Impact of bank of agriculture credit's on agricultural productivity in South Western Nigeria

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Abstract

This study examined the impact of Bank of Agriculture (BOA) credit facilities on agricultural productivity in the South-West region of Nigeria. A multi-stage sampling technique was employed to select 225 beneficiaries and 630 non-beneficiaries farmers. Descriptive statistics were implemented to investigate the socio-economic attributes of the respondents. Impact of credit was analyzed using Propensity Score Matching (PSM), and the productivity of producers was analyzed using Total Factor Productivity (TFP). The respondents' average age was 47.6 years, and 87.0% of them were male. The average PSM score was 0.269, with four matching methods (Nearest Neighbour, Radius, Kernel, and Stratification matching) being implemented. The maximum and minimum propensity were 0.8207 and 0.0525, respectively. Both the balancing property and the region of common support (0.0503, 0.8209) were satisfied. The average treatment effect on the productivity differences of the treated (ATT) was approximately 0.347, and this difference was statistically significant at the 1% level. Productivity of ATT varied by approximately 21.0%. In summary, this investigation provided compelling evidence that the BOA credits have a positive impact on agricultural productivity in the South West. It was suggested that administrations at all levels and financial stakeholders should collaborate to ensure that producers have access to credit.

Keywords: Credit, Productivity, Impact, Radius, Kernel, Stratification matching.

Contents

Contribution of this paper to the literature
This study uniquely compares the productivity impacts between beneficiaries and non-beneficiaries of Bank of Agriculture credit in South Western Nigeria, providing a dual-perspective analysis. Unlike prior research, it incorporates farmers' socio-economic and contextual variables to reveal nuanced insights into credit utilization and barriers, guiding targeted policy and program improvements.

1. Introduction

Agricultural sector has been characterized as the most significant sector of the economy, and it has the potential to significantly contribute to the nation's future economic development, as it has in the past [1]. The study also asserted that agriculture is a critical component of the socio-economic development of most developing economies and is a significant factor in national development. Agriculture was a significant source of foreign exchange revenues and it supplied the burgeoning population with sustenance and employment, as well as basic materials for the expanding industries. According to Ogen [2] agriculture was the most significant sector in the 1960s in terms of its contribution to the GDP and occupational distribution. Additionally, the Nigerian economy could be accurately described as an agricultural economy in the first decade following independence. Agriculture is a substantial contributor to Nigeria's GDP, with small-scale producers playing a dominant role in this contribution, as per Rahji and Fakayode [29]. Nevertheless, her productivity and development are impeded by their restricted access to credit facilities [3].

According to the World Bank Report [4] relationship between agricultural financing and economic development has been the subject of extensive theoretical and empirical research in both developed and developing countries. In order to examine the impact of agriculture on the Nigerian economy, Rhaji [5] implemented the ordinary least squares method. He concluded that the absence of accessible, affordable, and sufficient credit is the cause of the systemic decline in the agricultural sector's contribution to the Nigerian economy. However, agricultural credit is regarded as a strategic resource that can be used to elevate the living standards of our rural, impoverished agricultural community by promoting the production of crops and animals to new heights. Consequently, it is essential for the growth of the economy. Credits are critical factor in the enhancement of agricultural productivity. Farmers can acquire the necessary apparatus and inputs for conducting agricultural operations as a result of the timely availability of credit [6]. The quickest method of boosting agrarian productivity is through the provision of inexpensive and accessible credit [7]. Credit is granted for the acquisition of seed, fertilizer, cattle, and implements, as well as for the alleviation of distress. Farmers must have the necessary funds to increase the utilization and diversity of their inputs. The producers' reserves are either negligible or nonexistent, necessitating that they borrow to finance their productive endeavours. The majority of farmers, particularly those who are minor, are unable to obtain essential commodities (such as fertilizer, enhanced seed, advanced technology, and plant protection) from their sources due to a dearth of funding. Therefore, agricultural credit is a critical component in providing the necessary investment to stimulate production growth [8]. Also, credit facilitated the adoption of yield-enhancing technologies while the demand for inputs was enhanced by the increased flow of credit to producers [9].

Consequently, credit to farmers is usually recognized as a successful strategy for increasing agricultural output [10]. The process of improving agriculture and transforming the rural economy is said to be reliant on agricultural finance. According to Mahmood, et al. [11] the fastest way to increase agricultural output is to provide affordable and easy loans. The agricultural sector, according to the thesis, is more dependent on credit than any other sector of the economy because of seasonal changes in farmer returns and the financial needs involved with the shift from subsistence to commercial farming. Credit allows people to improve their level of life and earn more money [11]. As a result, there is growing concern over the producers' incapacity to access credit, despite the presence of credit rules. For example, in 2000, the Nigerian Agricultural Cooperative and Rural Development Bank (now the Bank of Agriculture) set aside N5 million for each local government area in the nation as an investment revolving fund. Farmers who had access to finance faced much higher mean input expenditures per hectare, independent of their socioeconomic standing. The acquisition, administration, and repayment of credit are plagued by a multitude of issues, despite its importance in agricultural production. The Nigerian Agricultural Cooperative and Rural Development Bank (NACRDB), founded in 1973 and formerly known as the Nigerian Agricultural and Cooperative Bank, is a government-sponsored lending organization dedicated to meeting the credit needs of agriculture. The efficacy of NACRDB has been inadequately reviewed, due mostly to a high default rate among receivers [12].

