

Effects of agricultural credit on wheat productivity of small farms in Sindh, Pakistan

Are short-term loans better?

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Abstract

Purpose – The purpose of this paper is to evaluate the impact of short-term loan (STL) vs long-term loan (LTL) on wheat productivity of small farms in Sindh, Pakistan.

Design/methodology/approach – The econometric estimation is based on cross-sectional data collected in 2016 from 18 villages in three districts, i.e. Shikarpur, Sukkur and Shaheed Benazirabad, Sindh, Pakistan. The sample data set consist of 180 wheat farmers. The collected data were analyzed through different econometric techniques like Cobb–Douglas production function and Instrumental variables (two-stage least squares) approach.

Findings – This study reconfirmed that agricultural credit has a positive and highly significant effect on wheat productivity, while the short-term loan has a stronger effect on wheat productivity than the long-term loan. The reasons behind the phenomenon may be the significantly higher usage of agricultural inputs like seeds of improved variety and fertilizers which can be transformed into the wheat yield in the same year. However, the LTL users have significantly higher investments in land preparation, irrigation and plant protection, which may lead to higher wheat production in the coming years.

Research limitations/implications – In the present study, only those wheat farmers were considered who obtained agricultural loans from formal financial institutions like Zarai Taraqiati Bank Limited and Khushhali Bank. However, in the rural areas of Sindh, Pakistan, a considerable proportion of small-scale farmers take credit from informal financial channels. Therefore future researchers should consider the informal credits as well.

Originality/value – This is the first paper to examine the effects of agricultural credit on wheat productivity of small farms in Sindh, Pakistan. This paper will be an important addition to the emerging literature regarding effects of credit studies.

Keywords Pakistan, Cobb–Douglas, IV approach, Short-term loan, Wheat productivity

Paper type Research paper

1. Introduction

For the modernization of agriculture and rural economic development, agricultural credit plays a vital role. The modernization of agriculture is the process of introducing modern technologies, improving human resources, managing natural resources and environment; however, agricultural credit remains one of the most important factors. Agricultural credit provides an opportunity to farmers for sufficient use of inputs, adoption of modern technologies and more proper allocation of resources to enhance food security and eradicate poverty (World Bank, 2003). Financing of agricultural production, especially through the provision of credit to small-scale farmers, remains the key to macroeconomic development induced by agriculture (Anetor *et al.*, 2016). In Pakistan, the government has implemented a policy to improve farm production and food security by providing agricultural credit to smallholder farmers. The policy was partially successful in increasing the proportion of



households for receiving credit. However, it was less successful to fulfill the demand of farmers (Hussain and Thapa, 2012). This has led to a large gap between the demand for and the supply of credit. Agricultural credit has an essential role in enhancing agricultural production in Pakistan. Researchers showed that agricultural credit positively affected agricultural production yield per acre after controlling the education of farmers and family size (Hussain and Thapa, 2012; Rahman *et al.*, 2014; Saqib *et al.*, 2016; Abdallah, 2016). Previous literature attempted to explain that agricultural credit has a positive and significant impact on agricultural productivity. For example, credit has increased application of fertilizer and pesticides, irrigation and mechanization of agricultural production. Various researchers (e.g. Iqbal *et al.*, 2003; Khandhar and Faruqee, 2003; Rahman *et al.*, 2014; Akudugu, 2016) argue that credit enables farmers to purchase seeds of improved varieties, high efficiency pesticides and fertilizers; therefore, agricultural production increases in a timely and appropriate manner. Few studies, however, have focused on the impact of agricultural credit on wheat productivity in Pakistan. Bashir *et al.* (2010) examined the impact of credit on wheat productivity by using Cobb–Douglas production function and concluded that the impact of agricultural credit comes through using more wheat seeds per acre, more fertilizers and pesticides per acre, better irrigation and more efficient land preparation. Similarly, Ahmad *et al.* (2015) observed that agricultural credit has a significant impact on wheat productivity.

Despite the large amount of research on the role of agricultural credit, the researchers treated agricultural credit as a whole. As we know, the loan can be classified into short-term loan (STL), medium-term loan and long-term loan (LTL) according to the loan period. The STL with a period of one year or less is actually working capital loan mainly used for purchase of agricultural inputs such as seeds of improved varieties, fertilizers and pesticides, while the medium- and LTLs with a period of more than one year are mainly used to invest in fixed assets such as water pumps, tube wells, tractors, and other agricultural related machinery. The policy-makers, bankers and farmers may care about whether or not the STLs have a stronger effect on agricultural productivity than medium- and LTLs. The present study differs from previous researches by attempting to compare the effects of short-term and LTLs on wheat productivity in Sindh Pakistan (to simplify the analysis, the medium- and LTLs are combined and called LTL). Small-scale farmers demand both STL and LTLs. Therefore, it is very interesting and highly policy-related to analyze and compare the effects of STL and LTL on wheat productivity. The remainder of the paper is organized as follows: in sections 2 and 3, we describe the term-wise position of agricultural credit disbursed by Zarai Taraqiati Bank Limited (ZTBL) in Sindh province of Pakistan and province-wise wheat production and area under cultivation in Pakistan. Section 4 reviews related literature on impact of credit on crop productivity. In section 5, we give information on the data and methodology. Next, the estimation results are presented and discussed in section 6. Finally, the conclusion and policy implications are summarized in section 7.

