Financial access and food productivity nexus: Evidence from Pakistan

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Abstract

Food possesses a great importance in the lives of human beings as it provides energy and strength to the human body to think, grow and develop. The global population is increasing day by day, becoming even more difficult to manage food for every human being on earth. It is the responsibility of every state to provide food for its citizens. "Zero Hunger" is one of the major goals of the Sustainable Development Goals (SDGs') which aims to eradicate hunger from world. Researchers and policy makers identify several causes of food insecurity. This paper explains the importance of financial intermediation in food security as food is a basic human right and one of the foremost major issues of the nations which needs addressed. Pakistan is considered one of those countries which are food insecure, while most of its population is poor and have large family sizes. There are many causes of food shortage and malnutrition like poverty, unemployment, inequalities in income, among others but the most pronounced is the weak agriculture sector and limited financial capacity of majority of its people. Nobel Prize winner "Amartya Sen" discussed the issue of food insecurity concerning poverty (i.e., low purchasing power). However, this paper addresses the issue of food insecurity from the supply side. The study aims to analyze the impact of credit on food production. Financial intermediation can increase food supply by encouraging the use of quality inputs which aids food security. Primary data is collected through a survey, and the Cobb Douglas Production Function is used for econometric analysis. Results indicate that credit plays a significant and positive role in the increase of food production. Production of the borrowers increased after utilizing the credit due to the use of quality farming inputs. Increased production leads to low prices which increases the purchasing power of the people and ensures food security by providing ample quantity of food for everyone and everywhere. It also reveals that credit is not only helpful in achieving the "zero hunger challenge" but also for reducing poverty by increasing the income of the borrowers. The paper concludes with policy suggestions to strengthen the agriculture sector, financial institutions, and credit policies thus ensuring food security.

Introduction

The objective of this article is to examine the relationship between credit and food production as food is one of the fundamental rights and basic human necessities. Without food, the survival of human beings would not be possible. The Food and Agriculture Organization (FAO) was established on the 16th of October 1945 in Quebec, Canada to meet the universal challenge of hunger. The first session of FAO was held from 16th October to 1st November 1945 in which the constitution of the FAO was drafted. The Food Security was defined as

"when all people, at all times, have physical (social) and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (World Food Summit, 1996). The term "social" was added in the above definition in 2002. According to FAO, 795 million people in the world are suffering from chronic undernourishment due to shortage of food where out of these 780 million live in developing countries (FAO, IFAD, & WFP, 2015). The report further states that, "Every poor person is not hungry, but all hungry people are poor". FAO held several food summits to ensure global food security. During the 1996 summit, which was attended by 112 heads and deputy heads of state, a plan of action was conceived for each nation which emphasizes to adopt individual strategy within the available resources to solve the collective issue of global food security. The plan of action also aimed at eradicating hunger and malnutrition from all over the world.

In September 2000, the United Nations Millennium Summit met in New York as a special session of UN General Assembly. Eight Millennium Development Goals (MDGs') including the first goal of "Eradicate the Extreme Poverty and Hunger", were approved in the Summit. The practical target of this goal was to reduce by half the proportion of the people suffering from hunger between 1990 and 2015. But unfortunately, the MDG to halving the hunger and poverty by 2015 was not achieved by most of the governments. In the year 2016, the number of undernourished people increased from 777 million in 2015 to 815 million which is alarming, but this number is still down from about 900 million in the year 2000. United Nations introduced the Sustainable Development Goals (SDGs') to replace the MDGs. The SDGs' are also known as "Transforming our World: the 2020 Agenda for Sustainable Development" or Agenda 2030 in short. Negotiation on "Post-2015 Development Agenda", begun in January 2015 and ended in August 2015. The final document was adopted in September 2015 in New York (USA) at the United Nations Sustainable Development Summit. 193 countries of the United Nations General Assembly adopted the 2030 agenda which includes 92 paragraphs. Within the agenda, paragraph 51 outlines the 17 Sustainable Development Goals and the 169 associated targets. "Zero Hunger" is the second SDG which is aimed to be achieved by 2030 (UN 2015).