The BOA, which is entirely under the control of Nigeria's federal government, is the country's most significant agency for supporting agricultural and rural development. The Federal Ministry of Finance Incorporated owns 60% of the structure, while the Central Bank of Nigeria (CBN) owns 40%. The Federal Ministry of Agriculture supervises the Bank of Agriculture Limited. The Nigerian Agricultural Bank (NAB) was formed in 1973 and renamed the Nigerian Agricultural and Cooperative Bank (NACB) in 1978. The Nigerian Agricultural Cooperative and Rural Development Bank Limited (NACRDB) was founded in 2000 as a result of a merger with the People's Bank of Nigeria (PBN) and the acquisition of the risk assets of the Family Economic Advancement Programme (FEAP). In 2010, a plan was adopted to turn the Bank into a long-term and efficient national agricultural and rural development finance organization. This technique resulted in a future rebranding as BOA Limited [13].

It is a nationally owned development bank entrusted with providing low-cost loans to smallholder and commercial farmers, as well as small and medium-sized rural businesses. It also provides microfinancing to small and medium-sized non-agricultural businesses. The goal is to ensure the sustainable provision of agricultural and rural finance services, thereby supporting the national economic development agenda, which includes food security, poverty alleviation, job creation, reducing rural-to-urban migration, reducing reliance on imported food, and increasing foreign exchange earnings.

1.1. Statement of the Problem

According to Phillip, et al. [10] the provision of financing to farmers is generally regarded as a successful technique for augmenting agricultural productivity. Mahmood, et al. [11] said that credit gives farmers the ability

increasing the income and enhance level of life. Agricultural financing is seen vital for enhancing agriculture and transforming the rural economy. The assertion is that the agriculture industry relies heavily on credit than any other input due to the fluctuations in farmers' earnings and the finance needed for the transition from subsistence to commercial farming. Despite Nigeria's huge fertile land, a large percentage of the population suffers from hunger, poverty, and unemployment as a result of agricultural neglect. Several agro-industries depend largely on the importation of vital raw materials for manufacture, while a considerable proportion of Nigerian youths remain unemployed. Various laws have been implemented to address these issues, with banks designated to play a significant role in financing via the supply of loans. Nonetheless, the truth persists that banks, namely commercial banks, have not adequately addressed the issue, as seen by the limited impact on agricultural loans [14].

Conversely, in instances when loans are poised for approval, some farmers or customers lack the requisite collateral and integrity demanded by banks as a safeguard against potential losses or unexpected liabilities in the event of failure. Consequently, several loans are diverted to non-agricultural projects due to the tendency of certain individuals to prioritize extravagant home expenditures, so undermining the intended aim of the credit. Some reputable customers, who may be shielded from this allegation, are inevitably burdened by uncontrolled elements, like change in policies, and challenges in securing official permits [15].

Numerous studies indicate that the provision of accessible and inexpensive financing is the most effective method for enhancing agricultural productivity [31]. The claim is that the agriculture industry relies more heavily on the finance necessary for transitioning from subsistence to commercial farming. In response Nigeria Government established financial institution (BOA) saddled with responsibility of providing easy and cheaper credit to farmer. But the drawback is that many farmers have collateral, while some diverted the loan instead of using in it to boost the production.

Given the foregoing, the study investigated impacts of agricultural credit on agricultural productivity in Southwest. Specific objectives are to:

1. Profile the socio-economic characteristics of the BOA credit facilities beneficiaries and non-beneficiaries.
2. Analyze the productivity differentials between non-beneficiaries and beneficiaries of BOA credit facilities in South-Western Nigeria.
3. Analyze the effect of BOA credit on farm productivity of the beneficiaries in the South-Western Nigeria.

2. Literature Review

2.1. Empirical Framework

The demand for commodities to enhance crop production had increased as a consequence of the credit transfer to producers, according to Siddiqi, et al. [9]. Omotoso and Omotayo [16] and Omotayo, et al. [17] found that the annual household income, per capita annual household income, rice income, rice output, and rice yield of producers are significantly and positively impacted by the utilization of credit in rice cultivation. Furthermore, a study conducted by Akinola and Oladejo [18] highlighted that direct lending mechanisms offered by BOA played a pivotal role in fostering innovation among agribusinesses within the region. This was evident through investments made by farmers towards modern farming techniques after securing funds from BOA-based credit programs. Ayegba and Ikani [19] revealed that less has been done to boost agriculture by assisting farmers through sufficient credit. On an institutional level, Omotoso and Omotayo [20] noted that while there were positive impacts associated with accessing BOA loans for agriculture purposes - including improved infrastructure and technology adoption - challenges related to loan accessibility processes hindered broader participation among small-scale farmers.