2. Agricultural credits disbursed by ZTBL in Sindh, Pakistan

In Pakistan, formal agricultural credit is mainly provided to farmers through ZTBL, commercial banks, domestic private banks, cooperatives and Khushhli Bank Limited. These formal sources of credit are working under the supervision of State Bank of Pakistan. The demand of agricultural sector for agricultural credit has been increasing for many years in Pakistan. The ZTBL was established in 1951. ZTBL has a team of 1441 mobile credit officers, 354 branches and 51 regional offices in all over the country. ZTBL is the first bank of Pakistan erstwhile Agricultural Development Bank of Pakistan (ADBP) that provides various loan schemes including Awami Zarai Scheme (farm credit and non-farm credit), Kissan Dost Loan Scheme, Sada Bahar Loan Scheme, One Window Operation Loan Scheme,

Asan Qarza Loan Scheme, Shamsi Tawanai Loan Scheme, Rural Development Loan Scheme, and Crop Loan Insurance Scheme for the development of agriculture sector. ZTBL is considered one of the most important formal sources of agricultural credit in Pakistan.

The basic aim of the ZTBL ever since its establishment entails granting loans to farming communities for agricultural development in Pakistan. The total volume of agricultural credit increased from PKR 10,260.5m to PKR 64,897.29m in Pakistan during the period 1996–2010. The same trend was found in the Punjab province of Pakistan where during the same period the total amount of agricultural credit increased from PKR 8,143.54m to PKR 52,995.25m. Similarly, agricultural credit of Sindh province increased steadily from PKR 1,439.31m to PKR 8,093.51m. The province-wise agricultural credit disbursed by ZTBL is depicted in Figure 1 (GOP, 2011).

Furthermore, ZTBL makes short-term, medium-term and LTLs to the farmers. STL is made to the farmers for working capital that is mainly used to purchase improved variety seeds, fertilizers, and pesticide. Medium- and LTLs are provided to farmers for fixed capital that is used to purchase farm implements and improvement of the land tractor, tubewell, farm machinery and land consolidation. The volume of short-term credit increased from PKR 6,122.45m to PKR 57,281.46m, a medium-term loan from PKR 522.26m to PKR 5,265.28m. In contrast, LTL decreased from PKR 3,615.79m to PKR. 2,350.55m from 1995 to 2014. The same pattern was found in Sindh province of Pakistan where during the same period the short-term credit and medium-term credit increased from PKR 1,042.09m to PKR 7,535.50m and PKR 92.82m to PKR 433.96m, respectively. There existed ups and downs in long-term credit in Sindh province of Pakistan where this loan decreased from PKR 304.40m in 1995 to PKR 124.05m in 2014. The term-wise position of agricultural credit disbursed by ZTBL in Sindh province of Pakistan is shown in Figure 2 (GOP, 2011).

Purpose-wise, the loans disbursed to farmers can be classified into eight categories. The loan for fertilizers was the highest annually, followed by seeds since 2001. The amount of total loan increased from PKR 3,159.6m to PKR = 27,495.1m from 1995 to 2010. The amount of loans disbursed for fisheries was the lowest, increasing from PKR 7.0m to 3.1 million in Pakistan in the period 1995–2010. The amount of loans used for fertilizers increased generally, from PKR 488.5m to PKR 3,617.0m in the period 1995–2010 as depicted in Figure 3 (GOP, 2011).

3. Province-wise wheat production and area under cultivation in Pakistan

Wheat is the major cereal crop and it is a staple food of the Pakistani population. It is also a globally traded commodity (Wajid, 2004). In Pakistan almost 80 percent of the farmers grow wheat (Hussain *et al.*, 2012). Figures 4 and 5 show the province-wise wheat production and

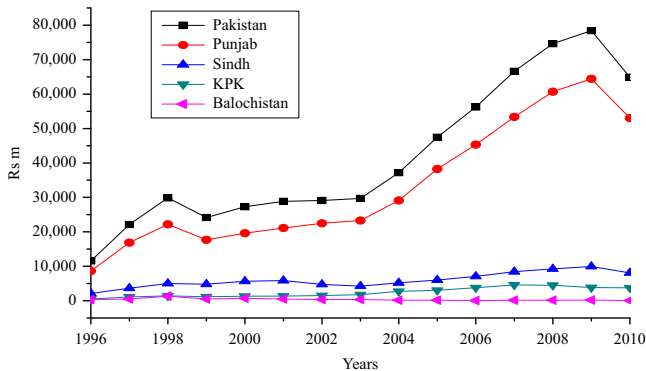
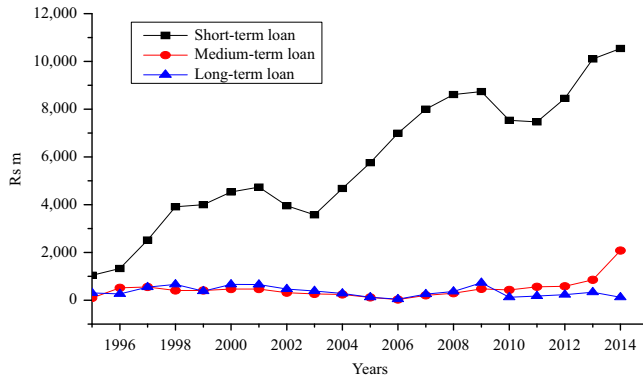


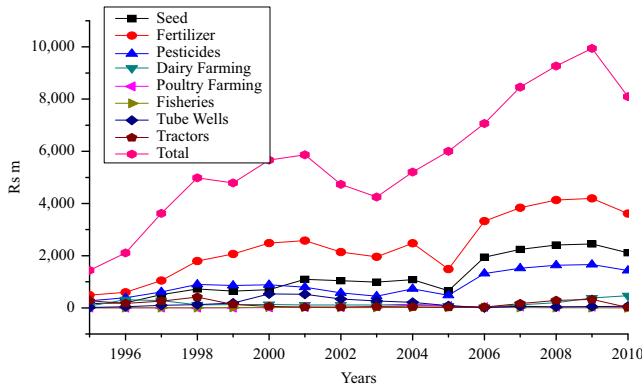
Figure 1.
Province-wise
agricultural credit
disbursed by ZTBL
in Pakistan