Pakistan is also the signatory of SDGs' and tries to overcome the issue of hunger and poverty. Food policy is integral to achieve this goal. Food policy refers to a plan of action related to food systems (Pinstrup, Andersen, & Watson, 2011). This can include policies related to agriculture, producer subsidies, consumer subsidies, price stabilization, food safety, and resource management. The concept of food policy concerning developing countries, in particular, focused on the accessibility and availability of food, is eventually integrated with production (Maxwell & Slater, 2003). There are different factors which are affecting food availability and accessibility in the country. Issues being faced, regarding food policy, are strongly linked with agricultural issues. Unfortunately, Pakistan did not have any formal national agricultural policy, however, formulated a first draft of Food Security Policy in 2017. Before the formulation of the draft policy, some key issues, which were considered constraints in production and productivity, were identified. Low production is one of those which is further associated with lack of credit.

In Pakistan wheat is used as major food source by the majority of the population. Provision of food has been made part of the constitution as a basic right of every citizen. Article 38(d) of the constitution states; "The state shall provide necessities of life, such as food, clothing, housing, education and medical relief for all citizens irrespective of sex, caste, creed or race, as per permanently or temporarily unable to earn their livelihood on account of infirmity, sickness or unemployment".

Though food is the fundamental right of every citizen of Pakistan, still 22% population of Pakistan is undernourished. Around two-thirds of households in Punjab do not get the proper food and nutrition that is essential for a healthy life. Similarly, around 67.4% of households in Khyber Pakhtunkhwa, 83.4% in Baluchistan and 70.8% in Sindh province do not have access to adequate food (Mishal, 2016).

Food is directly linked with the agricultural sector. Unfortunately, this sector is on the decline for the past two decades in Pakistan. Punjab is producing a major food crop (i.e., wheat), but the production is not enough for the rapidly increasing population. Farmers are facing losses due to which they are converting their lands from food crops to other cash crops like sugar cane, cotton, etc. Moreover, poor technology, old cultivation methods, and financial constraints are some major reasons of low production (Bashir, Ahmed, Hassan, Adil, & Bakhash, 2007). Pakistan will have to counter hunger challenge to meet Sustainable Development Goals which is not possible without strengthening agriculture sector and by removing major constraints (Ahmad, 2011). There are many other causes of hunger and malnutrition such as poverty, unemployment and, inequalities in income, however, weak agriculture sector is the major origin of all these because food is dependent on agriculture (Ahmed & Farooq, 2010).

Literature Review

Finance is the backbone of every business. Financial support is provided through credit to poor farmers for the purchase of agricultural inputs. Pakistan, being a developing country where farmers have meager income to purchase quality inputs, mostly relies on household seeds and fertilizer (Iqbal, Ahmed, & Abbas, 2003). Due to use of poor quality inputs, production is lower which increases food insecurity. Moreover, 43.5% of the population of Pakistan is dependent on the agriculture sector for their livelihood (Javed, et al., 2006). Furthermore, this sector is contributing a lot towards the Gross Domestic Production (GDP) of the country by employing half of the labor force of the country. Due to financial constraints, these farmers lose their possible income every year and get trapped in a vicious circle of poverty. Hence, credit is a great support for them (Farooq, Ahmed, & Altaf, 2009).

Agriculture growth plays a crucial role in the economic growth of developing countries. This sector is also eradicating poverty and hunger by producing food and income for the poor and low-income farmers (Riaz, Khan, & Ahmad, 2012). Lack of access to financial services is a major constraint in the modernization of agriculture (Bshir & Azeem, 2008). Financial development has a significant relationship with agricultural development. However, access to credit and capital is a perennial problem in developing countries (Smith, Ei, & Jensen, 2000). Most farmers are unable to provide collateral to financial institutions, due to which they cannot produce enhanced yields, and thus, earn a lower income, ultimately falling into a vicious circle of food insecurity. (Yu, You, & Fan, 2009). With the availability of credit, farmers will purchase quality inputs and cultivate the wheat at right time which will increase wheat production thus making farmers food secure (Mittal & Sethi, 2009).

Production costs are increasing day by day due to inflation. The unavailability of financial resources is a key hurdle of less production (Ayaz & Hussain, 2011). Most farmers are excluded from financial services because they are unable to provide collateral. Moreover, credit facility from banks is also not available to lessee or tenants (Ahmed & Heng, 2012). Small and poor farmers often use the age-old methods for agriculture which fail to give optimum production. Such farmers hardly fulfill the food needs of their own families leading to poverty, malnutrition, hunger and perpetual food insecurity. If this problem is not controlled, then food insecurity will lead to severe famine. They work hard in the fields but cannot get potential output because of unavailability of financial help (Ali, Mushtaq, Ashfaq, & Abedullah, 2008). Availability of collateral free credit and the expansion of bank branches in proximity can provide benefits to maximum farmers (Dhrifi 2014). It may be appropriate that the government should open a window of financial services for small farmers and tenants. Such categories of farmers have larger numbers as compared to big landholders but are poorer and more vulnerable as compare to big landlords (Olaoluwa, 2016). Therefore, the inclusion of such farmers in financial services can yield significant results. Low prices of food grains are also discouraging farmers from growing more food as cost of production is increasing every year and farmers face losses in the form of low prices of the food grains (Das, Senapati, & John, 2009). Some farmers borrow money from middlemen or from informal sources which charge high-interest rates. During harvest, farmers are left with little money for their necessities as they pay the major chunk of their income to middlemen to repay the loan amount with high-interest rates. Such situations are regressive and discourage farmers from agriculture occupation (Nadeem & Mushtaq, 2012).

