow or rent-outed. Conversely, some farmers cultivated their land (both Rabi and Kharif) in 2012 but did not cultivate land (both Rabi and Kharif) in 2014 (these farmers exited or left their farms). In this case, we selected the farmers who cultivated land during the survey in 2012 (both Rabi and Kharif seasons) but did not cultivate land in 2014 (both Rabi and Kharif seasons) and defined these households as those who 'exit' or 'left' farming. Similarly, we identified the 'continuing' farming households to meet our study objectives (refer to Figure 2).

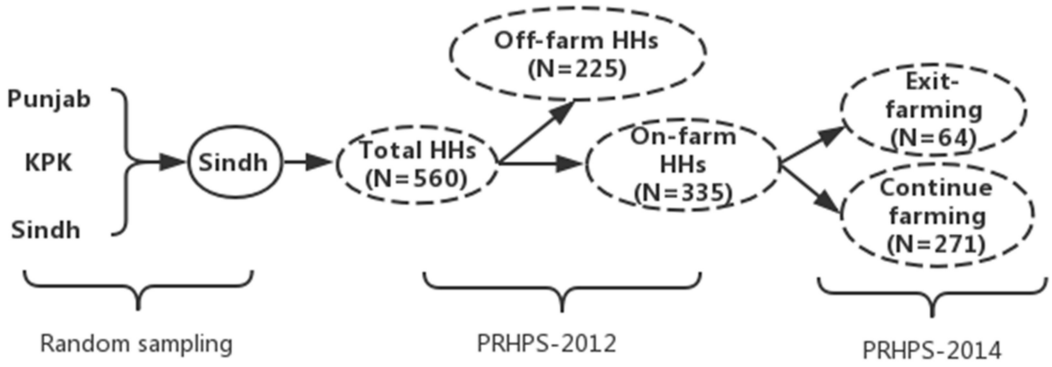


Figure 2. Sampling of Households (HHs) and study process from the Pakistan Rural Household Panel Survey (PRHPS, 2012–2014).

In 2012 and 2014, a total of 560 households in Sindh participated in the survey. A further analysis showed that 335 (60%) of households were farmers during the 2012 survey, while the other 40% of households were not involved in farming activities. Next, we analyzed these 335 households and found that 64 (19%) households were not farming households in either the Rabi or Kharif seasons during 2014. Finally, we defined these 64 (19%) households as those who 'exit or left farming' and the rest of the 271 (81%) as those who 'continued farming' (Table 1 and Figure 2).

Table 1. Study districts and sample size with strata divisions based on commercial zones (Karachi city).

Strata	Districts	Distance to Commercial Zone (km)	Continued Farming	Left Farming	Total Sample
Strata 1	Thatha	102	77	15	92
	Hyderabad	162	52	14	66
Strata 2	Sanghar	303	22	10	32
	Dadu	335	79	11	90
Strata 3	Jacobabad	548	41	14	55
Total	-	-	271	64	335

The data used here come from the five districts of the Sindh province. Figure 3 illustrates the distribution of the 'exit and continue' farming households across each district. We categorized these five districts into three strata according to their distance from the most populous and economic hub city of Pakistan, 'Karachi', to determine the impact of commercial zones in the context of farming exits. Karachi city is the provincial capital of Sindh and is the primary source of off-farm employment, attracting people from across Pakistan. We categorized all five study districts according to their locations and distance from Karachi: Strata 1: the nearest to Karachi city; Strata 2: between Strata 1 and Strata 3; and Strata 3: the farthest from Karachi city (Table 1).

