

## FOOD SCIENCE & TECHNOLOGY | RESEARCH ARTICLE

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# Ranking and relationship of agricultural credit with food security: A district level analysis

Sana Iftikhar<sup>1\*</sup> and Hafiz Zahid Mahmood<sup>2</sup>

**Abstract:** Agriculture sector is back bone of agrarian economies and it is the primary source of food in these economies like Pakistan. Current situation of Pakistan's economy highlighted that agriculture sector contributes the 19.8% share to GDP and provides 42.3% of the total work force. There is a lot of empirical work which focus on consistent expansion of agriculture output. Food production in agricultural economy require bundle of resources but credit is one of the factor which help in risk aversion and risk Management. The one of the major problem faced by the farmers is the shortage of credit availability. Therefore, this study has been devised to observe the impact of institutional and non-institutional agricultural credit on the level of food security in the districts of Punjab province of Pakistan. In this regard multiple linear regression models are rendered to quantify the relationship between food security (i.e. Food Insecure Population, Food Availability, Food Access and Food Absorption) and Agricultural Credit (i.e. Overall Agricultural Credit, Institutional Agricultural Credit and Non-Institutional Agricultural Credit). The study find that Institutional Agricultural Credit is significantly helping in combating food insecurity while Non-Institutional Agricultural Credit shows unexpected results. Therefore it is strongly recommended to cates institutional credit to reduce food insecurity issues in the country.

**Subjects:** Social Sciences; Urban Studies; Behavioral Sciences; Development Studies; Economics, Finance, Business & Industry

**Keywords:** food security; institutional agricultural credit; non-institutional agricultural credit; Punjab

### ABOUT THE AUTHOR

Sana Iftikhar is a PhD Scholar in department of Economics at National College of Business Administration & Economics Lahore, Pakistan. Her research interests include agricultural production, agricultural resources, food security, human capital development, economic growth and climate change. Currently, she is working on the issue of climate change and its impact on food security and economic growth.



Sana Iftikhar

### PUBLIC INTEREST STATEMENT

Food security is a situation when all people at all-time have easy access towards food. As the situation of food insecurity is alarming in Pakistan. To reduce the food insecurity level, more agricultural production is required to produce more food. Agriculture sector is back bone of agricultural economies and it is the primary source of food in these economies like Pakistan. Food production requires many resources but agricultural credit is one of the factor which help in better and more agricultural production. The one of the major problem faced by the farmers is the shortage of credit availability. Therefore, this study has been devised to observe the impact of agricultural credit on the level of food security in the districts of Punjab province of Pakistan. Results show that Institutional Agricultural Credit is significantly increasing the food security level.

## 1. Introduction

The agricultural credit plays an important role in farming sector for more and efficient production in developing economies and Pakistan. The one of the major problem faced by the farmers is the shortage of credit availability for adoption of modern techniques in the agriculture sector (Malik & Nazli, 1999). Agricultural credit is financial terms that bring up to loans and other types of credit extended for agriculture purposes. Under capitalism, agricultural credit is a type of investment of loan capital in agriculture which is an important economic connection between the city and the countryside. Agricultural credit uses to develop agriculture and raise the standard of living of the rural population. The availability of institutional credit can also help farmers in facilitating the farm productivity enhancement which will lead to higher income and better living. Jan and Khan (2012) emphasized the need to involve the small common farmers in the comfortable credit distribution circle and Zarai Taraqiati Bank Limited (ZTBL) is the biggest contributor in providing credit to farmers in Pakistan (Ahmed & Gill, 2007).

There are two major sources of agricultural credit suppliers in Pakistan, which are institutional and non-institutional sources. In institutional sources are ZTBL, commercial, cooperative, domestic and private banks, where as non-institutional credit suppliers include friends, neighbors and individual money lenders (Idrees & Ibrahim, 1993). Farmers can adopt new technology and diversify their production without and risk if they have easy and timely access to credit which for the rural sector is composed of formal and informal credit providers (Adams & Fitchett, 1992; Aleem, 1990). The supply of agricultural credit remained insufficient in both way quantitatively and qualitatively after taking various methods of farm credit. Only 15% of the credit requirement of farm sector meets from institutional agricultural credit (Rao, 2003). Farmers want to approaches Non-institutional banks more as compared to the institutional banks due to the lack of sufficient supply of agricultural credit (Nahatkar, Mishra, Raghuwanshi, & Berohar, 2002; Sharma, 1978; Singh, 1973). Financial support through agricultural credit is very important for bridging the gap between the incomes and expenditures of small farmers. Industrial growth can be maintained through this credit. This support extends from credit supply to improved seeds, better fertilizers and also liquid finance for harvesting time period and other expenses (Iqbal, Ahmad, Abbas, & Mustafa, 2003).

Like all the business models which require own capital and borrowed capital, farming also requires investment assistance from credit provided by the banks so that farmers can increase and sustain their production. Diversified soil, climate, hardworking, man power, huge agricultural and agricultural systems for the farmers which are the great gifts for Pakistan which provide them competitive edge in international markets (Khan et al., 2011). There are currently 26 commercial and microfinance banks with 3,900 branches to provide agricultural credit. These banks include ABL, Habib Bank, Muslim Commercial Bank, United Bank, two of the specialized banks i.e. Zarai Taraqiati Bank, Punjab Provincial Corporate Bank and further 14 private and domestic banks. Further there are five microfinance banks which are intended to provide finance to farmers. The finance can be applied for any of the following activities like growing crops, livestock, poultry, fisheries, orchards, forestry, nurseries, apiculture and sericulture (Table 1).