2.2. Theoretical Framework

2.2.1. Theory of Impact Evaluation

According to the World Bank [21] impact assessment assesses the intended and, preferably, unforeseen consequences of a particular intervention. Impact evaluation differs from outcome monitoring, which focusses on the achievement of objectives. It seeks to determine how participants' well-being changed in the absence of the intervention. This entails counterfactual analysis, which is defined as "a comparison between the actual events and the events that would have occurred in the absence of the intervention" [22]. Impact evaluations aim to address cause-and-effect enquiries. They seek to identify outcome changes that can be directly linked to a program [23]. Impact evaluation assists in addressing critical enquiries essential for evidence-based policymaking: what is effective, what is ineffective, the context, the reasons, and the associated costs. There has been a growing focus on this issue in policy-making across Western and developing countries [24]. This component is crucial in the evaluation toolkit and essential for global initiatives to enhance aid delivery's effectiveness and public expenditure, ultimately contributing to improved living standards [25].

Since it is impossible to see program participants' outcomes if they were not beneficiaries, an impact evaluation is fundamentally an issue of missing data. In the absence of counterfactual data, the most viable alternative is to assess the outcomes of treated individuals or households against those of a non-treated comparison group. In this process, a comparison group is selected that closely resembles the treated group, ensuring that individuals receiving treatment would have experienced outcomes akin to those in the comparison group had treatment not been administered. Effective impact evaluations depend on identifying an appropriate comparison group [26]. Researchers employ two primary approaches to replicate the counterfactual of a treated group: (a) establishing a comparator group via a statistical design, or (b) adjusting the program's targeting strategy to eliminate pre-existing differences between the treated and non-treated groups prior to outcome comparison.

The equation below illustrates the fundamental evaluation problem by comparing outcomes Y between treated and nontreated individuals i:

$$Yi = \alpha Xi + \beta Ti + \varepsilon i \qquad (1)$$

Where T is a dummy equal to 1 for those who participate and 0 for those who do not. X is a collection of additional noted traits of the person and maybe of his or her home and local surroundings. At last, ε is an error term indicating latent traits influencing Y as well. The equation shows a method often employed in impact assessments—that of

gauging the direct influence of the program "T" on results Y. Changes in pricing within program regions might potentially be of importance as indirect impacts of the program—that is, those unrelated to participation.

The problem with estimating equation $(Yi = \alpha Xi + \beta Ti + \varepsilon i)$ is that Because of these elements—a deliberate program placement and self-selection within the program—treatment assignment is not usually random. Programs are therefore positioned in line with the needs of the communities and people, who then self-select depending on program design and location. One might base self-selection on observable traits, unseen elements, or both. Regarding unobserved components, the estimating equation's error term will include variables likewise linked with the treatment dummy T. One cannot quantify and hence explain these unseen properties in the equation above, thereby generating unobserved selection bias.

That is, cov $(T, \varepsilon) \neq 0$ indicates the failure of one of the main assumptions of ordinary least squares in acquiring unbiased estimates: independence of regressors from the disturbance factor λ. Naturally, the correlation between T and ε biassed the other estimates in the equation, including the estimate of the program impact β. One might also depict this issue in a more conceptual context. Imagine one is assessing an antipoverty initiative meant to increase family earnings, a credit intervention.

$$D = E(Yi(1) | Ti = 1) - E(Yi(0) | Ti = 0) \quad (2)$$

Where D= different in productivity of credit beneficiary and non-beneficiary Yi stand in for household i's per capita income. Ti = 1 represents for participants the value of Yi during treatment as Yi (1). Ti = 0 for nonparticipators allows Yi to be expressed as Yi (0). The average impact of the program may be shown as follows if Yi (0) is utilized across nonparticipating homes as a comparative result for participant outcomes Yi (1)

One may also assume, less strongly, conditional exogeneity of program placement. The validity of the effect estimations is determined by the exogeneity of program targeting across treated and non-treated regions, as well as the justified assumptions on the comparability of participant and comparison groups. Still, one cannot evaluate the degree of bias "B" without any strategies or presumptions [26].