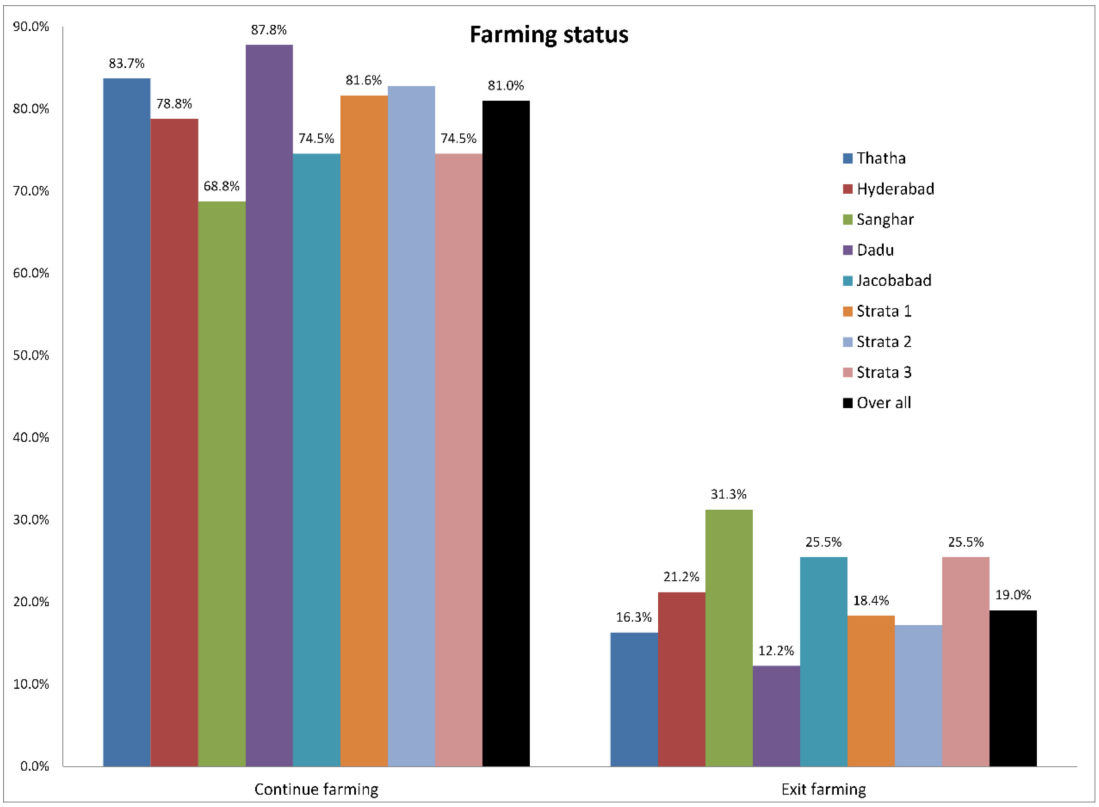


Figure 3. Farming statuses for all study districts and strata divisions based on exiting and continuing farming.

3.2. Econometric Approach

Our empirical approach to hypothesis testing is based upon a Binary Logistic Regression analysis due to the dichotomous nature of the dependent variable (e.g., continuing farming = 1 or leaving farming = 0). We set the Binary Logistic Regression as

$$p = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \ldots\ldots + b_kX_k \quad (1)$$

where p is the probability of the presence of the characteristic of interest and b_0, b_1, b_2, b_3, b_k are the coefficients to be estimated, while X_1, X_2, X_3, and X_k are the explanatory variables. As the dependent variable is dichotomous in nature, the influence on the dependent variable is compared to the regression coefficients. The Wald statistic regression coefficient is divided by its standard error squared. The logit transformation is defined as the logged odds ratio (O.R.):

$$O.R. = \frac{p}{1-p} = \frac{probability\ of\ presence\ of\ characteristics}{probability\ of\ absense\ of\ characteristics} \quad (2)$$

$$logit(p) = ln\left(\frac{p}{1-p}\right) \quad (3)$$

By taking the exponential of both sides of the regression equation given above, the equation can be rewritten as

$$e^{b_i(1+X_i)} - e^{b_iX_i} = e^{b_i(1+X_i)-b_iX_i} = e^{b_i+b_iX_i-b_iX_i} = e^{b_i} \quad (4)$$