Source: GOP (2011)



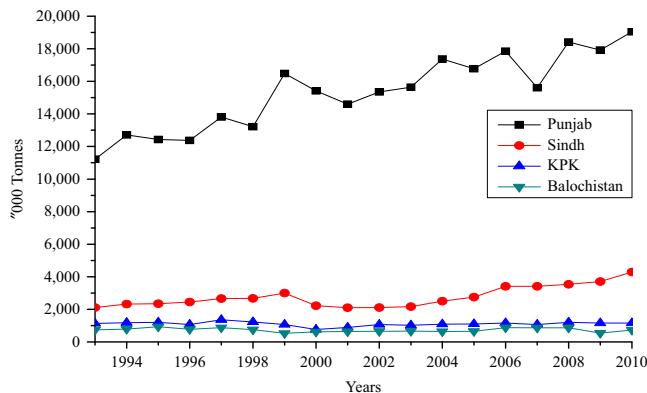
Source: GOP (2011)

Figure 2. Term-wise agricultural credit disbursed by ZTBL in Sindh province of Pakistan



Source: GOP (2011)

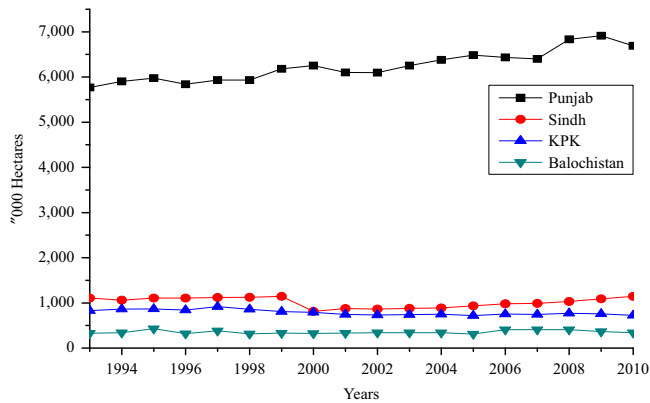
Figure 3. Purpose-wise agricultural credit disbursed by ZTBL in Sindh province of Pakistan



Source: GOP (2011)

Figure 4. Province-wise wheat production in Pakistan

Figure 5.
Province-wise
area under wheat
cultivation in Pakistan



Source: GOP (2011)

land area under cultivation over the period 1993–2011. It is clear that wheat production is higher and cultivated area is larger in Punjab province as compared to those in Sindh, KPK and Balochistan provinces of Pakistan, respectively. Punjab province is the largest wheat producer, while Sindh is the second largest one in wheat production and area under cultivation. Even though Sindh is not the largest producer, it is a good case study for wheat production in Pakistan. Hence, we select Sindh province of Pakistan as the sampling area of the research.

4. Review of literature

Credit has a positive impact on agricultural development and generates employment opportunities in rural areas (CBCR, 2004). Agricultural household models not only show that farm credit is required with the limitations of self-financing, but also explain the level of output and the time interval between inputs and outputs (De Janvry and Sadoulet, 1995). World Bank (2006) reported that access of smallholder farmers to formal financial services in rural areas is deficient in spite of the growth in credit distribution worldwide. Boucher *et al.* (2006) explained that agricultural production constitutes 40 percent of the credit reserved population in Honduras and Peru, with credit reserved production average from 50 percent to 75 percent of the acquired input. Various researchers studied impact of agricultural credit on agricultural productivity in different regions of the world (e.g. Chaudhry and Hussain, 1986; Carter, 1989; Feder *et al.*, 1990; Shrestha, 1992; Zeller *et al.*, 1998; Iqbal *et al.*, 2003; Siddiqi and Baluch, 2009; Khan *et al.*, 2007; Sial *et al.*, 2011; Chandio, Jiang, Joyo and Rehman, 2016; Chandio, Yuansheng, Sahito and Larik, 2016), and found that agricultural credit had a significantly positive impact on agricultural productivity. No doubt, agriculture is the main means for improving the socio-economic conditions of the farmers. In the context of developing countries, credit is an important tool for increasing farm production (Okurut *et al.*, 2005). The role of credit markets in food production is recognized worldwide. In rural Pakistan, the importance of credit for increasing agricultural production and improving socio-economic conditions of the rural households has been highlighted by previous studies. For instance, Zuberi (1989) found that 70 percent of total formal credit was used for the purchase of primary farm inputs and concluded that increases in agricultural productivity can be explained by changes in the number of farm inputs such as seeds, fertilizers, and pesticides. Likewise, Malik *et al.* (1991) used a two-stage structure model where the probability of taking formal credit is predicted in the first stage and the predicted value is used in the second stage to