3. Methodology

3.1. Study Area

The research was carried out in Southwest Nigeria. Southwest Nigeria consists of six states: Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo. It is designated as the South West geopolitical or geographical region of Nigeria. The area mostly speaks Yoruba; nevertheless, several variants occur even within a single state. The area is located between longitudes 20° 31' E and 60° 0' E, and latitudes 60° 21' N and 80° 37' N. The area's population is 28,767,752, covering a total of 77,818 km² [26]. Southwest Nigeria is delineated to the North by Kwara and Kogi States, to the East by Edo and Delta States, to the South by the Gulf of Guinea, and to the West by the Republic of Benin.

The climate of Southwest Nigeria is tropical, marked by distinct wet and dry seasons. The climatic conditions vary between Nigeria's two distinct seasons: the rainy season (March - November) and the dry season (November - February). The dry season signifies the onset of Harmattan dust, as frigid, arid winds from the northern deserts infiltrate the southern regions at this time. The temperature ranges from 21°C to 34°C, and annual precipitation varies between 1,500mm and 3,000mm [13]. Agriculture is the primary occupation of the population in the area. They farm food crops such as rice, yam, cassava, maize, and cowpea, while cash crops include cocoa, oil palm, kola nut, plantain, banana, cashew, citrus, and timber. Animal husbandry, including fisheries, poultry, pig farming, goat, sheep, and cow raising, is evident.

Figure 1 is the map of Nigeria shows all the regions and States. Green portion is the North West region, yellow part is North West, red part is North central, blue part South East, purple part is south south region and white part is the South West region where this research was carried out.
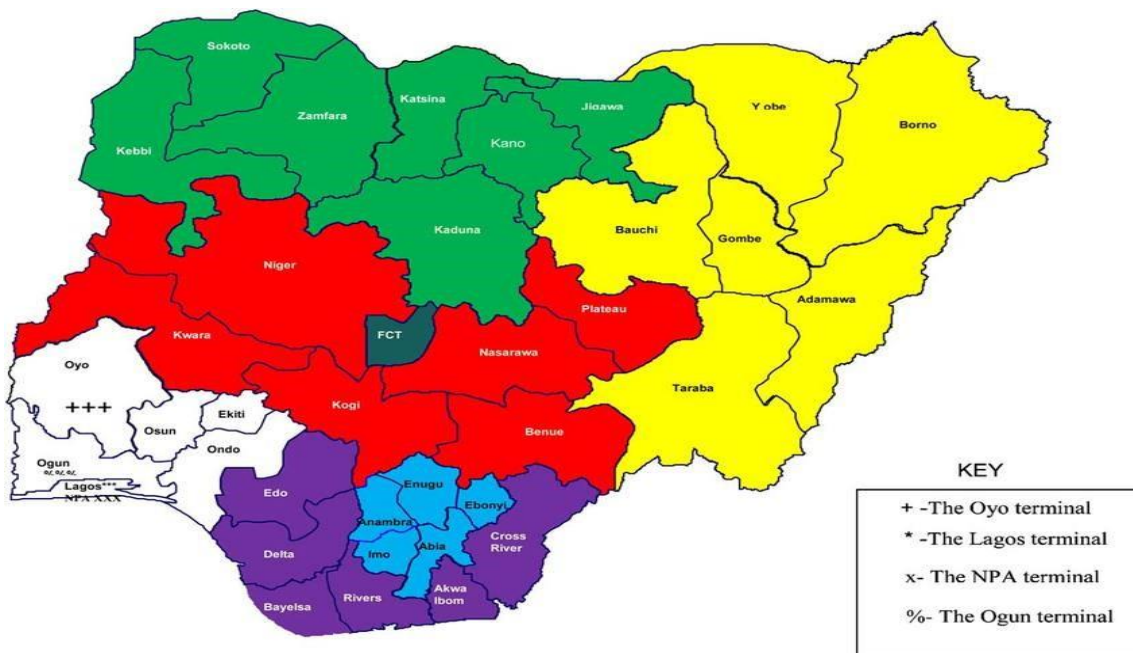

Figure 1. Map of Nigeria.

3.2. Population of the Study

Study populations were made up of farmers (those that benefited and those that did not benefit from BOA credits) in the Southwest, Nigeria.

3.3. Sampling Techniques and Sample Size

Multi-stages sampling technique was adopted. In stage one, three States were randomly selected from six States in the South-west, Nigeria (which are Ogun, Osun and Oyo States). In stage two, all the three branches of Bank of Agriculture in each of the state were selected and list of applicants (successful and non-successful) were collected; make total number of nine (9) branches. Branches of bank of agriculture limited in each of the three States are: Ogun State (Abeokuta, Imeko and Abigi Branches), Osun State (Osogbo, Ode-Omu and Ile-Ife Branches) Oyo State (Igbo-ora, Ibadan and Iseyin branches). Stage involved systematic selected of 25 beneficiaries (successful applicants) from each of the lists that was collected from each of the nine (9) branches; make a total of 225 beneficiaries. In stage four, 70 non- beneficiaries (non-successful applicants) were also systematically selected from the list provided by the bank; make a total of 630 non-beneficiaries. Both beneficiary and non-beneficiaries were 855 respondents.