By way of interpretation, when a variable X_i increases by 1 unit, with all other factors remaining unchanged, then the probability (of exiting or continuing farming) will increase by a factor of e^{b_i}, where e^{b_i} is the O.R. for the independent variable that gives the relative amount by which the probability

of the outcome increases (greater than 1) or decreases (less than 1) when the value of the independent variable is increased by 1 unit. For example, when the farming status is coded as 0 (leaving farming) and 1 (continuing farming), the regression coefficients are explained by the impact of increasing or decreasing the probability of cases of 'exiting' or 'continuing' farming.

4. Results and Analyses

We analyzed the data in two steps. First, we used an Analysis of Variance (ANOVA) or Chi-square test to calculate the bivariate differences of those who exit or continue farming (Table 2). We also categorized these farming households into large, medium, or small farms. For example, the agricultural farms in Pakistan are categorized by their farming status (as an owner, tenant, or share cropper); the farms which cultivate land more than 12.5 acres in size are considered to be large farms, those ≤12.5 acres in size are medium farms, and those ≤2.5 acres in size are small farms (Table 3). We then used binary logistic regression to estimate the livelihood transition due to the various livelihood assets by creating a 'full-model' and a 'reduced model' (Table 4). In the full-model, we ran a regression including all sets of capitals simultaneously. Following Bhandari [7] and Huybregts et al. [64], the reduced-model includes only statistically significant variables from the full-model that contribute to exiting farming. More importantly, these significant variables were tested in the reduced model for previous economic behavior hypotheses. In addition, we tested for multicollinearity among the explanatory variables using the Variance Inflation Factor (VIF). The maximum VIF value was 3.9 (below 10), which is econometrically problematic [65]. Overall, the explanatory variables in both models correctly predicted over 80% of the cases (Table 4).

Table 2. Livelihood assets and descriptive characteristic of households (mean or %).

Livelihood Assets	Continued Farming (n = 271)	Left Farming (n = 64)	Significance Difference	All (n = 335)
Human capital:				
Age of Household head (years)	41.75	42.09	−0.34	41.81
Education of household head (years)	2.55	2.73	−0.19	2.58
Number of working age children (6–14 years)	1.41	1.14	0.27*	1.36
Number of working age males (15–64 years)	1.83	1.27	0.56***	1.72
Number of working age females (15–64 years)	1.50	1.22	0.28*	1.45
Number of elderly persons (>64 years)	0.15	0.06	0.09	0.13
Natural capital:				
Own land (Yes=1)	45.4	25.0	20.4**	41.5
Rented-in land (Yes=1)	2.2	3.1	−0.9	2.4
Shared-in land (Yes=1)	66.1	82.8	−16.8**	69.3
Total cultivated land (Acres)	6.2	3.8	2.4***	5.7
Ground water irrigation (Yes=1)	14.0	15.6	−1.6	14.3
Canal water irrigation (Yes=1)	82.7	76.6	6.1	81.5
Use mechanical technology (Yes=1)	88.2	92.2	−4.0	89.0
Use bio-chemical technology (Yes=1)	92.6	92.2	0.4	92.5
Livestock ownership (Yes =1)	91.9	75.0	16.9***	88.7
Economic capital:				
Received assistance or subsidy (Yes =1)	64.6	53.1	11.5*	62.4
Off-farm employment (Yes =1)	37.6	62.5	−24.9***	42.4
Loans outstanding (Yes=1)	31.7	32.8	−1.1	31.9
Crop inputs used as credit (Yes=1)	45.8	37.5	8.3	44.2
Crop input payment paid with a mark-up (Yes=1)	11.4	12.5	−1.1	11.6
Locational characteristics:				
Exogenous shocks and crops affected (Yes =1)	48.3	71.9	−23.5**	52.8
Access to community services (within 20 minutes of travel =1)	20.7	18.8	1.9	20.3
Distance of district from home (km)	28.9	22.1	6.7***	27.6
Off-farm source (factory/industries) distance from village (less than 5 km =1)	10.0	23.4	−13.4**	12.5
Strata 1: Near a commercial zone	43.1	45.3	−2.2	43.5
Strata 2: Between strata 1 and 3	27.3	37.5	−10.2	29.2
Strata 3: Farthest from a commercial zone	29.6	17.2	12.4*	27.3