examine the impact of fertilizer use per acre. Chandio, Jiang, Joyo and Rehman (2016), Chandio, Yuansheng, Sahito and Larik (2016) investigated the impact of institutional credit, cultivated area, fertilizers consumption and water availability on wheat productivity for the 1982 to 2011 period. Using the OLS method, the estimates show that institutional credit, cultivated area and water availability have a positive impact on wheat productivity in Pakistan. Another study of von Braun *et al.* (1993) shows that smallholders having access to formal credit have 37 percent higher input expenditures than those who do not have access to formal credit. Similarly, other researchers have found negative impact of lack of access to credit on farm production in developing countries such as in Pakistan (Sial and Carter, 1996), India (Kochar, 1997), Kenya and Ethiopia (Freeman *et al.*, 1998), Peru (Guirking and Boucher, 2008), Vietnam (Duong and Izumida, 2002) and Tunisia (Foltz, 2004). Thus, agricultural productivity can be boosted through the timely availability of credit which enables farmers to purchase farm inputs like high yield seeds, fertilizers, pesticides and modern farm machinery. Another interesting debate is whether credit to small farms is more productive than credit to large farms. Khandker and Faruqee (2003) observed that agricultural loan disbursed to small-scale farmers is more effective and suitable for farm production than that disbursed to the large-scale farmers. The ADBP gave more facilities and loans to the large-scale farmers than the small-scale farmers, while the loans given to small-scale farmers are proved to be more productive than those given to the large-scale farmers. It also played a very important role in the development of the lifestyle of the small-scale farmers and in reducing their poverty too. Similarly, Iqbal *et al.* (2003) suggested that the formal sources of credit should be encouraged to expand the agricultural credits for farming sector, especially small-scale farmers. Another study by Fayaz *et al.* (2006) found that agricultural credit schemes launched by ZTBL had a significantly positive impact on agriculture production and income of the rural households. Nasir (2007) examined that agricultural credit played an important role in agriculture development. It helps smallholders to undertake new investments and adopt new agricultural technologies to enhance agricultural productivity. Lack of access to formal credit has a negative effect on farm production and well-being. Chandio *et al.* (2017) examined the smallholder farmers' access to agricultural credit in Sindh province of Pakistan. Using the probit model, estimates reveal that a number of socio-economic factors including household size, farming experience, off-income and availability of collateral significantly influenced on smallholder farmers' access to agricultural credit. Chachar (2007) investigated that agricultural credit is the need of both smallholders and large holders for production and development. In Pakistan, almost 95 percent farmers have a landholding size less than 25 acres. In rural areas, the institutional agricultural credits are negligible except that disbursed by ZTBL. Due to complicated procedure of documentation, small-scale farmers lose their interest to apply for agricultural credit from formal sources. Most smallholder farmers prefer to purchase the agricultural inputs at double prices payable after the sales of their products. In the existing literature, there are few works that have been done to compare effects of different terms of agricultural credit on wheat productivity. Therefore, this study attempts to empirically analyze the effects of short term and long term of agricultural credits on wheat productivity of small farms in Sindh, Pakistan.

5. Data and methodology

5.1 Study area

Sindh is the second highest populated province in Pakistan with a total population of 42.4 million covering a land area of about 140,914 square kilometers representing the third largest province in Pakistan. Data of this study is derived from a wheat farmer survey in

three districts of Sindh in Pakistan (i.e. Shikarpur, Sukkur and Shaheed Benazirabad). The main food crops cultivated in these districts are wheat, rice, potato, while the main cash crops are sugarcane, cotton, tomato, chilies and onion (GOS, 2010).

5.2 Data and variables of the study

In this study, primary data were used. Data were collected from a sample of 180 wheat growers who were selected from three districts of Sindh, Pakistan (i.e. Shikarpur, Sukkur and Shaheed Benazirabad). The random sampling technique was applied for selection of farms. The sample of this study contains only those wheat growers who have acquired credits from ZTBL and Khushhali Bank (KB). Primary data were gathered using a modified version of a structured questionnaire adapted from (Okunade, 2007). The questionnaire covers both open and closed-ended questions. This study used yield of wheat as a dependent variable while per acre costs of major agricultural inputs such as seed, land preparation, fertilizers, plant protection, irrigation and labor and the amount of credit obtained by the wheat growers from ZTBL and KB used as independent variables. Also, various socio-economic characteristics of the borrowers including age, education level, household size, farming experience and landholding size were used. The analysis was done using both software SPSS version 22 and STATA version 13.

5.3 Main research method

Several researchers used different econometric techniques to see impact of credit on crop productivity in different parts of the world. Jacobson and Schedvin (2015) applied logistic and OLS methods to empirically analyze the trade credit and the propagation of corporate failure. The research has been published in world leading journal *Econometrica*. Bashir (2010) used Cobb–Douglas production function to estimate the impact of credit on rice productivity by treating institutional credit as a whole. Likewise, Ahmad *et al.* (2015) applied Cobb–Douglas production function to examine the impact of agricultural credit on wheat productivity in district Jhang, Pakistan. Afrin *et al.* (2017) employed stochastic production frontier approach for assessing the impact of financial inclusion on technical efficiency of paddy farmers in Bangladesh. Likewise, Abdul-Hanan Abdallah (2016), utilized probit model at the first stage, while stochastic frontier approach at the second stage, to estimate the impact of credit on technical efficiency of Ghanaian maize farmers. The present study is different from the previous studies, in which the researchers treated agricultural credit as a whole to see the impact of credit on wheat productivity, but the present study tried to classify agricultural credits to see the impacts of different term of loans on wheat productivity. Therefore, this study is carried out with three steps. The first step is to estimate the effect of STL on wheat productivity based on a multiple logarithm linear regression (MLLR). The second step is to estimate the impact of LTL on wheat productivity based on a MLLR with the same explanatory variables except the variable of LTL. The last step is to compare the coefficients of STL as well as LTL on wheat productivity in the study area. Following the previous literatures, in this study we used Cobb–Douglas production function to examine the effects of agricultural credits on wheat productivity. Cobb–Douglas production function approach helps to understand the impact of explanatory variables (for instance, costs of farm inputs such as seed, land preparation, fertilizers, pesticides, irrigation, labor and amount of the short-term and the LTLs) on wheat productivity. The model was used by (Bashir *et al.*, 2010; Nadia and Chughtai, 2012; Ahmad *et al.*, 2015; Abdallah, 2016; Afrin *et al.*, 2017). Cobb–Douglas production function can be written as follows:

$$Y = AX_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} \quad (1)$$

Taking the natural logarithm of Equation (1) and considering the case of seven explanatory variables, Equation (1) converts to the following form:

$$\begin{aligned} LOGY = & \beta_0 + \beta_1 LOGX_1 + \beta_2 LOGX_2 + \beta_3 LOGX_3 + \beta_4 LOGX_4 + \beta_5 LOGX_5 \\ & + \beta_6 LOGX_6 + \beta_7 LOGX_7 + \mu_i \end{aligned} \tag{2}$$