Furthermore, bank credit is playing a significant role in agricultural production as credit fulfills the financial requirements of farmers for agricultural production (S.B.Williams, Ajao, & Ogunniyi 2007). With the availability of financing, farmers use quality inputs which increase their production. Increased production increases the income of the farmers which encourage them to grow more (Kofiakwaa-Sekyi, 2013). The agriculture sector not only provides raw material to the industrial sector but also a means of subsistence for most of the population. Traditional methods of production based on self-reliance are a hurdle for higher productivity. The problem becomes cyclic. Low production in one season leads to poor quality inputs in the following season because of lack of finance and this vicious circle continues (Ali & Iqbal 2005).

In Pakistan, the government provides agricultural credit through different programs like microcredit, National Rural Support Programs, and credit from commercial banks. Farmers who are availing this facility are far better off than those who do not. Increase in production will make a secure food Pakistan that will also be self-reliant (Usman, 2016).

Literature concludes that provision of finance can strengthen the agriculture sector and its production. The definition of food security given by FAO in 1996 reveals the two major dimensions of food security, availability, and affordability. Most of the researchers discussed the definition of food security concerning affordability i.e. purchasing power. Noble prize winner "Amartya Sen" also explained the same concerning poverty. However,

this study emphasized an increase in food production to ensure food security. If ample food would be available, then prices would be lower, and everyone would be able to buy food. Moreover, production at vast scale will reduce the cost of production.

Material and Methods

Credit is one of the important factors of production and also one of the key factors of small-scale businesses and other economic related activities. Various researchers have used different variables to analyze the impact of credit on agriculture production, thus food security. Agricultural credit plays a mediatory role and enhances food security by making quality inputs available when needed. The purpose of this study is to analyze the impact of different variables, such as credit, seed, fertilizers, and pesticides, on farmers' (i.e. borrowers) agricultural production.

Punjab is the major agricultural province which produces a large number of agricultural products as compare to other provinces. Punjab provides wheat to other provinces as the land of other provinces is less fertile and supportive for major food staple of the country (e.g., wheat). The farmers of the district Bahawalnagar obtained the largest amount of agricultural credit from Zarai Tarqiati Bank Limited (ZTBL), which is a major public bank that provides agricultural credit all over the country. A list of borrowers who obtained credit for the wheat crop was obtained from the zonal office of ZTBL situated in Bahawalnagar. The total number of borrowers who obtained credit for the wheat crop was 930. The sample size was found to be 280 by using the following statistical formula.

$$n = N / 1 + Ne2 \qquad (1)$$

(where n= Sample Size, N= Total Populating or Sample Frame and e = margin of error

(Population of the study is 930 and error margin is 0.05)
=930/1+930 (0.05)2

= 930/ 1+2.325

=930/3.325

= 279.70

= 280 Approximate Sample Size

District Bahawalnagar comprises of five tehsils, namely Bahawalnagar, Chistian, Fort Abbas, Haroonabad and Minchinabad. Though the population of the district is homogeneous, to avoid any bias, the proportionate sampling technique was used to secure the participation of borrowers from each Tehsil in the sample. The sample size was then divided according to the percentage proportion of each Tehsil in the total sample frame. Afterward, borrowers were randomly selected from each tehsil as per the percentage.

Data Collection Technique

Data were collected through a survey. A detailed questionnaire was designed and face to face interviews were

Table 1: Selection of Sample

Sr.No	Tehsil's Name	Number of Borrowers	Percentage of Each Tehsil in Total Sample Size	Proportionate Sample Size According to the Percentage of Each Tehsil in Sample Size	Round Figure
1	Bahawalnagar	211	22.69	63.53	63
2	Chistian	166	17.85	49.98	50
3	Fort Abbas	262	28.17	78.88	79
4	Haroonabad	116	12.47	34.92	35
5	Minchinabad	175	18.82	52.70	53
	Total	930	100	100	280

conducted to collect the relevant information from the borrowers.