The figure shows that from July 2011–March 2012 several major banks released Rs. 107.7 billion which is 76.3% of the whole years quot. ZTBL provided Rs. 37.9 billion or 54% of its target, and domestic banks given Rs. 37.3 billion or 69% of their funds. MFBs disbursed Rs. 8.5 billion or 70% of their target, and the PPCBL released Rs. 6 billion or 79% of its allocated target. As compared to other sectors, agriculture is more sensitive to the availability of the credit as this sector is more sensitive to the seasonal variations, and upgrading from subsistence farming shows significant increase in output, hence this credit supply can be a good opportunity to expand the output and increase income (Abedullah, Mahmood, & Khalid, 2009).

Idrees and Ibrahim (1993) tested that most of the small farmers are not aware about the availability of credit and hence are unable to access to latest farming practices. Because of this agricultural credit fails to meet the requirement of the agricultural farmers to expand the output and in

**Table 1. Supply of agricultural credit by institutions (Rs. In Billion)**

Year	ZTBL commercial	Banks PPCBL	Domestic	Private	Banks	MFBs	Total	
							Rs. Billion	(%) Change
2007–08	66.9	94.7	5.9	43.9	0.0	21	1.6	–
2008–09	75.1	110.7	5.6	41.6	0.0	23	3.0	10.1
2009–10	79.0	119.6	5.7	43.8	0.0	24	8.1	6.5
2010–11	65.4	140.3	7.2	50.2	0.0	26	3.0	6.0
2011–12	66.1	146.3	8.5	60.9	12.1	29	3.8	11.7
2011–12P	37.8	107.6	6.0	37.3	8.5	19	7.4	–
2012–13P	38.0	123.7	5.4	51.0	13.0	23	1.0	17.0

Note: P: Provisional (Mar–July).

Source: Economic survey of Pakistan, 2013–14.

Pakistan most of the formal loan providers in the rural areas tends to lend to the large farmer or land owners as compared to the small farmers and small farmers have restricted access to credit (Inayatullah, Munir, Usman, & Idrees, 2012; Khandker & Faruqee, 2003). Because of increase in the cost of fertilizers, biocides, improved seeds and machinery and also the price hike of agricultural products, agriculture now need support from credit more than past and it is increasing with time to absorb this cost especially for the small farmers. Siddiqui (1982) and Zuberi (1982) highlighted the role of credit supply to the economic growth, where the distribution of this credit instrument should be based on reasonable pattern to enhance the prosperity of the small farmers. Sial and Carter (1996) highlighted that the efficiency of agricultural credit in Punjab, Pakistan and concluded that the farmers who acquire average size loan are more productive (48%) as compared to the non-borrower farmers. Umrani (1984) presented that the biggest constraint that the small farmers face is the timely availability of agricultural micro credit.

Sial, Awan, and Waqas (2011) pressed the major dilemma for the agriculture in Pakistan which is the increase in the cost of inputs such as better seeds fertilizers, pesticides and machineries for which (Bashir, Mehmood, & Hassan, 2010) proposed that the availability of agricultural credit can help to absorb this pressure of rising costs. It was agreed upon in several drafts of National Agricultural Policy (2010) the availability of credit and it timely manner is required for the poor farmers. FAO (2012) debated that credit can help avoiding food insecurity by maintaining the food prices and not allowing the increasing input cost to transfer to the increase in the food cost. Also this credit will help to overcome the extreme weather and water shortage problems by adopting less sensitive production.

Food Security for all means that people at all times must have economic and physical access to adequate level of nutritious, safe and culturally appropriate food and energy (The World Food Summit, 1996). The term “food security” used to refer the access to adequate amount of food for meeting dietary energy needs that implied for many as self-sufficiency at the national level producing required food domestically. A country which cannot produce the needed food quantity and has no resources or afford to buy food from the international market to meeting its needs is not food sovereign state (Pinstrup-Andersen, 2009). Food security, thus, becomes a fundamental component of national security that which is generally ignored (Fullbrook, 2010). According to Food Insecurity Report Pakistan (SDPI, SDC & WFP, 2009), 61% districts (i.e. 80 out of 131) of the country were below the critical levels of food security. Moreover, the report exclaimed that amongst the 48.6% food insecure population 22.4% were extremely food insecure. It is constituted by three main components which are (i) Food Availability i.e. physical availability through production, import and aid) (ii) Food Access i.e. financial access to food and (iii) Food Absorption i.e. food utilization and assimilation (SDPI, SDC & WFP, 2009).