This study examines the effects of STL and LTL on wheat productivity and for this regression estimation we used Equation (2). After estimation of the effects of STL and LTL, than now we compare the regression coefficients of STL and LTL by a dummy variable and for this estimation the following equation is used:

$$\begin{aligned} LOGY = & \beta_0 + \beta_1 LOGX_1 + \beta_2 LOGX_2 + \beta_3 LOGX_3 + \beta_4 LOGX_4 + \beta_5 LOGX_5 \\ & + \beta_6 LOGX_6 + \beta_7 X_7 + \mu_i \end{aligned} \tag{3}$$

In order to deal with the selection bias, this study used the instrumental variable (IV) approach in the analyses estimated with a two-stage least squares (2SLS) method. The 2SLS method has been widely used (Hahn and Hausman, 2002; Murray, 2006) since the approach is suitable to deal with the problems of endogeneity caused by simultaneity, measurement errors or omitted variables among others (Cameron and Pravin, 2009; Greene, 2008; Wooldridge, 2009).

5.4 Hypothesis of the research

The following hypotheses have been formulated to examine the effect of the STL in comparison with a medium- and LTL on the wheat productivity of small farms in Sindh, Pakistan:

- H0. STL has a no bigger impact on wheat productivity increase than LTL.
- H1. STL has a bigger impact on wheat productivity increase than LTL.

6. Results and discussion

6.1 Descriptive analysis

Table I presents summary statistics of socio-economic characteristics of the surveyed households. The descriptive statistics reveal that the average age of wheat farmers is approximately 41 years. It can, therefore, be stated based on the results that the majority of wheat farmers are in their youthful age and very energetic to carry out the farming-related activities. Farmers, on average, had seven years of formal education, which means that the educational level does not only improve the efficiency of the farmers but also improve their capability to understand and adopt new farming techniques (Olagunju and Adeyemo, 2007). Generally, it is understood that farmers who had more experience of farming might be more efficient and productive through trial and error (Olagunju and Adeyemo, 2007). The results show that the wheat farmers have on average

Variables	Description	Mean	SD	Min.	Max.
Age	Number of years of household head	41.1778	8.881061	26	69
Education	Years of formal education of the head	6.80556	5.120991	0	16
Experience	Experience of the sample respondents in years	28.3722	7.214224	18	50
Household size	Number of persons in the household	8.96667	2.46064	5	15
Farm size	Number of acres	13.2148	11.55887	2	62

Source: Researchers' own calculations, Field Survey (2016)

Table I.
Socio-economic characteristics of the surveyed households

28 years of farming experience. In the study area, the mean household size is nine people. The average landholding in the study area is about 13 acres. The landholding size is an important factor in accessing agricultural credit from formal sources and it is also a symbol of high social status in the society which helps acquire credit from informal financial channels (Hussain and Thapa, 2012; Saqib *et al.*, 2016).

Credit is the basic component of all economic activities like agriculture. Availability and adequate agricultural credit affect crop productivity in the way it facilitates the farmers to purchase improved farm inputs at the sowing time. In Pakistan, formal credit sources provide two main types of agricultural loans which include STL scheme and LTL scheme. The short-term loan scheme is provided for the acquisition of farm inputs including improved seed varieties, fertilizers and pesticides and the maximum duration of this credit scheme is 18 months. The LTL scheme is provided for the purchase of tubewell equipment, machinery and farm implements, reclamation of land, building, and the period of this scheme is 5 to 7 years (Iqbal *et al.*, 2003; Miah *et al.*, 2006). Table II reports that the majority (75.3 percent) of the respondents were STL users while (24.7 percent) of the respondents were LTL users. The results show that the maximum amount of agricultural credit received by the LTL users was PKR 1,000,000.00 with a mean value of PKR 353,104.55 whereas the STL users obtained the maximum amount of agricultural credit was PKR 700,000.00 with on average amount of credit was PKR 253,407.31.

Table III presents summary statistics (minimum, maximum and mean) of the important variables used in the empirical analysis. It reveals that the mean yield per acre of the sampling farms was 38.18 maunds with a minimum of 16.00 maunds and a maximum of 60.00 maunds. The mean per acre seed used was 57.27 kgs while it ranged from 50.00 kgs to 80.00 kgs per acre. Furthermore, the results show that average cost of fertilizers per acre was PKR 9,871.333 with a minimum of PKR 3,700.00 and a maximum of PKR 13,700.00. Similarly, the mean cost of irrigation per acre including canals and tubewell was PKR 1,650.872. Additionally, the average cost of pesticides per acre was PKR 1,008.88.

Table II.
Amount of loan
obtained by STL
users and LTL
users (PKR)

Loanees	Frequency	Percent	Min.	Max.	Mean
STL users	135	75.3	20,000.00	700,000.00	253,407.31
LTL users	45	24.7	70,000.00	1,000,000.00	353,104.55
Total	180	100.0	90,000.00	1,700,000.00	606,511.86

Note: SLT, short-term loan users; LTL, long-term loan users

Source: Researchers' own calculations, Field Survey (2016)

Table III.
Summary statistics of
agricultural inputs

Variables	Unit	Min.	Max.	Mean
Yield of wheat per acre	Maunds	16.00	60.00	38.18
Seed used per acre	Kg	50.00	80.00	57.27
Fertilizers cost per acre	PKR	3,700.00	13,700.00	9,871.33
Pesticides cost per acre	PKR	600.00	1,800.00	1,008.88
Irrigation cost per acre	PKR	200.00	5,000.00	1,650.87
Labor cost per acre	PKR	1,200.00	5,625.00	3,205.61
Amount of loan	PKR	20,000.00	960,000.0	280,639.2

