CASE STUDY

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Credit margin of investment in the agricultural sector and credit fungibility: the case of smallholders of district Shikarpur, Sindh, Pakistan

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Abstract

Background: This study examines the access to credit, credit investment, and credit fungibility for small-holder farmers and medium- and large-scale farmers in the agricultural sector of the Shikarpur District of Sindh, Pakistan.

Methods: A standardized questionnaire was used to collect data from 87 farmers in the Shikarpur District. We investigated the availability of credit and the use of credit fungibility by farmers with small-, medium-, and large-scale holdings by applying a credit fungibility ratio and an ANOVA technique. The factors that influence the farmers' access to agricultural credit were analyzed using a probit regression model.

Results: The results revealed that farmers in both study groups used some amount of their agricultural credit for non-agricultural activities. Further, the results of the probit regression analysis showed that formal education, farming experience, household size, and farm size had a positive and significant influence on the farmers' access to agricultural credit.

Conclusion: Based on these findings, our study suggests that a strong monitoring of farmers is needed in the study area.

Keywords: Agricultural credit, Fungibility, Investment of Credit, Credit margin, Pakistan

Background

The agriculture sector has an important role in the economy of Pakistan. About 42.3% of employment and near about 19.5% of the GDP were generated by this sector (GOP 2017a; Rehman et al. 2015). Agricultural credit is an essential element of agricultural growth in the developing countries. It is a temporary substitute for personal saving by accelerating technological change by stimulating smallholder productivity, asset formation, food security and the subsequent rural agricultural income to stimulate agricultural production (Kimuyu and Omiti 2000). The World Bank has also promoted agricultural credit through its private finance department and other banks such as the International Finance Corporation (IFC). Small-scale peasant farmers must be provided formal funding if they are able to generate a marketable surplus that can contribute to the development process (WB 2008). Different studies have been done regarding

agricultural credit in the Pakistan and its impact on agricultural growth as well as for the economic growth. The access of agricultural credit has a vital role for smallholder farmers in the Pakistan, furthermore, Rehman et al. (2017a) study on fertilizers consumption, water availability and credit distribution results revealed that the credit distribution had a positive influence to agricultural production in the Pakistan. Similarly, Saqib et al. (2016) study results show that the small-scale farmers have limited access to the agricultural credit as compared to the medium and large-scale farmers.

The limited access to agricultural credit has been identified as a major constraint on the agricultural development of smallholder farmers in many developing countries (Chandio et al., 2016a; Dercon and Christiaensen 2011; Guirkinger and Boucher 2008; Karlan et al. 2014; Keramati et al. 2016; Rehman et al., 2017b). Smallholder farmers, that consider the important sectorial drivers, have low access to the credit, one of the key constraints. A research study in the key areas conducted in Kenya shows that low credit access is one of the main constraints highlighted to improve access, increase productivity and overcome rural poverty (RoK 2006). The chances for small farmers to increase their output and eventually improve their income that depend largely on their access to credit and their ability to make effective use of credit (Chandio et al. 2017c; Mahmood et al. 2009; Siddiqi and Baluch 2009). In recognition of this, the government of developing countries provide subsidized credit to the small farmers (Ellis 1992). Hussein and Ohlmer (2008) study revealed that where individuals are subject to credit constraints, individuals cannot take advantage of their own credit and thirst for the relevant market conditions at the moment. Market imperfections, institutions, and individuals or family-related factors may limit access to credit markets. Inefficiencies or imperfections in credit markets in developing countries are often caused by government interest ceilings, monopoly power, large transaction costs and moral hazard (Bell et al. 1997; Li et al. 2014; Wu et al. 2016).