Food security is the people's right to define their own policies and strategies for the sustainable production, distribution and consumption of food that guarantees the right to food for the entire population, on the basis of small and medium-sized production, respecting their own cultures and the diversity of peasant, fishing and indigenous forms of agricultural production, marketing and management of rural areas, in which women play a fundamental role. Thus, it is not only the availability of food that matters but its easy access and proper absorption amongst the population is also crucial. Both physical and economic access to food is the important aspect of food security. One of the important indicators of economic access to food is the proportion of people below the poverty line (FAO, 1998). Biological food absorption is affected by food preparation and health condition of an individual influenced by sanitation, clean drinking water, and knowledge of the households regarding proper food storage, processing and basic nutrition (For example, in Hyderabad, contaminated water took ten lives and 1,000 people were hospitalized over the course of two months in 2004. Khan, Azeem, Iqbal, and Manzoor (2002) reported that 51% of the vegetable produce was unsuitable for human consumption due to excess chemical residues.

### 1.1. Global food insecurity

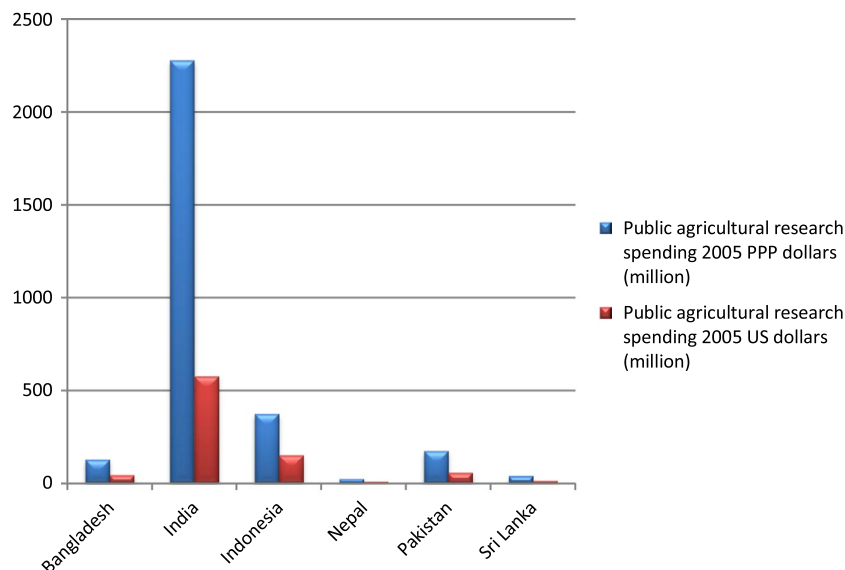
As a joint initiative of African leaders, the private sector, and the G8 countries, the New Alliance is designed to bring these groups together to mobilize private investments and align aid to recipient countries for agricultural and rural development and food and nutrition security (IFPRI, 2013).

In 2000, the global community adopted the Millennium Development Goals, which called for halving both the proportion of people living in extreme poverty and the proportion of people suffering from hunger. At a global scale, the poverty goal has been achieved, but progress toward halving hunger is not on track.

There had been instances of rapid economic and food production growth recently, but still for South Asia it has not improved in terms of nutrition. South Asia is home of around 35% poor of the world which also have alarming levels of hunger. This region is worse in terms of rate of undernourishment of the children and host to largest number of undernourished children in the world. In Bangladesh, India and Pakistan minimum of 1/3rd adult women are underweight at per report of IFPRI. Close to 850 million people worldwide still suffer from chronic hunger (IFPRI, 2013) (Figure 1).

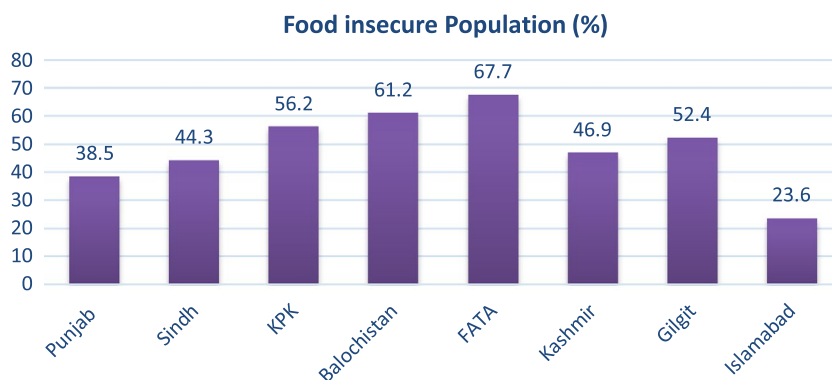
The above graph shows that India has highest public agricultural research spending in both PPP and US dollars (million), Nepal has lowest public agricultural research spending, Pakistan also found in the lowest category.

**Figure 1. Public agricultural research spending 2005 PPP and US dollars (million).**



**Figure 2. Food insecurity situation in Pakistan.**

Source: Food insecurity in Pakistan Report (SDPI, SDC & WFP, 2009).



### 1.2. Food security in Pakistan

The situation of food security is not uniformly found within the country, it varies among regions and provinces. Some regions are more affected by food insecurity than others. From 2003–2009 in Punjab this situation is decreasing from 24–17, Sindh increasing from 6–8, KPK and Balochistan are moving towards the border line (SDPI, SDC & WFP, 2009). The following graph shows the high percentage of the population of Pakistan being under the threat of food unavailability. The major portion of the population living in Punjab and Sindh are already facing adverse conditions for a shortage of food up to 40% for the population. FATA has the highest level of food insecure population which is 67.7%, Balochistan is 61.2%, and KPK is 56.2%. Fortunately, Islamabad is facing the lowest percentage of food insecure population which is 23.6%. The comparison of the food availability in Pakistan as compared to the world brings concerns to the policy makers; there is a need to adapt higher sustainable productivity in food production in order to meet the increasing demands of the population (Figure 2).