Notes: The significance difference between continuing and exiting farming was tested using a one-way ANOVA F-test or a chi-square as appropriate (the significance level was at 1%, 5%, and 10%, ***, **, and *, respectively).

Table 3. Total operating (cultivated) farm size.

Cultivated Land (Acres)	Continued Farming (n = 271)	Left Farming (n = 64)	All (n = 335)
Small farmers (≤ 2.5)	26.57	28.12	26.57
Medium farmers (> 2.5 ≤ 12.5)	65.33	71.88	65.33
Large farmers (>12.5)	8.14	0.00	8.14

Table 4. Results of the binary logistic regression for predicting an exit from farming (n = 335).

Livelihood Assets	Full-Model	Reduced-Model
Human capital:		
Age of Household head (years)	–0.068** (0.934)	–0.057** (0.945)
Education of household head (years)	0.032 (1.033)	-
Number of working age children (6–14 years)	0.877* (2.404)	0.381 (1.464)
Number of working age males (15–64 years)	1.190** (3.287)	1.472*** (4.359)
Number of working age females (15–64 years)	0.956* (2.602)	0.722* (2.058)
Number of elderly persons (>64 years)	2.145** (8.545)	1.830** (6.232)
Natural capital:		
Own land	–0.655 (0.520)	-
Rented-in land	0.563 (1.756)	-
Shared-in land	1.270 (3.561)	-
Total cultivated land	0.288** (1.333)	0.233** (1.263)
Groundwater irrigation	–1.678 (0.187)	-
Canal water irrigation	–0.306 (0.736)	-
Use mechanical technology	0.262 (1.299)	-
Use bio-chemical technology	0.602 (1.826)	-
Economic capital:		
Livestock owned (Yes =1)	–1.598** (0.202)	–1.011* (0.364)
Assistance or subsidy from government (Yes =1)	–1.005* (0.366)	–0.585 (0.173)
Off-farm employment (Yes =1)	1.961*** (7.107)	1.736*** (5.676)
Loans outstanding (Yes=1)	0.634 (1.885)	-
Crop inputs used as credit (Yes=1)	–0.627 (0.534)	-
Crop input payment paid with a mark-up (Yes=1)	1.039 (2.828)	-
Locational characteristics:		
Exogenous shocks and crops affected (Yes =1)	0.748* (2.113)	0.767* (2.153)
Access to community services (<20′ travelling =1)	0.496 (1.641)	-
Distance of district from home (km)	0.105*** (1.111)	0.108*** (1.114)
Off-farm source (Factory/industries)distance from village (<5 km=1)	0.538 (1.712)	-
Strata 1: Near Karachi city	-	-
Strata 2: Between strata 1 and 3	–0.710** (0.492)	–1.540** (0.081)
Strata 3: Farthest from Karachi city	–2.940*** (0.053)	–2.512*** (0.378)
Intercept (constants)	–3.343 (0.035)	-
Chi-square	149.239***	127.295***
Degrees of freedom	26	13
Pseudo R^2	0.577	0.507
Model prediction of correct value (%)	87.5	86.6

Notes: Wald Chi-square significance levels are at 1%, 5%, and 10% (***, **, and *, respectively), and the odds ratios are written in parenthesis.