Access and utilization of the agricultural credit are therefore considered as an important means of increasing agricultural production and improving rural livelihoods (Gatti and Love 2008; Shimamura and Lastarria-Cornhiel 2010). At the macro level, limited credit has been identified as a major constraint preventing people from getting out of poverty (Kumar et al. 2013). Several studies have found that the bulk of agricultural credit is used for the non-agricultural purposes, including the purchase of consumer goods and celebration of festivals (Muhumuza 1997; Siddiqi and Baluch 2009). The production and development loans provided by the financial institution are important for the growth and development of agriculture sector (Chandio et al. 2017d). Production loans are used to purchase seeds, chemical fertilizers, insecticides, water charges, labor, animal feeds, and medicines. Similarly, development loans are used to purchase agricultural equipment such as tractors, threshers, trolleys, cutting machine adhesives, spray machinery and pipe-handling equipment. In this regard, the agricultural output of small-scale farmers is very low, their land size is small and also their capital investment is small. Consequently the role of agricultural credit is crucial for the agricultural development (Chandio et al. 2016b; Chandio et al., 2017e; Fayaz et al. 2006).

Simon (2013) research suggested that, among other things, the age and sex of family heads of households and the size of their families are the main determinants of rural credit usage in the Zimbabwe. Similarly, Amjad and Hasnu (2007) analyzed the use of rural credit by small farmers in Pakistan and found that household labor and the

literacy of heads of household are affecting the use of credit by farmers one of the factors. Credit swaps have been explored by some research institutes. For instance, credit is spent on consumption and festivals, education and healthcare, and repayments of loans (Akram and Hussain 2008; Hussain and Thapa 2016). Nosiru (2010) and Enimu et al. (2017) research showed that in Nigeria microfinance was provided to support farmers' investment in purchasing more agricultural inputs to enhance their agricultural productivity. The findings revealed that the microcredit has negative effect on agricultural productivity. This was due to the utilization of microcredit in other necessities. In various parts of the world, an ample of empirical literature regarding smallholders access to formal credit and its effect on agricultural productivity and as well as the livelihood of smallholders has discussed. To study agricultural credit fungibility issues and utilization of credit in agriculture sector limited empirical literature is available in Pakistan, particularly in Sindh. Small, medium and large-scale farmers were acquired agricultural credit from both formal financial institutions and informal financial channels in the study area. The main objective of this study was to examine agricultural credit investment in the agricultural sector and credit fungibility which is known as the utilization of agricultural credit in the non-agricultural sector.

Methodology

Study area

This study was conducted in the Shikarpur District of Sindh Province, Pakistan. The total area of the Shikarpur District is 2,512 square kilometers. The 2017 census showed that the total population of the district was 1,231,481, and the total number of households was 207,555. Out of the total population, approximately 303,249 people were living in urban areas, and 928,232 people resided in rural areas (GOP 2017b). Shikarpur District is situated in the northern part of the province, and plays an important role in rice cultivation. The majority of rural households in this region rely on rice cultivation as their major source of employment and livelihood.

Sample size and data

For this study, a three-stage random sampling technique was adopted. In the first stage, we selected the Shikarpur District over several other possible districts because Shikarpur is the main rice growing district of Sindh Province. In the second stage, Lakhi Gullam Shah, an administrative subdivision (taluka) of Shikarpur, was selected at random for the study. In the final stage, 15 landholder farmers were selected randomly from each of 6 villages. These farmers were interviewed personally by means of a pretested questionnaire. Thus, the total sample size was 90 landholder farmers, but we included only 87 landholder farmers as the sample for data analysis in this research. In the district, smallholder farmers need more credit to purchase farm inputs (e.g., feed and fertilizer) and farming implements. In this study, landholder farmers were identified specifically for sampling, and the sample size was set according to the method described by Yamane (1967). Primary data were collected from the respondents by means of a questionnaires. The survey included inquiries about the age of the head of the household, education level, farming experience, amount of credit obtained from different sources, amount of credit used for agriculture, and the amount used for other

purposes. The collected sample size was determined with a margin of error as specified below:

$$n = \frac{N}{1 + Ne^2} \tag{1}$$

Where n indicates the sample size, N indicates the total number of landholder farmers, and e is the margin error.