The comparison of the food availability in Pakistan as compared to the world brings concerns to the policy makers; there is a need to adapt higher sustainable productivity in food production in order to meet the increasing demands of the population.

### 1.3. Food security situation in Punjab

In Punjab Province 38% of the district is at the borderline while 12% of the population is food secured. The situation of the borderline is increasing from 6–13 from 2003–2009 and the food security situation is decreasing from 24–17 from 2003–2009. Punjab, being the bread basket of Pakistan and host to many industrial units, suffered a severe setback in the past few years. The industrial crisis due to power shortages, increases in production costs and insignificant growth in income of households are some of the reasons for increasing vulnerability to food insecurity. Key rural resources play a very important role to promote the food security. These are the resources which enhance the food production and help in efficiency in production. Agriculture is very important to improve the situation of food demand; lack of agricultural resources like land tenure, land distribution leads to food shortage and sustainable growth in food is possible with the efficiency of agricultural growth or key rural resource distribution.

Pakistan's agriculture is the backbone of the economy. 19.8% of GDP is derived from the agriculture sector and employs 42.3% of the total work force. It is the main source of livelihood for 66% of the country's population. The agriculture sector has a fairly large potential for growth (GOP, 2015–16). Focusing on agriculture production is a basic requirement for assuring food availability in terms of proteins and calorie intake. If affordable food prices are assured with its adequate supply then we can have a sustained food security policy within the region. Within Pakistan there has been significant development in terms of food supply, while we compare the years of 1961, 1990 and 2008 we can see that the food availability of cereals per capita has been 120, 137 and 154 kg respectively, within which 80% is because of an increase in wheat production (Ahmad, 2010).



The government of Pakistan is focusing to maintain the 2,400 calorie per person per day requirement of food availability from 1990s which was 1754 in 1961. Still the present calorie count as compared to developed and developing countries is lower by 26 and 10 percent respectively. There had been significant changes in the food intake composition, for the case of wheat it has been declining from 48% in 1990 to 38% in 2006, there is decline for the case of cereals too from 20% in 1990 to 6% in 2006. There had been variable trend for the case of livestock such as it increased from 12% in 1990 to 18% in 2002 while showing a fall to 15% in 2006. While other foods like oils, vegetables, fruits and sweeteners have increases from 20% in 1970 to 37% in 2006.

Pakistan food security is threatened by a growing population and declining food productivity growth. Agricultural resources play an important role in enhancing food security. Discussions on agricultural agreements allow developing countries to check and increase tariffs to protect national food security and employment. According to the Agricultural Finance Data, the financial performance of agricultural banks declining in 2008. The Federal Reserve describes that agricultural banks are the commercial banks with agricultural loans accounting for more than 14% of their loan portfolio and the average return on assets and equity at agricultural banks declined in 2008. By September 2008, the return on equity at agricultural banks declined to 7.6%, and the rate of return to assets declined to 0.8%.

#### **1.4. Objectives of the study**

The objectives of this study are described as follows:

- To rank the districts of the Punjab province on the basis of availability and distribution of overall agricultural credit, institutional and non-institutional agricultural credit.
- To quantify the relationship between Institutional, Non-Institutional and Overall Agricultural Credit with Food Security/Food Insecurity in the study area.
- To gauge the impact of types of agricultural credit on the components of Food Security like, Food Availability, Food Access and Food Absorption.

#### **2. Literature review**

There are several empirical studies describes below which are focusing on the beneficial role of agricultural credit in the agricultural production function.

According to (Andrew, 2000) the scope of subsidized agricultural production credit is increases with the development of new production techniques for which (Atieno, 2001) suggested that in order to increase the small farmer's access to the agricultural credit, there should be a bigger network of formal credit institutions and easy lending terms what are in favor of these farmers. Hence empirically it can be said that the farmers who have accessed to the credit have higher average production income, this is because with credit farmers can access to better production technology, better seeds, machinery, also the process of acquiring the agricultural credit helps farmers to evaluate their production productivity.

Khan, Jan, Rehman, Mehmood, and Ali (2007) and Shah, Khan, and Khan (2008) found a positive relationship between productivity and agricultural credit in Pakistan where the short term credits by ZTBL is also found beneficial for the agricultural production. Bashir and Azeem (2008) and Javed et al. (2006) investigated the important determinants of agricultural sector and showed that the facility of credit positively increases the crop productivity which is in result caused crop production and farmers income. Rashid et al. (2002) showed that because of the credit constraint, it is the small farmers who are not using the HYV rice in their farms.

According to Zuberi (1989) the direct role of credit comes out to be insignificant but it played its role through increased usage of seeds and fertilizers in the production function of agricultural sector. Whereas Qureshi and Shah (1992) showed that this institutional credit is significant in increasing

agricultural output and the marginal impact of credit is higher than the impact of fertilizers. Kumar, Singh, and Sinha (2010) the present study has examined the status, performance and determinants of institutional agricultural credit. Socio-demographic factors are affecting the major number of institutional credit which is gained by the farming households. Those factors are education, farm size, family size, caste, gender, occupation of household, which are the determinants of the agricultural credit. They suggest that there should be the simple procedure for getting agricultural credit for the less educated and illiterate smallholder farmers.