Note: 1 maund = 40 kilograms; kg = kilogram; PKR = Pakistani rupees

Source: Researchers' own calculations, Field Survey (2016)

Finally, the mean amount of agricultural credit was PKR 280,639.2 with a minimum of PKR 20,000 and maximum of PKR 960,000.0

Table IV reports the mean difference of the yield of wheat and key agricultural inputs of STL users and LTL users in the study area. The mean area cultivated by STL users and LTL users are 15.794 and 18.979 acres. The most notable finding of the study is that STL users produced on average 6 maunds per acre more yield of wheat than LTL users, which is statistically significant at 1 percent level. Further findings of the study reveal that the average 2.6 kg more seed used by STL users compared to LTL users and there is negative significant difference at 10 percent. The cost differences in seed and fertilizers are negative and significant at 1 percent and 5 percent, indicating that STL users had invested more in purchasing improved wheat varieties and chemical fertilizers compared to LTL users to get high wheat productivity and improve income. These results are in line with the findings of Hussain and Thapa (2012), Ahmad *et al.* (2015) and Saqib *et al.* (2016). They reported that agricultural credit was used for purchasing of improved farm inputs. On the contrary, cost differences in land preparation, irrigation, and labor are positive and significant at 1 and 10 percent, demonstrating that LTL users had invested more in land preparation, better irrigation and labor as compared to STL users. A preliminary tendency can be found that the STL users have a preference for short-term, quick-acting farm inputs while the LTL users have a preference for long-term, long-acting ones.

6.2 Empirical analysis

6.2.1 Effects of short-term loan and long-term loan on wheat productivity with MLLR. First, we have examined the effect of STL on wheat productivity and the results of MLLR are presented in Table V. Cobb–Douglas production function has been used, so the estimated coefficients are actually elasticities of production. The coefficient of STL is ($\log \text{STL} = 0.115604$), which implies that wheat productivity will increase by 0.11 percent if increasing the use of STL by 1 percent. The computed *t*-value for this coefficient is 5.00; this shows that the coefficient is highly statistically significant at 5 percent level. The role of formal agricultural credit in increasing farm production and improving the livelihood of the farmers is recognized worldwide. The maximization of profit is the main aim of every producer. It is evident that short-term credit is an important tool for increasing wheat productivity and improving the living standards of wheat farmers. In rural areas of Sindh, Pakistan, farmers preferred short-term credit to purchase major agricultural inputs including improved variety seeds, fertilizers, pesticides and to invest in land improvement and agricultural machinery. The short-term agricultural loan is normally disbursed by

Variables	Short-term loan users	Long-term loan users	Difference	<i>t</i> -value
Cultivated area (acre)	15.794	18.979	3.184	0.635
Wheat yield (maunds)	40.318	34.159	-6.159	-4.108***
Seed rate (kg)	57.159	54.545	-2.613	-1.826*
Seed cost (PKR)	2,856.250	2,685.454	-170.795	-1.985**
Land preparation cost (PKR)	4,132.954	4,565.909	432.954	2.693***
Fertilizers cost (PKR)	10,347.727	9,622.500	-725.227	-2.466***
Pesticides cost (PKR)	881.818	1,021.590	139.772	2.293
Irrigation cost (PKR)	1,890.909	2,237.886	346.977	1.865*
Labor cost (PKR)	2,108.181	2,744.045	635.863	3.598***

Note: *, **, ***Significant at 10, 5 and 1 percent levels, respectively

Source: Researchers' own calculations, Field Survey (2016)

Table IV.
Difference in yield
of wheat and key
inputs of STL users
and LTL users

Code	Variables	STL			Variables	LTL		
		Coefficient	t-value	p-value		Coefficient	t-value	p-value
$\log X_1$	Seed cost	0.55613***	3.62	0.001	Seed cost	0.65207***	4.14	0.000
$\log X_2$	Land preparation cost	0.15143	1.40	0.166	Land preparation cost	0.18854*	1.68	0.096
$\log X_3$	Fertilizers cost	0.25450**	2.04	0.044	Fertilizers cost	0.28337**	2.20	0.031
$\log X_4$	Pesticides cost	-0.00804	-0.11	0.914	Pesticides cost	-0.05521	-0.71	0.479
$\log X_5$	Irrigation cost	0.01409	0.46	0.646	Irrigation cost	0.01702	0.54	0.593
$\log X_6$	Labor cost	0.37050***	8.22	0.000	Labor cost	0.31899***	7.18	0.000
$\log X_7$	Short-term loan	0.11560***	5.00	0.000	Long-term loan	0.07923***	4.15	0.000
C	Constant	-8.82855***	-5.80	0.000	Constant	-8.95393***	-5.67	0.000
R^2		0.6652				0.6391		
Adj R^2		0.6366				0.6083		
F-Statistic		23.28				20.74		
Prob > F		0.0000				0.0000		

Table V.
Effects of STL and LTL on wheat productivity

Notes: SLT, short-term loan users; LTL, long-term loan users. *, **, ***Significant at 10, 5 and 1 percent levels, respectively