Analytical techniques

The methodology for the credit margin of investment and credit fungibility in the agricultural sector following (Hussain, 2012) and specified as;

$$CR_F = \frac{CR_f}{\widehat{CR_t}} \times 100 \tag{2}$$

where CR_F indicates the credit fungibility in percentage, CR_f indicates the annual average of credit used for other needs and $\widehat{CR_t}$ represents an annual average of credit obtained from different sources.

The credit margin of investment is specified in the eq. 3 and below;

$$CR_m = \left(\widehat{CR_t} - CR_f \right) \tag{3}$$

$$CR_{in} = \frac{CR_m}{\widehat{CR_t}} \times 100 \tag{4}$$

where CR_m indicates an annual credit margin of investment and CR_{in} indicates credit margin of investment in percentage.

Regression analysis

In this study, the dependent variable is a dummy variable 1 for access to credit from formal sources and 0 for access to credit from informal sources. Consequently, the Probit regression model was used to examine the important factors that influence farmers' access to credit.

$$Y_i = \psi_0 + \psi_1 X_1 + \psi_2 X_2 + \psi_3 X_3 + \psi_4 X_4 + \psi_5 X_5 + \mu_i \tag{5}$$

where Y is access to credit (binary dependent variable), X_1 denotes the age of the household head, X_2 represents education level, X_3 represents farming experience, X_4 represents household size, X_5 represents landholding size, ψ_0 to ψ_5 represents parameters of the model to be estimated and μ_i denotes error term.

Results

The result of Table 1 reports the differences between the means of demographic characteristics of the sample of eighty-seven landholder farmers. The whole sample average age was 38.29 years while smallholder farmers had 36.54 years and medium and large-scale farmers had 41.63 years. The average years of the formal education for the whole sample were 6.36 years, smallholder farmers had 5.35 of education and medium and large-scale farmers had up to 8.30 years of formal education. Furthermore, the

Table 1 Characteristics of Farmers Group

Characteristic	Smallholder farmers ($n = 55$)	Medium & large-scale farmers ($n = 32$)	Total ($n = 87$)	*t*-value
Age (years)	36.54	41.63	38.29	3.03***
Education level (years)	5.35	8.30	6.36	2.99***
Farming experience (years)	26.22	27.43	26.64	0.90
Farm size (acres)	5.67	21.73	11.20	6.31***

Note: *** shows significance at $P < 0.01$

farming experience of smallholder farmers, medium, and large-scale farmers had 26.22 and 27.43 years. Additionally, an average farm size for the whole sample was 11.20 acres while smallholder farmers and medium and large-scale farmers had farm size of 5.67 and 21.73 acres, respectively. The value of T-test showed a significant difference between smallholder farmers and medium and large-scale farmers with respect to their age, education level, and farm size. On the other hand, there was no significant difference in farming experience among the group of farmers.

Table 2 reports the results of credit margin of investment in the agricultural and credit fungibility by farmer's group. The total annual average of credit is Rs. 58,547.368 and Rs.135833.3 were received by smallholder farmers and medium and large-scale farmers. Furthermore, results showed that amount of out of total credit, Rs. 30,167.68 and Rs. 76,763.27 had invested per year in the agricultural by smallholder farmers and medium and large-scale farmers (see Table.2). Additionally, the results revealed that there was a big amount of fungibility in the total credit acquired by a group of farmers in the study area. The majority of farmers had utilized credit for non-agricultural purposes. In the study area, farmers had utilized their credit in family expenditures, health, education and other businesses respectively. Regarding credit, fungibility results showed that around 48.47% and 43.49% had the credit fungibility by smallholder farmers and medium and large-scale farmers. Among smallholder farmers, credit fungibility was observed more than those of medium and large-scale farmers. Our findings are consistent with the findings of (Ayaz and Hussain 2011), who compared to medium and large farmers that they used more credit in consumption, social activities and off-farm activities other than agriculture activities. Out of total amount of credit, 51.53% of funds had invested in agriculture by smallholder farmers. Whereas, 56.51% of credit had invested by medium and large-scale farmers. In the study area, it was observed that medium and large-scale farmers had more invested in agriculture than smallholder farmers. T-test value indicated that there is a highly significant difference in credit