Data Analysis Method

The Cobb Douglas Production Function (CDPF) was used for econometric analysis. It was proposed by Kunt Wicksell[1] (1851-1926) and tested by two economists namely Charles Cobb and Paul Douglas in 1928[2] against statistical evidence. They gave an abridged view of the American economy in which they determined the output by the amount of labor used and capital invested; their model proved remarkable. This model is used by many researchers and economists to determine the output.

The function given by Charles Cobb and Paul Douglas is:

$$Y (L, K) = bL^a K^b \qquad (2)$$

Where,
Y= Total Production
L= Labor Input
K= Capital Input

Customized CDPF for this study

$$Y = b_0 C^{b1} S^{b2} F^{b3} P^{b4} \qquad (3)$$

(Where, "y" stands for production, "C" stands for Credit, "S" stands for Seed, "F" stands for Fertilizers, "P" stands for pesticides while b_1, b_2, b_3 and b_4 are the elasticities)
By taking Natural Log (ln) from both sides (to transform this model into Multiple Linear Regression Model (MLRM)

$$\ln Y = \ln b_0 + b_1 \ln C + b_2 \ln S + b_3 \ln F + b_4 \ln P + u \ln e \qquad (4)$$

By assuming

$$\ln y = y, \qquad \ln b_0 = a$$
$$\ln C = x_1, \qquad \ln S = x_2$$
$$\ln F = x_3, \qquad \ln P = x_4 \text{ and } \ln e = 1$$

$$Y = a + b_1 x^1 + b_2 x^2 + b_3 x^3 + b_4 x^4 + u \qquad (5)$$

Operational Definition of the Variables

Production (y)
Production was taken as a dependent variable. The per-acre total production of wheat in KGs was asked and used in the analyses. The borrowers obtained this production after utilization of credit.

Amount of Credit (x_1)
Amount of credit was taken as an independent variable. As credit was disbursed according to per acre of agricultural land so per acre total amount of credit obtained in rupees was asked and used in the analyses.

Seed (x_2)
The seed was taken as an independent variable. Quantity and quality of seed both effects the production. The total quantity of seed (in KGs) used in per acre was asked and used in the analyses.

Fertilizer (x_3)
Fertilizer was also taken as an independent variable. Fertilizer increases the fertility and productivity of the land. It also gives strength and protection to seed sown. Total

Table 2: The result of Econometric Analysis (Cobb Douglas Production Function)

Variables	Beta Coefficient	t-value	Sig. (p-value)
Constant	2.729	13.801	0.00
Credit	0.326	13.403	0.00
Seed	0.173	3.759	0.00
Fertilizer	0.185	3.892	0.00
Pesticides	0.051	1.721	0.086

Dependent Variable: Production　　　　F-Value= 240.103　　　　R-Square =0.78

1. Refers *http://www.econlib.org/library/Enc/bios/Wicksell.html*
2. ibid

quantity of fertilizer (in KGs) used in per acre land was asked and used in the analyses.

Pesticides (x$_4$)

Pesticides give protection to seed and crop from insect and various crop diseases. It increases the production by saving the crop. Total quantity (in milliliters/liters) used in per acre land was asked and used in the analyses.

Results

The above table shows the result of MLRM. The constant of the model was found to equal 2.729 with a t-value of 13.801, which is significant at the 5% level of significance. The beta coefficient of credit was found at 0.326 with a t-value of 13.403, which was highly significant at 5% level of significance. It showed that a 1% increase in credit will bring a 32.6% increase in production. Therefore, it is concluded that credit has a positive effect on wheat production, which further leads to food security. The beta value of seed was found to be 0.173 with a t-value of 3.759 which was also significant at 5% level of significance. This indicated that a 1% increase in seed will bring a 17.3% increase in yield production.

Results showed that the beta coefficient of the third independent variable (fertilizer) has a value of 0.185 and t-value of 3.892 which was also significant. It showed that a 1% increase can bring an 18.5% increase in production. Furthermore, the beta value of the fourth independent variable (pesticides) was calculated at 0.051 with a t-value of 1.721. The F-value showed the overall significance of the model. The above result showed that the F-value was found to be equal to 240.103, which is significant at the 5% level of significance, indicating the overall fitness of the model.