Table 2 provides comparative descriptive statistics. These statistics indicate that the households that continue farming are significantly larger than those that left farming in terms of the number of their working-age females (1.50 vs. 1.22), working-age males (1.83 vs. 1.27), and working-age children (1.41 vs. 1.14), except for elderly persons and the age of the household head. Conversely, the education of the household heads who left farming (2.73 years) is slightly higher but is not statistically different compared to those who continue farming (2.55 years). The cultivated land size is significantly larger for households that continue farming (6.2 acres) than for those that left farming (3.8 acres). For the

households that left farming, we also noted that their operated land (3.8 acres) is smaller than that of those continuing farming (6.2 acres); land ownership is also the same (25% vs. 45%). Interestingly, about 83% of share croppers left farming, which is a statistically significantly greater percentage than the percentage of those who left farming in both rented-in farming households (3%) and own-land farming households (25%). The households that own livestock are significant more likely to continue farming (92%) than those that left farming (75%). This result is surprising, showing that households (75%) with livestock ownership leave farming. This may be due to two factors. First, most of the farmers who left farming are share croppers (83%). Like land or crop sharing, farmers can also own animals on land shared from friends, relatives, or landlords. Once these share croppers exit farming, they return their animals to their real owners due to their lack of animal feed. Second, women mostly do field work, including crop sowing and harvesting, the rearing of livestock, and harvesting herbs and grass for their animals. Approximately 72% of households are badly affected by exogenous weather shocks, including floods, heavy rain-fall, and uncontrolled crop diseases, which result in consistent crop losses and significantly contribute to farming exits. Therefore, we conclude that family labor resources, particularly for share croppers, positively contribute to the decision to exit farming as part of a livelihood transition strategy.

The existence of commercial working plants, such as factories, located near the household provide opportunities for non-farm activities, which increases the possibility of nearby farmers to exit farming. Approximately 23% of households leave farming because they have off-farm work sources near their villages. As expected, the number of households that engage in off-farm work is significantly higher for those exiting farming than for those choosing to continue (62% vs. 38%). Locationally, approximately 23% of households that exit farming are close to urban areas in their home district, while significantly fewer households in the remotest areas exit farming due to their distance from commercial zones (Strata 3, 17%) compared to Strata 1 (45%) and Strata 2 (37%). Therefore, we can conclude that the household location of off-farm sources has a positive effect on exiting farming.

As mentioned above, Table 3 presents the categorization of households into small, medium, and large farms, which shows that that farmers of approximately 72% of medium, 28% of small, and very few large farms have left farming. Based on Tables 2 and 3, most of the farming households were share croppers (82%), and most of the exiting farmers were medium farmers (72%). These results indicate that most households that left farming were medium sized and share cropper farmers.

Table 4 presents the results of the binary logistic regression with full and reduced models. The full-model presents the effects of all measures of human, natural, economic capital, and locational characteristics for exiting farming. Overall, the full-model results indicate that 58% of the variation in exit decisions is due to the above mentioned measures. The results from the reduced-model provide only the measures that significantly contribute to exiting farming in the full-model. Statistically insignificant variables were sequentially removed from the analysis, beginning with the weakest measures. In the reduced model, ten variables were found to be statistically significant in explaining the farming exits. These ten measures explain 51% of the variation in exiting farming, suggesting that they are critical factors related to transitioning to off-farm work in rural Sindh. Below we discuss the individual impacts of these livelihood assets on transitions out of farming.

4.1. Human Capital

The estimated results of human capital show that the number of family members who contribute to farm labor are also a potential source of alternative earnings; in particular, working-age males, working-age females, and working-age youth have a positive effect on the probability of exiting farming. For example, the results in Table 4 (full model) show that an increase of one working-age child (6–14 years) increases the probability of exiting farming by a factor of two (O.R. = 2.404); a working-age female (6–14 years) increases the probability of exiting farming by more than two (O.R. = 2.602); and a working-age male (15–64 years) increases the probability of exiting farming by more than three (O.R. = 3.287). More than 67% of Pakistani families (mostly in rural areas) live as a joint family,

which can eliminate the labor constraints within that family and can easily allow them to diversify their income strategies by exiting farming. In contrast, an increase in the age of the family head decreases the probability of exiting farming (O.R. = 0.934). Unusually, the number of elderly persons increases the probability of exiting farming by more than eight times (O.R. = 8.545). Indeed, elderly and aged persons mostly exit farming by handing their farms over to younger successors in Pakistan. However, when there is no young successor within the family, these aged farmers have to continue to farm to provide for their families.