Table 2 Credit Margin of Investment in the Agricultural Sector and Credit Fungibility

Farmer's Group	Credit received by farmers	Credit Margin of Investment	%age of Credit Investment	Credit Used for Other Needs	%age of Credit Fungibility
	$\widehat{CR_t}$	CR_m	CR_{in}	CR_f	CR_F
Smallholder farmers (55)	58,547.368	30,167.68	51.53	28,379.68421	48.47
Medium and large-scale farmers (32)	135,833.3	76,763.27	56.51	59,070.07	43.49
T-test = 11.93789***; *P*-value(0.000)				1.41739*; *P*-value(0.0831)	

NB: *** and * show significance at 1% and 10%
Source: Computed from data from field survey, 2016

investment in agriculture and credit fungibility between smallholder farmers and medium and large-scale farmers.

The amount of agricultural credit invested by a group of farmers in the agricultural is further analyzed and the results are presented in Table 3. Regarding the land preparation and investment, it was a highly significant difference was observed among the group of farmers. For instance, on the average amount of agricultural credit had more invested by medium and large-scale farmers than smallholder farmers ($p < 0.01$). Similarly, in seeds, chemical fertilizers, insecticides, irrigation and in labor investment the farmers were found significantly different ($p < 0.01$). The medium and large farmers have more investment as compare to smallholder farmers, and the smallholder farmers invested more about Rs. 8288.59 for the land preparation as compared to other activities. Similarly, Rs. 22,140.00 more invested in land preparation than seeds, chemical fertilizers, insecticides, irrigation and in labor cost by medium and large farmers.

Determinants of rice farmers' access to credit

The determinants of rice farmers' access to credit were estimated employing probit regression model, and the estimated results were illustrated in Table 4. The analysis shows that formal education, household size, and farm size were the important factors influencing rice farmers' access to credit in the study area. However, the age of the rural household head has a negative effect on access to credit while rice farming experience has a statistically insignificant influence access to credit.

Discussion

Agricultural credit is an important component of all economic activities like agriculture. Proper utilization of agricultural credit has dominant role to get high crop productivity, the results of Tables 2 and 3 reveal that the medium and large-scale farmers had invested more in purchasing of main farm inputs like seeds, fertilizers and pesticides as well as in the preparation of land, irrigation and labour. Further results show that medium and large-scale farmers had relatively low fungibility than smallholder farmers in the study area. Our results are consistent with the findings of (Hussain 2012), who highlighted that smallholder farmers had more credit fungibility than large-scale farmers in the Punjab, Pakistan. Further, the findings of the study are also consistent with (Akram and Hussain 2008; Hussain and Thapa 2012, 2016; Nosiru

Table 3 Investment of Credit in the Agricultural Sector by Farmers Group

Investment	Smallholder farmers (n = 55)	Medium & large-scale farmers (n = 32)	*t*-value
Land preparation	8288.59	22,140.00	13.11***
Seeds	4998.24	15,133.30	8.40***
Chemical fertilizers	6982.45	17,956.67	7.91***
Insecticides	2889.47	3805.00	2.96***
Irrigation	3205.24	8489.96	6.86***
Labour	3803.66	9238.33	10.06***

NB: *T-test* was applied to test for difference of investment of credit in the agricultural sector by farmer's group
***shows significance at $P < 0.01$
Source: Field survey data, 2016

Table 4 Results of Probit Regression

Variable	Coefficient	Std. Error	z-value	P > z	Marginal effect
Age	−0.0059	0.0267	−0.22	0.823	−0.0018
Education	0.0909**	0.0452	2.01	0.045	0.0277**
Experience	0.0128	0.0246	0.52	0.601	0.0039
Household size	0.1550**	0.0720	2.15	0.031	0.0473**
Farm size	0.1452***	0.0407	3.56	0.000	0.0443***
Constant	−2.7000	1.2554	−2.15	0.031	