Source: Researchers' own calculations, Field Survey (2016)

formal financial institutions at the start of the sowing season of crops (Khan *et al.*, 2007). Unlike the previous studies (e.g. Javed *et al.*, 2006; Bashir *et al.*, 2010; Nadia and Chughtai, 2012; Ahmad *et al.*, 2015; Chandio, Jiang, Joyo and Rehman, 2016; Chandio, Yuansheng, Sahito and Larik, 2016) that treat the agricultural credit as a whole to estimate the impact of credit on crop productivity, the present study classifies the agricultural credit into the short-term and LTLs and compares their different effects on wheat productivity. After estimating the effect of STL on wheat productivity, again we have examined the effect of LTL. The results are presented in Table V. The coefficient of LTL is ($\log \text{LTL} = 0.0792379$), indicating that per acre wheat productivity increases by 0.07 percent if the use of LTL increases by 1 percent. The calculated t-value for this coefficient is 4.15; this reveals that the coefficient of LTL is statistically significant at 1 percent level. Khan *et al.* (2007) reported that agricultural credit has played a pivotal role in enhancing agricultural production. Undoubtedly, agriculture is the main means for improving the livelihood of the farmers. In the context of the developing countries, institutional credit is an important tool for agricultural development (Okurut *et al.*, 2005). Wheat is the staple food in Pakistan and it contributes 1.9 percent to the GDP and 9.6 percent of the value added in agriculture (GOP, 2016). Research reveals that credit plays a significant role in increased yield of wheat. For example (Jan *et al.*, 2017; Bashir *et al.*, 2010; Ahmad *et al.*, 2015), concluded that agricultural credit has a significant effect on the yield of wheat. In rural areas of Pakistan, most of the smallholder farmers grow wheat for subsistence only (Asim *et al.*, 2015). In the study area, farmers grow wheat for their home consumption as well as for marketing. Timely and adequate availability of funds enables farmers to cultivate more farmland and benefits more from the economy of scale. The value of the coefficient of multiple determinations i.e. R-square is 0.6652; which implies that about 66 percent of the total change in wheat productivity is explained by the seven independent variables. The calculated value of F-Statistic is 23.28, which is highly significant and presents the overall significance of the model.

When comparing the coefficients of the STL and the LTL, it shows that the STL has a bigger elasticity than the LTL, tentatively implying that the STL has a stronger effect on

enhancing the wheat yield given the wheat production level in Sindh. This also explains to some extent that much more farmers apply for a STL in the sampling farms in Sindh, Pakistan. Certainly, this tentative result needs confirmation by further test.

6.2.2 *Comparative effects of STL and LTL on wheat productivity by a dummy variable.* Table VI reports the results for comparison of STL and LTL coefficients estimated using the Cobb–Douglas production function. This study compares the size of dummy variable (STL = 1, 0 = LTL) and concludes that the coefficient of STL variable is positive and highly significant than the coefficient of LTL variable. This means that STL has a bigger and stronger effect on wheat productivity in the study area. This finding is to some extent similar to the findings of earlier studies (e.g. Iqbal *et al.*, 2003; Bashir *et al.*, 2010; Abdallah, 2016; Afrin *et al.*, 2017). However, they treated agricultural credit as a whole. According to the term of credit, the agricultural loan can be classified into STL, medium loan, and LTL. Different terms of loan have different effects on crop productivity. STL is considered as a very effective tool in agricultural production since it is frequently used to purchase agricultural inputs such as fertilizers, seeds, pesticides, animal feeds and medicines. Whereas, LTL is supplied for the purchase of farm equipment i.e. tubewell installations, land preparation, tractors/power tiller together with necessary equipment like cultivator, tiller, mouldboard plough, disc harrow, cage wheel, trailer, threshers, combine harvester, cutter binders, spray machinery and drip irrigation, etc. Further, the estimated results show that there is a positive relationship between per acre seed cost and wheat productivity for Cobb–Douglas production function estimation at 1 percent level, which is consistent with earlier studies Coelli and Battese (1996), Jaforullah and Premachandra (2003), Ogundari (2008) and Abdallah (2016). Correspondingly, costs of main inputs such as land preparation, fertilizers and labor positively and significantly affected wheat productivity in Cobb–Douglas production function estimation. These results of the study are similar to the findings of Jaforullah and Premachandra (2003), Ogundari (2008), Bashir *et al.* (2010) and Buriro *et al.* (2015). Recently, in developing countries like Pakistan, smallholder farmers’ demand for agricultural credit has been increasing. Smallholder farmers need more funds for production and consumption (Khan and Hussain, 2011; Jan and Khan, 2012). Due to a number of constraints like lack of collateral, high interest rates and lack of land ownership smallholder farmers cannot access agricultural credit from formal sources and most of the smallholder farmers rely on informal credit sources (Akudugu, 2012; Ajagbe, 2012; Nouman *et al.*, 2013; Hananu *et al.*, 2015; Fecke *et al.*, 2016; Chandio *et al.*, 2017).

Code	Variables	Coefficient	Robust SE	t-value	p-value
$\log X_1$	Seed cost	0.5541732***	0.1229697	4.51	0.000
$\log X_2$	Land preparation cost	0.2079872***	0.0833446	2.5	0.014
$\log X_3$	Fertilizers cost	0.4431192	0.1066721	4.15	0.000
$\log X_4$	Pesticides cost	-0.1275618**	0.0641132	-1.99	0.048
$\log X_5$	Irrigation cost	0.0122767	0.0215398	0.57	0.569
$\log X_6$	Labor cost	0.2814387***	0.0507716	5.54	0.000
X_7	DummySTL	0.1016653***	0.0289059	3.52	0.001
C	Constant	-8.031357***	1.168912	-6.87	0.000

F-statistic = 29.43

Prob > F = 0.000

R² = 0.605

Root MSE = 0.18496

Note: ** ***Significant at 5 and 1 level, respectively

Source: Researchers’ own calculations, Field Survey (2016)