Ayaz and Hassain (2011) examine the impact of institutional agricultural credit on production efficiency of the farming sector in district Faisalabad in the Punjab province of Pakistan. They collect primary data of 300 farmers of 2009 from ZTBL of Faisalabad and Jaranwala branches. Farming experience, education, access to farming credit, herd size and number of cultivation practices were the independent variables. Results show that these variables have significant effect on the farmer's technical efficiency in agricultural credit. They suggested that by providing more credit, enhance farmer's income and will reduce poverty. Ahmad and Heng (2012) examined that fertilizer is the most important determinant of agriculture productivity growth (TFP), human capital is the second important determinant. Agriculture credit also playing significant role but the area under crop is statistically insignificant. To enhance the agriculture productivity growth government should intervene by providing skill training workshops. Akudugu (2012) estimates that age of farmers, gender and political associations are the main determinants of credit demand by farmers. While the farm size, types of crops and savings are certain determinants of credit supply by the Rural Banks. He also concluded that the credit demand by farmers and supply by rural bank are determined by socio-economic and politico-cultural factors.

Hence there is a long debate of showing the promising influence of institutional credit for the farmers; it is the sector where the capital system helps the agricultural system. It is not only the timely credit which is useful, it is the nature of the receiver of credit and how it is absorbed (through better seeds, fertilizers or machinery) furthermore it engages other nonfarm labor that makes it the more important determinant for agricultural sector.

### 3. Methodology

#### 3.1. Study area

The study is undertaken in Punjab which is the biggest province of the country. It constitutes 29% reported area, shares 55% population, and contributes 57% of cultivated and 69% of cropped area for agricultural production of the country (GOP, 2013). Moreover, Punjab produces 76, 70, 68 and 69% of the total production of staple and cash crops like wheat, rice, sugarcane and cotton, respectively (GOP, 2013). Therefore, country's population mainly depends upon Punjab for its food requirements. The province has been stratified into 35 administrative units called districts. Despite most developed region of the country, there are regional resources distributional anomalies in the province. Therefore, it is decided to devise this study to rank all the districts of the province for the variables of interests and to achieve multiple objectives of this study.

#### 3.2. Data description

As far as the descriptions of variables are concerned, food insecure population is used in the form of percentage as per availability from the data source while Agricultural Credit had been used as ratio per total no. of farms of the districts of Punjab province. Agricultural credit consists on both Institutional and Non-Institutional Credit. Data of the Institutional Credit includes the Z.T.B.P, Commercial Banks, Financial Institutes and N.G.Os while the Non Institutional Credit includes Commission Agents and Friends & Relatives. Cross-sectional data is attained from various secondary data sources i.e. independent variables (overall agricultural credit, institutional credit, non-institutional agricultural credit, family size, farmer's literacy rate, rural population and canal & tubewell irrigation) from Punjab Agricultural Census Report 2010 (GOP, 2012) and dependent variables (food



insecure population, food availability, food access and food absorption) from Food Insecurity in Pakistan 2009 (SDPI, SDC & WFP, 2009).

### 3.3. Data analysis

In order to achieve the objectives i.e. ranking and relationships of Overall Agricultural Credit, Institutional Agricultural Credit and Non-Institutional Agricultural Credit with Food Insecure Population (%) in the districts of the Punjab province, different data analysis techniques are employed. Ranking and the empirical analysis is used to investigate the relationships between all target variables by employing Multiple Linear Regression Models.

#### 3.3.1. Ranking

Ranking of the districts were undertaken by placing the values of the target indicators in descending order tagging highest as number one and district with smallest values with their corresponding related numbers. The districts of the province are ranked in descending order for the values of food insecure population through overall agricultural credit, institutional agricultural credit and non-institutional agricultural credit.

#### 3.3.2. Econometric modeling

To determine the relationships between endogenous and exogenous variables under study Ordinary Least Square (OLS) method is employed. Moreover, enter method of regression is rendered to model the available variables and quantify the relationships between them by using STATA-11. Nevertheless following econometric models were selected to explain the results of the study.

*Model-1: Effect of total agricultural credit on food security, food availability, food access and food absorption:*

$$FIP = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 TAC + \beta_3 CTI + \mu \quad (I)$$

$$FAV = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 TAC + \beta_3 CTI + \mu \quad (II)$$

$$FAC = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 TAC + \beta_3 CTI + \mu \quad (III)$$

$$FAB = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 TAC + \beta_3 CTI + \mu \quad (IV)$$

*Model-2: Effect of institutional agricultural credit on food security, food availability, food access and food absorption:*

$$FIP = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 IAC + \beta_3 CTI + \mu \quad (I)$$

$$FAV = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 IAC + \beta_3 CTI + \mu \quad (II)$$

$$FAC = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 IAC + \beta_3 CTI + \mu \quad (III)$$

$$FAB = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 IAC + \beta_3 CTI + \mu \quad (IV)$$

*Model-3: Effect of non-institutional agricultural credit on food security, food availability, food access and food absorption:*

$$FIP = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 NIAC + \beta_3 CTI + \mu \quad (I)$$

$$FAV = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 NIAC + \beta_3 CTI + \mu \quad (II)$$

$$FAC = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 NIAC + \beta_3 CTI + \mu \quad (III)$$

$$FAB = \beta_0 + \beta_1 FS + \beta_2 FLR + \beta_3 RP + \beta_4 NIAC + \beta_3 CTI + \mu \quad (IV)$$

In the above Models FIP stands for food insecure population (%) while FAV, FAC and FAB are Food Availability, Food Access and Food Absorption respectively. TAC stands for the Total/Overall agricultural credit, IAC for Institutional agricultural credit, NIAC means Non-Institutional Agricultural Credit, FS is family size, FLR is the Farmer's literacy rate, RP is Ratio of Rural Population and CTI is the ratio of Canal & Tubewell Irrigation per total cultivated area.