3.4. Type of Data and Instrument used for Data Collection

This study used primary data acquired via a well-structured questionnaire. The questionnaire was framed in such a way to attain the objectives of the research. The questionnaire contained some useful information such as access to credit, constraint faced, inputs used, Output and revenue.

3.5. Methods of Data Analysis

Data were analyzed using descriptive statistics, Total Factor Productivity and Propensity Score Matching.

3.6. Model Specification
3.6.1. Total Factor Productivity (TFP)

$$TFP = logY - \beta_1 logK - \beta_2 logL \qquad (3)$$

Where Y = Output.

K= Capital.

And L= Labour costs.

Other necessary factors like Land, Fertilizer, Feed cost etc.

$$Explicitly: TFP = logY - \beta_1 logX_1 - \beta_2 logX_2 - \beta_3 logX_3 - \beta_4 logX_4 - \beta_5 logX_5 \quad (8)$$

Where TFP = Total Factor Productivity

$logY$ = Natural log of output

$logX_1$-$logX_5$ = Natural logs of inputs like; land, labour, Capital, chemical, Feed etc

β_1-β_5 = Coefficient of parameters

3.6.2. Propensity Score Matching (PSM)

Since the 1990s, propensity score matching has been widely used in Economics to assess the effects of a program or intervention on the economy. Ravallion [27] reiterated by Mapila, et al. [28] posits that propensity score matching involves the identification of two groups: those who participated in the intervention (access to credit in this study), represented by Ht=1 for beneficiary farmers, and those who did not participate, represented by Ht=0 for non-beneficiary farmers. Farmers receiving intervention benefits are paired with non-beneficiary farmers based on the likelihood that the latter would have benefitted from the intervention, referred to as the propensity score.

Propensity Score Matching was used to analyze impact of Agricultural Credit on farmers' productivity. It was used to compare the outcome of those benefited from agricultural credit and those who did not.

$$Yi = X_1 + X_2 + X_3 + - - -Xn + \epsilon \qquad (4)$$

Let Y_1 = Beneficiary of Agricultural Credit.

Y_0 = Non-beneficiary.

If a farmer is a recipient of Agricultural Credit, Z, an indicator variable, equals 1 (Z=1); if not, Z=0. This indicates if the farmer really got treatment (Credit). X represents a vector of control variables. Data on program recipients indicate the average result among the treated $E(Y_1|X, Z=1)$.

Thus, ATT of the scheme can be estimated as:

$$ATT = E(Y_1 - Y_0|, Z = 1) \qquad (5)$$
$$= E(Y_1|, Z = 1) - Ep|z = 1 \{EY(Y_0|Z = 1, P)\} \quad (6)$$
$$= E(Y_1|, Z = 1) - Ep|z = 1 \{EY(Y_0|Z = 0, P)\} \quad (7)$$

Where the first term of the above expression can be estimated from the treatment group and the second term from the mean outcome of the Matched (on P) comparison groups.

Table 1, shows the summary of the objectives of the study and analytical technique(s) used for each of the objective.

Table 1. Summary of objectives and analytical techniques.

S/N	Objectives	Description	Analytical technique
1	Describe the socio-economic characteristics of the BOA credit beneficiaries and non-beneficiaries. Nigeria.	Age, gender, marital status.	Descriptive statistics such as frequency, percentages and means.
2	Analyze the productivity differentials between the beneficiaries and non-beneficiaries of BOA credits in South-West Nigeria.	The diverse ways in which farmer improve their productivity. The factors to be considered are production factors: Inputs and output.	Total factor productivity (TFP) and t-test.
3	Analyze the effect of BOA credit on farm productivity of the beneficiaries in the South-Western Nigeria.	Different ways in which farmers make a living and build their worlds, e.g. improve productivity, increased income, improved welfare etc.	Propensity score matching (PSM).

4. Result and Discussion

Sex: Table 2 results showed that majority (87.1 percent) of respondents were male while only 12.9 percent were female. It also indicated that 91.1 percent of credit beneficiaries were male while female beneficiaries were just 8.9 percent, 85.7 percent of non-beneficiaries were male while 14.3 percent were female. This shows that male dominated agricultural production in the study area and that male benefited more from Bank of Agriculture Credit than female.

Age: It was revealed that 8 percent of beneficiaries have age below 30 years while 10.2 percent of non-beneficiaries belong to this age bracket and the pooled response was 9.6 percent. Only 8 percent and 9.7 percent of beneficiaries and non-beneficiaries were above 60 years respectively. The mean age were 48.5 years, 47.6 years and 47.8 years respectively for the beneficiaries, non-beneficiaries and pooled data. The average age of beneficiaries is slightly higher than that of non-beneficiaries. This is in tandem with findings of Nosiru [29] in his work where the average age for beneficiaries was 45.48 years while that of non-beneficiaries was 43.54years.