The number of working-age males, females, youth, and elderly persons contribute positively to exiting farming, with the exception of the age of the household head. These results suggest that the presence of more adults overcomes labor constraints, which positively impacts farming exits because young and educated farmers do not like to work on farms, thereby leading to an overall farming exit for the family. In Pakistan, children provide support to their parents by sharing their on-farm work as a member of the family labor force and as a hired laborer for off-farm activities. Boys and girls under 14 years of age help their parents on the farm by collecting firewood, animal grazing, fetching water, digging, washing clothes, preparing meals, and taking care of small children at home when their parents are in the fields [7]. In terms of off-farm activities, children are used as sources of hired and bonded labor [66]. The working-age females in Pakistan, particularly in Sindh province, work as hired labor both on-farm and off-farm to improve their income possibilities [67]. When this hypothesis is statistically tested, it provides strong evidence in support of our hypothesis (H1). Concern for the elderly persons in a family positively contributes to the farm exit decisions because, in Pakistan, there are no retirement plans for farmers like those that may be found in developed countries. When farmers become old, they can continue farming or exit farming based on their own choice. We, therefore, conclude that, when persons become old, they exit farming because their offspring do not let them do any work, allowing them to stay at home as a senior family member and as an advisor/decision maker in domestic affairs.

While education does not significantly contribute to exiting farming, its effects are positive, as expected (O.R. = 1.033). This lack of significance may have arisen due to there being little variation in education levels, as approximately 54% of households were not educated (0 years of education), 35% had >5 but <10 years of schooling, and 11% had 10 or more years of schooling. We also used education as a categorical variable, but the results remained insignificant (results not shown). This result concurs with earlier studies conducted by Stiglbauer and Weiss [45] in Austria, Bragg, and Dalton [68] in the USA, and Bhandari [7] in Nepal. Therefore, we conclude that the low education of most farming households reduces the probability to exit farming as a livelihood transition strategy. Furthermore, when education is tested statistically, there is insufficient evidence to explain farming exit decisions, so we reject (H3).

4.2. Natural Capital

Among the several natural capital measures, only cultivated land size was found to be statically significant in contributing to the farming exit decisions. Surprisingly, the total cultivated land has a positive impact on farming exit decisions. For example, a 1 acre increase in cultivated land increases the probability of exiting farming by 29% (O.R. = 1.333, full-model). This result seems implausible compared to Bhandari [7], who found that a one unit increase of operated land decreases the probability of a farm exit. The possible reason for our result is that approximately 72% of farms who exited were medium sized, and the majority of these were share croppers. For share cropping and due to the nature of sharing contracts in Pakistan, particularly in the study province, no matter whether the harvest is good or bad, less than 50% of the crop output remains for farmers, and generally a 50% or greater share of the crop output is reserved for land owners. This distresses farmers and dissuades them from continuing farming (in case of a lower output share) for subsequent seasons [60]. The results from Tables 2 and 3 also show that medium sized farms (72%) and shared-in farms (82%) consistently left farming. In the context of rented-in farmers, such farmers might simply exit their contracts when

they suffer large losses in farming after one crop season or possibly after one year. Thus, we can conclude that the total cultivated land area is not necessarily a major factor. However, when it comes to continuing farming, cultivated land area shows a robust relationship in explaining farming exits (H4). In contrast, this may result in a livelihood transition (refer to the full-model in Table 4). In fact, looking at the results for share croppers and rented-in households, this effect exerts a positive impact on exiting farming, though this impact is insignificant. In addition, land ownership shows a negative impact on exiting farming, but the results are not significant.