## 4. Results and discussion

### 4.1. District ranking

This section presents the ranking analysis of the variables e.g. Total Agricultural Credit, Institutional Agricultural Credit and Non-Institutional Agricultural Credit. Appendix 1–4 delineates the results of the Total Farm Households with Agricultural credit per total no. of farms as well as their ranking in all target districts. The results of ranking of Total agricultural credit and institutional agriculture credit are the same. Farms and households if have higher agricultural credit, then the access to better technology and productivity techniques will be easier, and can lead to increase in the agricultural output. Institutional credit help farmers to buy tractors and new machinery that can help in fast harvesting of crops. This credit is surely beneficial for the reduction in the food insecurity. In Total agricultural credit and Institutional agricultural credit, Hafizabad district at the highest rank. The reason might be behind that Hafizabad is the world largest rice exporter and famous with the name of cash crops district. Jehlum and Rawalpindi are at the bottom in this category because the people lives in Jehlum have their focus on immigration, they just always trying to go abroad and settled there. That's why they do not have interest in agricultural credit to improve the productivity or efficiency of crops.

There might be multiple reasons of best land distribution in Rawalpindi district due to the fact that this city is neighboring to the country's capital Islamabad and head quarter of armed forces. Therefore, there might be more/lucrative job opportunities in civil as well as in armed forces in the said district which would have reduced farming business charms for the people. Moreover, the district belong to arid zone with least surface irrigation facilities due to its hilly terrain. Overall land holding size is small in the district and perhaps that is why small farmers prefer to lease out their lands and like to work in twin city of Islamabad and Rawalpindi. In case of district wise ranking of Non-Institutional Agricultural Credit/total no. of Farms, Mandi Bahauddin district is at the highest rank and Jhelum district is at the lowest rank while Gujranwala, Faisalabad and Bahawalpur districts are at middle rank in Punjab Province (see Appendix 4).

### 4.2. Regression analysis

The regression model in Table 2 explains the relationships between total agricultural credits, percentages of food insecure population, food availability, food access and food absorption with others controlling variables. The other controlling variables are family size, farmer's literacy rate, ratio of rural population and canal & tubewell irrigation. As per values of *F*-statistics and concerning *p*-values, it is evident that the econometric model-I is well fit. But the values of  $R^2$  are low in case of (1) and (3) models, which explains that the overall variations in the model are only 42 and 34% respectively. The  $R^2$  values for model (2) and (4) are relatively better which are 63 and 73%. According to the results food security, food access and food absorption has negative relationship with the overall agricultural credit which means that with the increase in one unit of agricultural credit there will be 0.11 units decrease in the food insecurity and vice versa. These results are similar to the Khan et al. (2007). While in case of food access and food absorption, there is 1 unit increase in access and absorption, which leads to 0.003 and 0.0015 units decrease in the overall agricultural credit. Food insecure population is also having expected and significance results with others controlling variables (Table 3).

Institutional Agricultural credit consists on the Z.T.B.P., Commercial Banks, Financial Institutes and N.G.Os. These models are also fit and significant as the previous model run for overall agricultural credit. The  $R^2$  values of the (1) and (3) models are less but near to 50%. While the values for (2) and

**Table 2. Effect of total agricultural credit on food security, food availability, food access and food absorption**

<b>Total agricultural credit models</b>				
<b>Independent variables</b>	<b>Dependent variables</b>			
	<b>FIP (1)</b>	<b>FAV (2)</b>	<b>FAC (3)</b>	<b>FAB (4)</b>
	<b>(Coefficients &amp; significance)</b>			
Constant	33.95***	28.46	1.108	889*
FS	2.923***	-13.97	-0.044	-0.018
FLR	-0.275**	0.178	0.005	0.004*
RP	9.651	138.74	-0.369	-0.304*
TAC	-0.114	3.573*	-0.003	-0.0015
CTI	-0.087**	0.682*	0.001	-0.0002
R <sup>2</sup>	0.42	0.63	0.34	0.73

Note: Significance of bold value is 0.0001.

\*Significant at 1% level of significance.

\*\*Significant at 5% level of significance.

\*\*\*Significant at 10% level of significance.