Table VI.
Comparison effects of
STL and LTL on
wheat productivity

6.2.3 Results of instrumental variables (2SLS) regression. There may be a reverse causal relationship between credit acquisition and wheat yield. High yield farmers may be observed by the bankers and hence have a higher probability of obtaining credits than low yield farmers. In order to solve the endogenous problem, this study used IV method. The distance from the village to the bank and the availability of transports are selected as IV. IV must satisfy two conditions: In linear models, there are two main requirements for using IV. At the first stage, the IV must be correlated with the endogenous explanatory variables, conditional on the other covariates. If this correlation is strong, then the IV is said to have a strong first stage. At the second stage, the instrument cannot be correlated with the error term in the explanatory equation, conditional on the other covariates. In other words, the instrument cannot suffer from the same problem as the original predicting variable. If this condition is met, then the instrument is said to satisfy the exclusion restriction. First of all, considering high transaction costs due to long distance from banks and high transportation costs farmers are discouraged to apply for credit from formal sources and may turn to the informal sources of credit such as fellow farmers, friends, and relatives. At the same time, the distance from the banks will not affect the farmer’s production efficiency. Similarly, various types of transport can provide convenience for farmers to reach the banks. Meanwhile, the types of transportation to the banks don’t have an impact on wheat productivity. Based on the above analysis, we used 2SLS method. We used the Stata13 software to perform a 2SLS regression to obtain the regression results. By comparing the estimation results of Cobb–Douglas production function and 2SLS (Tables V and VII), It is evident that after considering the endogeneity problem, the coefficient of the STL in 2SLS becomes larger than in Cobb–Douglas production function regression model. This further suggests that the STL is far more conducive to improving wheat production efficiency than the LTL. The STL has a coefficient of 0.1636604, implying that one percent of increase in the STL will enhance the wheat yield by 0.16 percent.

6.2.4 Constraints to credit access by wheat farmers. During the field survey of this study we asked wheat farmers several questions about problems they faced during the assessment of agricultural credit from formal sources. Results in Table VIII show that 34 percent of wheat farmers were faced with the problem of cumbersome procedure of documentation for the credit. As a rule, the financial institutions provide agricultural credits on the basis of “Pass Book.” Whereas the process of acquiring pass book for agricultural credits is very tedious, which usually takes three to four months. Likewise, 47 wheat growers (26.1 percent) reported that they were faced with the problem of delay in

Code	Variables	Coefficient	t-value	P-value
$\log X_1$	Seed cost	0.4252736***	2.96	0.003
$\log X_2$	Land preparation cost	0.2977594***	4.06	0.000
$\log X_3$	Fertilizers cost	0.3242725***	3.58	0.000
$\log X_4$	Pesticides cost	-0.0608621	-1.32	0.187
$\log X_5$	Irrigation cost	0.0479007***	2.74	0.006
$\log X_6$	Labor cost	0.4962039***	10.93	0.000
$\log X_7$	Short-term loan	0.1636604*	1.74	0.083
C	Constant	-7.434969***	-7.86	0.000

$R^2 = 0.6456$

Root MSE = 0.17125

Wald $\chi^2 = 314.01$

Prob > $\chi^2 = 0.0000$

Note: *,***Significant at 10 and 1 percent level, respectively

Source: Researchers’ own calculations, Field Survey (2016)

Table VII.
Regression results
of instrumental
variables (2SLS)

loan disbursement. Due to non-cooperation and lengthy procedure of documentation, smallholder farmers are discouraged to apply for an agricultural loan from financial intuitions. Credit plays a significant role in the farming sector. Therefore, the timely and easy access of agricultural credit is the quickest way to increase wheat productivity. Additionally, 38 respondents (21.1 percent) complained about the high interest rate charged by financial institutions. For instance, ZTBL charged a rate of interest by 14 to 15 percent on production loan as well as on development loan. Whereas KB charged borrowing farmers an interest rate of 20 percent. Similarly, 34 farmers (18.9 percent) complained that they had to bribing the loan officers in order to obtain credits from formal sources. The findings of this study are consistent with the findings of Malik and Nazli (1999), Bashir and Azeem (2008), Akram *et al.* (2008), Phillip *et al.* (2009), Tagar and Panhwar (2010), Ugwumba and Omojola (2013), Verteramo Chiu *et al.* (2014) and Duniya and Adinah (2015).

7. Conclusion and policy implications

Maximization of crop productivity is the main aim of every producer. It is a fact that formal agricultural credit has a positive and significant effect on production levels and plays an important role in enhancing crop productivity. This empirical study evaluates the impact of STL and LTL on wheat productivity of small farms in Sindh, Pakistan. In this study primary data was used. Data was collected from a sample of one hundred and eighty wheat farmers who were selected from the three districts of Sindh, Pakistan (i.e. Shikarpur, Sukkur and Shaheed Benazirabad). The random sampling technique was used for selection of the sample. The sample size of this study consists of only those wheat growers who have borrowed STL or LTL from ZTBL and KB. Based on the findings, this study indicates that the majority of loanees are STL users, while the major complaints about the loan disbursement comprise of cumbersome procedures, delay in disbursement and high interest rate. The study reconfirmed that agricultural credit has a positive and highly significant effect on wheat productivity, while STL has a stronger effect on wheat productivity than LTL in the study area. The reasons behind the phenomenon may be the significantly higher usage of agricultural inputs like improved variety seeds and fertilizers which can be transformed into the wheat yield in the same year. However, the LTL user has a significantly higher investment in land preparation, irrigation and plant protection, which may lead to higher wheat production in the coming years. Based on the findings, the current study recommends that formal credit sources including ZTBL, KB, and other Commercial Banks should vigorously develop the STL for boosting up the crop productivity and increase the welfare of rural households. However, for the sustainable increase in wheat yield, there is also a need to accompanying the STL with the LTL and there may be a superimposed effect of the both. Also, formal credit sources should appropriately reduce the interest rate of agricultural credit, and introduce a special interest rate subsidy policy for wheat crop since the profit of wheat production is low, whereas the wheat is the staple food for the people.

Nature of Constraints	Frequency	Percentage
The cumbersome procedure of documents	61	33.9
Bribery	34	18.9
Delay in loan disbursement	47	26.1
High interest rate	38	21.1
Total	180	100.0

Source: Researchers' own calculations, Field Survey (2016)

Table VIII.
Problems stated
by the loanees

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