Marital Status: It was revealed that about 86 percent of beneficiaries and 85 percent of non-beneficiaries were married. Percentage of singles beneficiaries and non-beneficiaries were 4.9 percent and 9.7 percent respectively while 9.3 percent of beneficiaries and 5.8 percent of non-beneficiaries were either divorced, widowed or separated. This implies that married respondents had access to credit more than others. This conform with Olagunju [30] in her studywhere 78.30 percent of the respondents were married/engaged.

Education Qualification: Results in Table 2 showed that 14.2 percent of beneficiaries had no formal education. The percentage of beneficiaries and non-beneficiaries that had education up to tertiary level were 15.6 and 6.7 percent respectively. This implies that majority of beneficiaries (85.8 percent) and non-beneficiaries (89.7 percent) had formal education. This result contradicted the finding of Tilahun [31] in his study where majority (53.6 percent) of credit unconstrained and (56.2 percent) credit constrained had no formal education.

Farm Size: Revealed that majority of beneficiaries (72.0%) and non-beneficiaries (81.4%) had less or 5 hectares of land. The average farm size owned by beneficiaries was 5.9 hectares while that of non-beneficiaries was 3.7 hectares. This implies that on average beneficiaries had more land area than non-beneficiaries. This result contradicted that of Kiplimo, et al. [32] where mean farm size of farmers that accessed credit was 2.6 hectares and those that did not access credit was 2.9 hectares.

Contact with Extension Agents: It was further revealed that 59.1 percent of beneficiaries and 30.2 percent of non-beneficiaries had contact with extension agents. Beneficiaries and non-beneficiaries that did not have contact with extension agents were 40.9 percent and 69.8 percent respectively. This indicates that beneficiaries engaged with extension agents more frequently than non-beneficiaries. Results contradicted the findings of Kiplimo, et al. [32] which indicated only 21.5 percent of beneficiaries had contact with extension agents.

Type of Labour: The table also showed that 16.9 percent of beneficiaries and 45.6 percent of non-beneficiaries used family labour. Beneficiaries and non-beneficiaries that used hired labour were 48.9 and 21.2 percent respectively. Percentage of beneficiaries and non-beneficiaries that used both family and hired labour were 34.2 percent and 33.2 percent respectively. This implies that beneficiaries used more of hired labours than family labours. This result negated the findings of Takane [33] in his study "Labour use in smallholder agriculture in Malawi" where family labour accounted for 88% of total labour used.

Table 2. Socioeconomic distribution of respondents.

Socio-economic characteristics	Beneficiaries frequency % (N=225)		Non-beneficiaries frequency % (N=630)		Pooled frequency % (N=855)	
Sex						
Male	205	91.1	540	85.7	745	87.1
Female	20	8.9	90	14.3	110	12.9
Age (Years)						
≤ 30	18	8.0	64	10.2	82	9.6
31-40	36	16.0	103	16.4	139	16.3
41-50	83	36.9	223	35.3	306	35.8
51-60	70	31.1	179	28.4	249	29.1
Above 60	18	8.0	61	9.7	79	9.2
Mean	48.5		47.6		47.8	
Marital status						
Married	193	85.9	533	84.6	726	84.9
Single	11	4.9	61	9.7	72	8.4
Divorced	11	4.9	7	1.1	18	2.1
Widow/Widower	5	2.2	23	3.7	28	3.3
Separated	5	2.2	6	1.0	11	1.3
Education qualification						
Non-formal	32	14.2	65	10.3	97	11.4
Primary	85	37.8	289	45.9	374	43.7
Secondary	73	32.4	234	37.1	307	35.9
Tertiary	35	15.6	42	6.7	77	9.0
Farm size (Ha)						
≤ 5	162	72.0	513	81.4	675	78.9
6-10	34	15.1	89	14.1	123	14.4
Above 10	29	12.9	28	4.5	57	6.7
Mean	5.9		3.7		4.3	
Source of land						
Inheritance	109	48.5	386	61.3	495	57.9
Gift	41	18.2	107	18.0	148	17.3
Rent/Lease	30	13.3	70	11.1	100	11.7
Purchase	45	20.0	67	10.6	112	13.1
Contact with extension agents						

Socio-economic characteristics	Beneficiaries frequency % (N=225)		Non-beneficiaries frequency % (N=630)		Pooled frequency % (N=855)	
Yes	133	59.1	190	30.2	323	37.8
No	92	40.9	440	69.8	532	62.2
Type of labour						
Family labour	38	16.9	287	45.6	325	38.0
Hired labour	110	48.9	134	21.2	244	28.5
Family & hired labour	77	34.2	209	33.2	286	33.5

4.1. Productivity Differentials among the Respondents

Table 3 showed the mean productivity of beneficiaries compared to non-beneficiaries. Mean productivity of beneficiaries and non-beneficiaries was 1.64 and 1.29, respectively. The mean difference in productivity was 0.35, which was significant at the 1%. This indicates a significant difference in productivity between beneficiaries and non-beneficiaries.