The households that own animals such as buffalo, cattle, sheep, and goats are less likely to exit farming (O.R. = 0.202, full-model), leading us to accept our hypothesis (H5). Households that have better access to both canal and ground sources of irrigation are less likely to exit farming. However, in Pakistan, the availability of the canal water supply is inconsistent (only 4–6 months in a year). However, farmers seem to prioritize (particularly in cases of renting-in or sharing land) the use of canal water accessibility, as it is the cheapest source of irrigation; this could also encourage farmers to continue farming. As expected, both sources of irrigation negatively influenced farming exit decisions but remain statistically insignificant.

4.3. Economic Capital

The government provides support programs via subsidies and output support prices for structural changes in agriculture, which could encourage farmers to continue farming [31,50]. Our results also suggest that the households that benefit from such support are significantly less likely to exit farming (O.R. =0.366); therefore, we do not reject hypothesis H8. Does off-farm income influence a farmer's decision to continue or exit farming? Some studies from developed countries conclude that off-farm income stabilizes household income, which decreases the probability of exiting farming [31,32], while others conclude the opposite [35,69,70] and yet others provide mixed results [50]. Our results suggest that households that derive income from off-farm work along with farming are more likely to exit farming (O.R. = 7.107).

Financial constraints, especially those related to the use of crop inputs (fertilizers, seed, pesticides, diesel for pumping ground water, etc.), seem to have serious effects on farmers in Pakistan, as groundwater is considered one of the most reliable sources of irrigation due to its ongoing availability and consistent supply, which seems to encourage households to continue farming. As a result, farmers experience large markups on these input costs when using credit, so they have no option but to use as their own income and meager (or non-existent) savings. As a result, outstanding loans create additional extra pressures for farmers, which can affect their farming and even lead to farmers committing suicide [71,72]. Our results show that farming households that use crop input credits are more likely to exit farming when they suffer huge markups, while those who use crop input credits are less likely to exit farming when they do not experience huge markups. These results suggest that huge markups make farmers more likely to exit farming. Indeed, our results show that outstanding loans or debts can increase the probability of exit farming, but this result is not statistically significant.

Surprisingly, the households that use modern farm technologies (mechanical inputs such as tractors and other farm implements) and bio-chemical technology (bio-chemical inputs such as chemical fertilizers and pesticides) are also more likely to exit farming; again, this result is not statistically significant. These results do not indicate a strong relationship with farming exit decisions when tested statistically; therefore, we reject H6 and H7.

4.4. Locational Characteristics

The results show that community services have a positive impact on off-farm work, though this impact is not significant and rejects our hypothesis (H9). Geographical factors, such as urbanization, commercialization, and exogenous weather shocks, contribute beyond household and individual circumstances. Exogenous weather shocks increase the possibility of exiting farming, as the productivity of the agricultural sector declines due to the occurrence of natural disasters (floods, heavy rain,

and droughts), which reduce the earnings of rural farming communities [28]. For example, the super flood of 2010 in Pakistan was the most devastating flood in the history of the country and affected most of the area's agriculture and infrastructure. In the light of these concerns, the rural population of Pakistan is migrating from low productivity sectors (agriculture) to high productivity sectors (industry and services) [13]. As a result, households that have experienced large crop losses due to heavy rain-fall, floods, and crop disease are more likely to exit farming (O.R. = 2.113), and these exogenous shocks also push households to diversify their livelihoods beyond agriculture. The households with better access to community services are more likely to exit farming, although this impact is not significant. The home district distance shows a positive statistically significant impact on farming exits (O.R. = 1.111). The households that live within additional community service areas have a better chance of engaging in off-farm opportunities, which could encourage households to start off-farm work. The distance of nearby off-farm sources (factories, mills, and industry) has a positive impact on farming exits, but this impact is not significant. As expected, the distance to a commercial zone has a negative impact on farming exits. In particular, households from Strata 3 that are located far from a commercial zone showed a negative and significant (full-model) contribution to exiting farming. The same can be observed for Strata 2 (the reduced-model). To conclude, negative exogenous shocks and the distance of farming household to urban and/or commercial zones results in farmers exiting agriculture. These results, when statistically tested, provide strong evidence in support of hypotheses (H10) and (H11).