R-Square showed the significance of the captured model. The value of R2 was found at 0.78, indicating that all captured variables were highly significant. By summarizing the above results, it is concluded that after utilizing the credit, the production of the borrower farmers has increased (i.e. credit) has significant effects on the production of crops. Moreover, variables such as seed, fertilizer, and pesticides played a positive and significant role in food security by increasing the production of wheat crop.

Discussion

Food provides energy to work, grow, think and develop. It is the first and foremost obligation of the state to provide food to its citizens. Several policies are formulated around the globe to secure the food for every human on Earth. The government of Pakistan is also trying its best to eradicate hunger from the country. Several causes are identified for food insecurity, but low production is one of the major causes. Credit is playing a significant role in enhancing the production of food. Results show that if credit is provided to the farmers, production will increase. Increased production will not only reduce food insecurity and hunger but will also bring prosperity in the lives of farmers by enhancing their income.

Conclusions & Recommendations

Pakistan is a developing country in which most of the population lives in rural areas and is associated with its large agriculture sector. Pakistan is in the list of those countries which are food insecure. Pakistan is the signatory of the SDGs' and "zero hunger" is a major challenge to achieve. Pakistan formulated its first draft of Food Security Policy in the year 2017. The legislation and implementation of the policy is still under process. Pakistan opted the same definition of food security which was given by FAO in 1996 (updated in 2002).

The definition of food security stresses the availability and affordability of food for everyone and everywhere. If sufficient food is available, then prices will go down and everyone would be able to afford to buy it. An increase in food production will ensure the supply of food everywhere. This also indicates that increasing food availability can make Pakistan food secure. As previously mentioned, food is directly linked to the agriculture sector, and financial constraints are one of the major hurdles for farmers in agriculture production. In general, farmers are poor and do not have enough finance to purchase quality inputs (Iftikhar & Mahmood, 2017). When production levels remain low, this not only increases the food insecurity but also increases the poverty in the country.

The Pakistan government is providing credit facilities to farmers through several programs like National Rural Support Program and Punjab Rural Support Program among others. Several commercial and public banks are also providing credit to needy farmers; however, ZTBL is the major bank which is providing the borrowing facilities to fulfill the financial requirements of farmers (Inam, et al., 2018). The study was conducted to reveal the impact of credit on food production. ZTBL disbursed a large amount of credit in the district Bahawalnagar, while wheat is used as the major staple food by the major chunk of the population of the country. Therefore, the borrowers of district Bahawalnagar who obtained credit for the wheat crop are selected as sample. The results indicated that financial access (credit) and other inputs play a considerable role in food security by increasing

the production of food (wheat). Not only this, but increased production is also reducing poverty by increasing the income of the farmers. ZTBL is, however, charging high-interest rates that need revising as interest rate reduces the profit of the poor farmers. The government may consider providing interest-free loans to support farmers. The loan procedure should also be made easier so that farmers may avail this facility without any hassle. Conditions of collateral may also be relaxed for small farmers. Therefore, it can encourage small farmers to apply for loans, and thus, they will be able to obtain credit. Through this their production and income both may increase. The government procurement system may also be improved so that farmers may sell their products to the government at a reasonable price. Reasonable prices will encourage the farmers to work hard and grow more in the next season.

One of a recommendation is that the government may introduce the concept of collective kitchen, sustainable farming methods and home gardening to ensure food security. This will reduce the cost of food production, processing, preparing and cooking. Land use policy is also essential for food security as conversion of land from agricultural purposes to other commercial activities is also reducing production. Government may also introduce a policy to ban the conversion of lands from food crop to other cash crops. The crop insurance policy may be introduced and made compulsory for every farmer. Females are the vulnerable segment of society. Special credit schemes may be announced for females and disabled persons to give them more empowerment. The government may introduce training and guidance programs for farmers regarding better harvesting and cultivation. All these collective efforts can lead to increase in agricultural production hence making the country more food secure.

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Conflict of Interests

The authors hereby declare that there is no conflict of interests.

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Annotation from the Editorial Board

Future of Food: Journal on Food, Agriculture and Society supports and promotes sustainable agri-food systems.The paper at hand is addressing chemical fertilizer and pesticide application as means of enhancing agricultural productivity in Pakistan. The journal took this paper into consideration to enable discussion on the model provided. Yet the Editorial Board does not endorse the conclusion presented here. Loans to farmers for investments in pesticides are not an ideal approach to achieve food security. In the long run, farmers in Pakistan will need to abandon the conventional agricultural system which connects to vicious circles of poverty and food insecurity.