Table 3. T-test analysis (Productivity by credit).

Categories	Obs.	Mean	Std. err.	Std. dev.	[95% Conf. interval]	
Non-beneficiaries	630	1.29	0.007	0.17	1.28	1.31
Beneficiaries	225	1.64	0.031	0.46	1.58	1.70
Combined	855	1.38	0.011	0.32	1.36	1.40
Difference		-0.35	0.022		-0.39	-0.30
diff = Mean (0) − Mean (1)					t = -16.1	

4.2. Descriptive Statistics of Propensity Score and Region of Common Support

Results in Table 4 showed that the total was 833 farmers and average propensity score was 0.269. Maximum and minimum propensity was 0.8207 and 0.0525 respectively. This implies that the average probability to access credit from BOA by respondents was about 27 percent.

The region of common support (0.0503, 0.8209), as presented in Table 4, indicates the point at which treatment (beneficiaries) and control (non-beneficiaries) exhibit similar propensity scores, thereby satisfying the balancing property. Minimum propensity score is 0.0503, while maximum propensity score is 0.8207.

Table 4. Descriptive statistics of propensity score and region of common support.

Intervention	Obs.	Mean	Std. dev.	Min.	Max.
Credit (Propensity score)	833	0.27	0.17	0.05	0.82
Credit (Common support)	833	-	-	0.05	0.82

4.3. Distribution of Treated and Controls Across Blocks

Result in Table 5 showed that optimum number of blocks was 6 which was determined by the programme. Beneficiaries and non-beneficiaries that were matched at lowest p-score (0.05) were 7 and 133 respectively while only 1 farmer each for beneficiaries and non-beneficiaries were matched at highest p-score. This implies that very few respondents were matched at level of high propensity score.

Table 5. Distribution of treated and controls across blocks.

Access to BOA credit			
Block of P score	Non-beneficiaries	Beneficiaries	Total
0.05	133	7	140
0.10	167	38	205
0.20	224	84	308
0.40	74	66	140
0.60	9	29	38
0.80	1	1	2
Total	608	225	833

4.4. Predictive Performance of Probit

The summary of predictive performance of the BOA credit was presented in Table 6. It showed a very high performance (92.70 percent) in non-treatment case and about 26 percent performance in the treatment case. The overall performance was about 75 percent. This implies the BOA credit performed well in agricultural productivity in study area.

Table 6. Predictive performance of probit (In %).

Performance indicator	Credit
Overall correct classification rate	75.09
Correct non-treatment classification rate	92.70
Correct treatment classification rate	25.78

4.5. Average Treatment Effect on the Treated (ATT) Productivity Differences Result

Table 7 presents ATT regarding productivity differences. ATT was determined by calculating the difference in contract productivities between the treated group (beneficiaries) and the control group (non-beneficiaries) with comparable propensity scores. The methods employed for ATT productivity comparisons included Nearest Neighbour, Radius, Kernel, and Stratification matching. Table 7 presents the total number of treated contracts, the corresponding number of control contracts utilized for matching, ATT productivity differences, the ATT productivity differences expressed as a percentage of average productivities, and the t-statistics for the productivity comparisons. Radius, kernel, and stratification matching utilize all control contracts, whereas nearest neighbour

matching employs only a subset of these contracts (151 out of 608) that exhibit the closest propensity scores to the treated contracts. Each treated contract was paired with one or more control contracts.

Nearest Neighbour matching involved pairing each treated contract with one or more control contracts that exhibited the closest propensity score. All 225 beneficiary farmers were matched with 151 non-beneficiary farmers. ATT for productivity differences is 0.347, which is significant at the 1%. The ATT percent productivity difference was 25.04%. This result implies that BOA credit increases the agricultural productivity by 25.0 percent in the study area. Radius matching matched each treated contract with one or more control contracts that has the similar radius. It matched all 225 beneficiaries with 608 non-beneficiaries farmers. It used more control than Nearest Neighbour. ATT productivity for radius matching was 0.351 which was significant at 1% level of significance and ATT percent productivity difference was 25.33%. This result implies that BOA credit increases the agricultural productivity by 25.33 percent in the study area. Kernel matching paired each treated contract with a weighted average of all control contracts, assigning weights that are inversely proportionate to the distance between the propensity scores of the treated and control contracts. It correlated all 225 beneficiaries with 608 non-beneficiary farms. It used the same quantity of controls as Radius matching. The Average Treatment Effect (ATT) productivity for kernel matching was 0.358, significant at the 1% level, with an ATT percent productivity difference of 25.84%. This result implies that BOA credit increases the agricultural productivity by 25.84 percent in the study area.