Number of observation Log likelihood LR chi2(5) Prob > chi2 Pseudo R^2 (87) (−41.0622) (33.36) (0.000) (02889)

*** and ** show significance at $P < 0.01$ and $P < 0.05$
Source: Field survey data, 2016

2010; Saqib et al. 2017), who reported that the agricultural credit was used for non-agricultural purposes, for instance in education, health, consumption, festivals and repayment of loans. Several researchers adopted different econometric techniques for the data analysis such as Probit regression model, Logit and as well as Tobit regression model because of the nature of data. However, in our study, we have adopted Probit regression model to examine the determinants of rice farmers' access to credit. Various socioeconomic factors are influencing access to credit. The results of regression analysis are presented in Table 4. Age of the household head has a negative relationship with access to agricultural credit showing that when the age of the household increases, access to agricultural credit decreases. The results agree with the findings of Sebopetji and Belete (2009). Marginal effects of age of the household head reveal that as age increases by one unit, the probability of access to agricultural credit decreases by 0.0018%. Formal education has a positive and significant association with agricultural credit. The results of marginal effects indicate that if education level of the household increases by one unit, it increases access to credit by 0.0277%. This means that formal education plays an important role. Farmers with a high level of education could better understand the terms and conditions and the procedure of getting loans. Furthermore, household size has a positive and significant linkage with credit. Marginal effects of household size reveal that as household size increases by one unit, the probability of access to agricultural credit increase by 0.0473%. The findings of this study are consistent with the results of (Adeagbo and Awoyinka 2006; Duniya and Adinah 2015; Okunade 2007; Ugwumba and Omojola 2013). Additionally, farm size has a positive and highly significant relationship with access to agricultural credit. Its corresponding results of marginal effects reveal that if farm size increase by one unit access to credit increase by 0.0443%. Therefore, the farm size is a very important socioeconomic factor in accessing credit from formal financial sources. Also, it is a symbol of high social status in the society which helps in obtaining credit from informal financial channels. The results of this study are consistent with findings of (Ahmad et al. 2016; Hussain and Thapa 2012; Ugwumba and Omojola 2013).

Conclusion and policy implications

This study demonstrates that the credit margin of investment in the agricultural sector and credit fungibility among a different group of farmers in the district Shikarpur, Sindh, Pakistan. The findings of our study showed that formal financial institutions and informal financial channels used to provide agricultural credit to farmers in the study

area. Majority of smallholder farmers received agricultural credit from informal financial channels. Almost both group of farmers had fungibility in the amount of agricultural credit. In a different group of farmers, smallholder farmers have used a considerable proportion of their loans for other non-agriculture purposes while medium and large-scale farmers had more invested in every agricultural activity. Most of the smallholder farmers were in inadequate of funds, and out of this credit they could not solve their farm problems, therefore smallholder farmers diverted this amount to other non-agricultural purposes. Further, the results of probit regression model reveal that formal education, farming experience; household size and farm size have a positive and significant influence on the farmers' access to agricultural credit. Based on the findings, the study recommends that the government needs to ensure more supply of agricultural credit to the farmers which can eliminate their dependency on informal financial channels. Increased the supply of agricultural credit can enhance the agricultural productivity and welfare of the farmers, provide adequate resources to fulfill domestic needs of the farmers, and ultimately decrease credit fungibility. Additionally, there is need of strong monitoring by formal financial institutions in order to avoid the credit fungibility.

Abbreviations
GDP: For Gross Domestic Product; GOP: Government of Pakistan; IFC: International Finance Corporation; WB: World Bank

Availability of data and materials
All data and materials are available in this paper, so there is no other data to present.

Authors' contributions
Dr. Abbas Ali Chandio has designed the study by drafting the introduction and contributed in the data collection, analysis of the data and discussion part of the manuscript. Prof. Yuansheng Jiang has supervised the entire process of the research. Dr. Abdul Rehman has contributed in summarizing the literature review and critically evaluated and proof read the manuscript. All authors read and approved the final manuscript.

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Competing interests
The authors of this paper declare that they have no competing interests.

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