**Table 3. Effect of institutional agricultural credit on food security, food availability, food access and food absorption**

<b>Institutional agricultural credit models</b>				
<b>Independent variables</b>	<b>Dependent variables</b>			
	<b>FIP (1)</b>	<b>FAV (2)</b>	<b>FAC (3)</b>	<b>FAB (4)</b>
	<b>(Coefficients &amp; significance)</b>			
Constant	34.67***	14.39	77.31*	0.898*
FS	2.832***	-11.315	-0.08	-0.019
FLR	-0.275**	0.115	-29.20	0.004*
RP	9.423	145.8**	-0.067	-0.307*
CTI	-0.086**	0.679*	-0.235	-0.0002
IAC	-0.154	4.265*	0.288***	-0.002
R <sup>2</sup>	0.43	0.66	0.48	0.74

Note: Significance of bold value is 0.0001.

\*Significant at 1% level of significance.

\*\*Significant at 5% level of significance.

\*\*\*Significant at 10% level of significance.

(4) are 66 and 74% respectively. As far as the trends of results are concerned Institutional agricultural credit has negative impact on food security which is similar to the Model-I i.e. there is also a negative relationship between TAC and food insecurity of all of the districts of the Punjab province of Pakistan. Although, the results of others controlling variables are similar to the Model-I. The availability of institutional credit can also help us in facilitating the farm productivity enhancement which will lead to higher income and better living. Jan and Khan (2012) emphasized the need to involve the small common farmers in the comfortable credit distribution circle and in Pakistan. ZTBL is the biggest contributor in providing credit to farmers (Ahmed & Gill, 2007). Zuberi (1989) and Qureshi and Shah (1992) also find out that Institutional agricultural credit has significant effect on food security. Effect of institutional agricultural credit on food absorption is same as food insecure population while the result for food availability and food access are the opposite. Food availability and food access are having opposite but significant relationship with institutional agricultural credit (Table 4).

**Table 4. Effect of institutional agricultural credit on food security, food availability, food access and food absorption**

<b>Non-institutional agricultural credit model</b>				
<b>Independent variables</b>	<b>Dependent variables</b>			
	<b>FIP (1)</b>	<b>FAV (2)</b>	<b>FAC (3)</b>	<b>FAB (4)</b>
	<b>Coefficients &amp; significance</b>			
Constant	32.349***	82.92	0.001***	0.866*
FS	2.796***	-13.18	-0.039	-0.019
FLR	-0.253**	-.322	0.005***	0.004*
RP	9.463	137.70**	-0.349	-0.306*
CTI	-0.09**	0.863*	0.001	-0.0003
NIAC	0.12	0.856	-0.006	0.0007
R <sup>2</sup>	0.41	0.48	0.33	0.73

Note: Significance of bold value is 0.0001.

\*Significant at 1% level of significance.

\*\*Significant at 5% level of significance.

\*\*\*Significant at 10% level of significance.

In this model, the *F*-statistics and *p*-value are statistically significance, showing the overall fitness of the model. But the *R*<sup>2</sup> values of the three models (1–3) are less than 50%, indicating that the overall variations in the models are less than 50%. Only one model (4) in this case showing the R-square value 73%. This model shows that Non-Institutional Agricultural Credit has positive relationship with food insecurity. According to the *F*-test all the variables together are significantly affecting food insecurity at one percentage. The variables which are not included in the model are collectively contributing in increase of the food insecurity as the intercept is positive and significant. Moreover, the relationship between food insecurity and Non-institutional agricultural credit is opposite to the overall agricultural credit and Institutional Agricultural Credit which means that Institutional Credit and Overall Agricultural Credit both have strong impact collectively as compared to the Non-Institutional agricultural credit. Food availability and food absorption have positive relationship with non-institutional agricultural credit while the situation of food access is quite opposite to others controlled variables.

### 5. Conclusions and recommendations

The study aims to achieve multiple objectives e.g. to rank the districts of the Punjab province in terms of distribution of agricultural credit per number of farms and to observe trends of percentage Food Insecure Population with Institutional, Non-Institutional and Overall Agricultural Credit. As far as the ranking of Agricultural Credit is concerned, Jhang district is found at the top in Total Agricultural Credit and Institutional Agricultural Credit while Jehlum is found at the bottom in Total Agricultural Credit and Non-Institutional Agricultural Credit. However, Mandi Bahauddin is found in middle category in overall agricultural credit while it is found at bottom in the institutional agricultural credit.

The empirical results of agricultural credit shows that there is negative relationship between food insecure population with overall agricultural credit and institutional agricultural credit in the Punjab Province of Pakistan. It describe that if there is increase in overall agricultural credit and institutional then food insecure population is also increases and on food security move in opposite direction. We can say that overall agricultural credit; institutional agricultural credit and food security has negative association between each other. This indicate that when there is one unit increase in the agricultural credit take place then there is one unit decrease in the food insecurity and one unit increase in food security. Relevant studies show that the impact of farm credit can be made cost effective by strengthening more smallholders than medium and large holders (Khandker & Faruquee, 2003) and small farmers are facing problems in getting credit rather than large farmers Agricultural credit

(Inayatullah et al., 2012). Food availability and food absorption also have negative relationship with overall agricultural credit but food absorption has positive and significant effect. In case of Institutional agricultural credit, food security, food availability and food access are showing the expected outcomes. Non-Institutional agricultural credit is favorable for food availability and food absorption. This results support the study of (Rao, 2003), in which he indicates that people are moving towards non-institutional agricultural credit rather than institutional agricultural credit. All of them are dependent on Agricultural sector while the food production reduces day by day and there is shortage of surplus in rice export.