Stratification matching, matched each treated contract with one or more control contracts that have the similar strata. It matched all 225 treatments with 608 controls farmers. ATT productivity for stratification matching was 0.360 which is significant at 1% and ATT percent productivity difference was 25.98%. This result implies that BOA credit increases the agricultural productivity by 25.84 percent in Southwest.

Table 7. ATT productivities differences.

Matching method	Number of treated	Number of control	ATT productivity differences	ATT percent productivity differences	Standard error	t-statistic
Nearest neighbour	1.641(225)	1.294(151)	0.347	21.04%	0.036	9.66***
Radius	1.641(225)	1.290(608)	0.351	21.39%	0.031	11.18***
Kernel	1.641(225)	1.283(608)	0.358	25.84%	-	-
Stratification	1.641(225)	1.281(608)	0.360	25.98%	-	-

Note: Values in parentheses are numbers of observations. *** represents 1% level of significance.

4.6. Bootstrapped Standard Errors

Table 8 presented the result of bootstrapped standard error. The essence of bootstrapping was to adjust the standard errors and therefore, correct the bias in the estimate. The result showed very little or no difference in the standard errors of the estimate and that of bootstrapped standard errors. This implies that there were little or no bias in the estimate of the four matching methods used. The t-statistics for all the four matching methods used were significant at 1% level of significance. Table 8 presents compelling evidence that the BOA credit positively influences agricultural output in the research region.

Table 8. Bootstrapped standard errors of the matching methods.

Matching method	Number of treated	Number of control	ATT productivity differences	Standard error	t-statistic
Nearest neighbour	1.641(225)	1.294(151)	0.347	0.038	9.15***
Radius	1.641(225)	1.290(608)	0.351	0.034	10.24***
Kernel	1.641(225)	1.283(608)	0.358	0.027	13.35***
Stratification	1.641(225)	1.281(608)	0.360	0.034	10.56***

Note: Values in parentheses are numbers of observations. *** represents 1%.

4.7. Result of the T-Test

Table 9 presented the results of the hypotheses. Results revealed that, there were significant differences between BOA credit beneficiary farmers and non-beneficiary farmers with respect to sex, years of schooling, household size, main occupation, contact with extension agents, membership of organizations and farm size. Household size was significant at 10%. Sex, Years of schooling were significant at 5% while Main occupation, Contact with extension agent, membership of organizations and farm size were significant at 1%; hence, null hypotheses were rejected. There were no significant difference between the beneficiaries and non-beneficiaries with respect to age, marital status and farming years of experience; hence, null hypotheses were accepted.

Table 9. T-test estimates of the variables (Difference between means).

Variables	Mean		Diff	Std. error	T-value	P-value	Decision
	Treated	Control					
Age	48.480	47.630	0.847	0.858	0.99	0.324	Accept H$_O$
Sex	0.910	0.850	0.054	0.026	2.08	0.038**	Reject H$_O$
Married	0.857	0.846	0.011	0.028	0.42	0.673	Accept H$_O$
Years of schooling	7.836	7.108	0.728	0.360	2.02	0.044**	Reject H$_O$
Household size	7.862	7.405	0.457	0.259	1.76	0.078*	Reject H$_O$
Main occupation	0.738	0.529	0.209	0.038	5.56	0.000***	Reject H$_O$
Farming experience	18.711	18.051	0.660	0.899	0.73	0.463	Accept H$_O$
Extension contact	0.591	0.301	0.290	0.036	7.96	0.000***	Reject H$_O$
Member of organization	0.449	0.230	0.288	0.034	6.36	0.000***	Reject H$_O$
Farm size	5.861	3.700	2.161	0.433	4.99	0.000***	Reject H$_O$

Note: ***, ** and * represent 1%, 5% and 10%.

5. Conclusions and Policy Recommendations

Subsequent conclusions were derived from the results of this investigation: The study area was dominated by masculine agricultural production, and males derived greater benefits from Bank of Agriculture Credit than females. Both beneficiaries and non-beneficiaries were married and in their prime years. It was also determined that there was a substantial disparity in productivity between beneficiaries and non-beneficiaries, and that these disparities were genuine. The BOA credit performed exceptionally well in the study area. From the Nearest Neighbour, Radius, Kernel, and Stratification matching results, it was determined that agricultural productivity in Southwest increases approximately by 25% as a consequence of BOA credit. The policy implications of the findings were to enhance and maintain access to agricultural credit, as it was determined that agricultural productivity was positively influenced by agriculture. Consequently, educational stakeholders and governments at all levels (Federal, State, and Local governments) should collaborate to enhance farmers' access to formal education. Farmers should not be apprehensive about utilizing credit in their farming operations, as research has demonstrated that credits has beneficial impacts on agricultural productivity.

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