5. Conclusions and Implications

The agricultural sector is a major contributor to Pakistan's GDP and employment. However, approximately 19% of on-farm households have shifted to off-farm activities as part of a livelihood transition between 2012 and 2014. By establishing a conceptual framework and categorizing livelihood assets, this study empirically tested the factors influencing the 'exit or continue' farming decisions of farmers by employing a Binary Logistic Regression approach based upon data from 560 households that met our study objectives in 2012 and provided evidence that households are engaging in livelihood transitions.

5.1. Conclusions

Firstly, the age and labor numbers have a significant effect on the decision to exit farming. Elderly farmers prefer on-farm work, while younger farmers prefer off-farm work (as a new form of livelihood). The number of family members is a key determinant to decide whether a farmer will exit or continue farming. More family members indicate a greater likelihood to exit farming for a different career.

Secondly, outstanding loans put additional pressure on small farmers (including psychological pressure), leading them to close their farms. This is because marginal farmers have little access to institutional and financial services where land acts as collateral and are thus forced to use credit, which often involves large markups due to unfavourable share cropper contracts. This is particularly true for small- and medium-sized farms.

Thirdly, exogenous weather shocks and natural disasters force farmers to seek expensive loans, eventually forcing them to exit farming as a livelihood transition strategy. Revitalizing financial markets and controlling loan rates will be important policy areas for the government to pursue if it wants to retain farmers in the agricultural sector.

5.2. Implications

First, as approximately one third of farmers have exited farming since 2010, the government should consider providing more off-farm employment opportunities. In the absence of employment growth in the non-farm sector, such policies will likely be self-defeating and undermine the agricultural sector, while further exacerbating urban unemployment and congestion.

Secondly, small farms should be provided with greater support in the form of agricultural programs. More importantly, perhaps, the country needs to review its agricultural land use policy, thereby reshaping the cropping contracts of share croppers and undertaking structural changes in the agriculture sector to stop farming exits. This is because most small share cropper farmers exit farming due to financial constraints and the lack of modern agricultural machinery, technology, and equipment.

Thirdly, the agricultural sector still presents a traditional picture of farming activities in Pakistan. Educated people are leaving agriculture, and those who continue farming do not aspire to adopt/use modern agricultural techniques. This puts their livelihoods are at higher risk and will compel many such farmers to quit farming for a different career. This could significantly hurt the country's overall agricultural growth and sustainability, as well as farmers' behaviors regarding the survival of the farming sector.

Finally, there is lack of fresh relevant data on the farming exit behavior in the Pakistani literature. After reviewing many studies on farming activities in Pakistan, we did not find a single study that examines the future of farmers who exit farming as a livelihood transition strategy. Thus, there is an urgent need to study such farmers' behavior with several rounds of responses and data collection to determine the exit behavior of farmers. In this way, policy responses could be adjusted to stop farmers from exiting farming, specifically exits due to constraints and barriers.

In the future, the approach taken in the study has the potential to consider the drivers for the farmers who return to farming or make their debut into farming by shifting from off-farm activities to on-farm activities. It would be helpful to learn more about the constraints facing farmers, especially the impacts of using crop-inputs bought on credit on the future of farming in a broader sense. To the best of our knowledge, none of this work has yet been conducted, although the issue of using crop-inputs on credit with large mark-ups is likely to have major negative impacts on the future of farming in Pakistan.

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