Although this study has produced very good results for policy makers but it is strongly suggested to future researchers to carry out such kind of study using all of the independent variables. The future researchers must incorporate other inefficiency variables being used in the agriculture sector to determine relationship between food security and agricultural credit relations etc.

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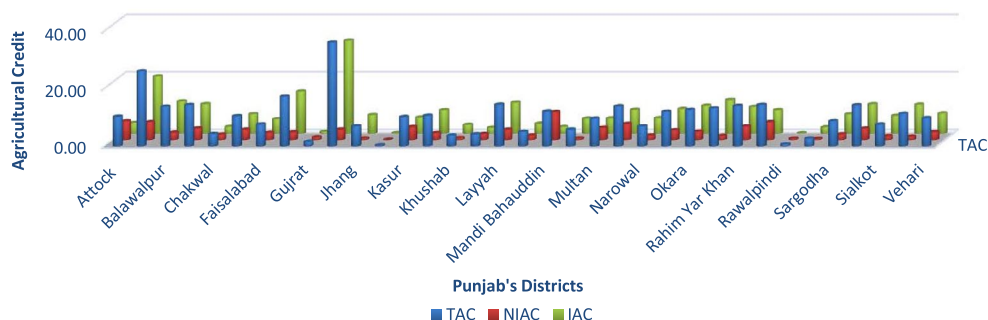
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## Appendix 1

Resources availability (Ranking) of total agricultural credit, institutional and non-institutional agricultural credit



Source: Author's estimation.



## Appendix 2

Ranking of total farm households with agricultural credit per total no. of farms

Rank	District	TAC	Rank	District	TAC	Rank	District	TAC
1	Hafizabad	35.99	13	Mandi Bahauddin	12.03	25	Jhang	6.92
2	Bahawalnagar	25.97	14	Nankana Sahib	11.95	26	Narowal	6.88
3	Gujranwala	17.18	15	T T Singh	11.23	27	Mianwali	5.79
4	Layyah	14.41	16	Khanewal	10.53	28	Lodhran	4.97
5	Rajanpur	14.31	17	D GKhan	10.36	29	Chakwal	4.22
6	Bhakhar	14.28	18	Attock	10.17	30	Lahore	4.12
7	Sheikhpura	14.2	19	Kasur	10.08	31	Khushab	3.7
8	R Y Khan	13.96	20	Vehari	9.71	32	Sahiwal	2.62
9	Muzaffargarh	13.81	21	Multan	9.54	33	Gujrat	1.55
10	Balawalpur	13.7	22	Sargodha	8.65	34	Rawalpindi	0.64
11	Pakpattan	13.1	23	Faisalabad	7.51	35	Jhelum	0.31
12	Okara	12.56	24	Sialkot	7.5			

Source: Author's estimation.

## Appendix 3

Ranking of farm households with institutional agricultural credit per total no. of farms

Rank	District	IAC	Rank	District	IAC	Rank	District	IAC
1	Hafizabad	32.34	13	Muzaffargarh	8.28	25	Faisalabad	5.04
2	Bahawalnagar	19.84	14	Rajanpur	8.16	26	Attock	3.72
3	Gujranwala	14.57	15	Khanewal	8.13	27	Lodhran	3.46
4	Pakpattan	11.7	16	Vehari	7	28	Khushab	3.05
5	Balawalpur	11.19	17	D G Khan	6.77	29	Chakwal	2.35
6	Layyah	10.8	18	Sargodha	6.72	30	MandiBahauddin	2.33
7	Bhakhar	10.26	19	Jhang	6.42	31	Sahiwal	2.25
8	Sheikhpura	10.23	20	Sialkot	6.17	32	Lahore	2.06
9	T T Singh	10.08	21	Kasur	5.6	33	Gujrat	0.65
10	Okara	9.69	22	Narowal	5.36	34	Jhelum	0.22
11	RYKhan	9.29	23	Multan	5.3	35	Rawalpindi	0.19
12	Nankana Sahib	8.57	24	Mianwali	5.25			

Source: Author's estimation.

#### Appendix 4

Ranking of farm households with non-institutional agricultural credit per total no. of farms

Rank	District	NIAC	Rank	District	NIAC	Rank	District	NIAC
1	MandiBahauddin	9.7	13	D Gkhan	3.59	25	Narowal	1.51
2	Attock	6.45	14	Nankana Sahib	3.38	26	Pakpattan	1.4
3	Rajanpur	6.15	15	Okara	2.87	27	Sialkot	1.33
4	Bahawalnagar	6.14	16	Vehari	2.7	28	T T Singh	1.16
5	Muzaffargarh	5.53	17	Gujranwala	2.61	29	Gujrat	0.9
6	R Y Khan	4.66	18	Balawalpur	2.52	30	Khushab	0.65
7	Kasur	4.48	19	Faisalabad	2.46	31	Mianwali	0.54
8	Multan	4.24	20	Khanewal	2.4	32	Jhang	0.49
9	Bhakhar	4.02	21	Lahore	2.05	33	Rawalpindi	0.45
10	Sheikhpura	3.97	22	Sargodha	1.94	34	Sahiwal	0.37
11	Hafizabad	3.65	23	Chakwal	1.87	35	Jhelum	0.09
12	Layyah	3.61	24	Lodhran	1.51			

Source: Author's estimation.



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