

Credit Constrained Condition of Farm Households and Profitability of Agricultural Production in Nigerian Agriculture

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Abstract: Credit is an important factor for improving the profitability of agricultural production activities of the resource poor smallholder farmers. This study was carried out in two Local Government Areas of Oyo and Ondo States of South-Western Nigeria, where the National Special Programme for Food Security (NSPFS) was implemented. The provision of credit to smallholder farmers was a major strategy employed by the programme to increase farmers' productivity, income and standard of living. The study investigated the determinants of credit constrained conditions of farm households and analyzed the effect of credit on profitability of agricultural production enterprises between credit constrained and unconstrained beneficiaries of NSPFS credit in the study area. A multi-stage sampling technique was used to collect primary data from 320 beneficiaries of agricultural production credit under the NSPFS. Descriptive statistical tools and switching regression model were used for analysis of the primary data obtained from the survey conducted. The findings of the study showed that majority (76.9%) of the credit beneficiaries were credit constrained while, the remaining (23.1%) were credit unconstrained. The result of the probit analysis showed that farmers' age, household size, gender, size of landholding, access to other credit, value of other assets, monthly household expenditure and choice of crop and livestock enterprises were the significant variables that determined the credit constrained condition of NSPFS credit beneficiaries in the study area. The switching regression model was used to determine the effect of credit constrained condition on farmers' profit. The result showed household size, amount of NSPFS credit obtained, access to other credit and monthly household expenditure as the significant factors that determined the profitability of agricultural production enterprises of credit constrained beneficiaries under the programme. The result further revealed that age, years of formal education, access to other credits, size of landholding and value of other assets were the significant variables that determined the profit of credit unconstrained farmers in the study area. The significance of the estimated lambda parameter for both groups of credit beneficiaries implies that ordinary least square estimate of the data collected would have yielded a bias estimate and therefore, the use of the switching regression model has corrected for biasness in the data obtained. A test of hypotheses on difference in profitability of the two groups showed that profit of the credit unconstrained farmers is higher than that of credit constrained farmers.

Key words: NSPFS, credit-constrained, credit-unconstrained, profitability, probit and switching regression models, lambda parameter

INTRODUCTION

Nigeria is the most populous country in Africa with a population of 140 million people on a land area of 924,000 km². One of the challenges of successive Governments is how to ensure sustainable national food security for its ever growing population. However, the Nigerian agricultural sector is dominated by resource poor smallholder farmers who lack adequate capital to achieve their production potential. Therefore, the Government had in the past intervened in the credit market with the establishment of Nigerian agricultural and rural development bank, agricultural credit guarantee scheme

fund, peoples bank, community banks and other special programmes such as national poverty eradication programme. The aim of Government interventions in the provision of credit for rural households is to improve the access of rural dwellers to formal credit. This is reflected in the micro-finance policy objective of Nigerian Government, which seeks to make financial services accessible to a large segment of the potentially productive population, which otherwise would have little or no access to financial services (CBN, 2005). Agricultural production credit, targeted at credit constrained farmers is expected to facilitate investment in agriculture and attain substantial impacts on smallholder farms

(Freeman *et al.*, 1998). The National Special Programme for Food Security (NSPFS) was implemented between 2001 and 2007 as a major intervention of Nigerian Government in the agricultural sector to increase farmers' productivity, income and standard of living. The programme cost the Federal Government of Nigeria a sum of US \$45.24 million and an additional \$22.25 million expended on South-South Cooperation component of the programme. The main implementation strategy of NSPFS is to empower small farming communities with timely provision of credit to achieving the NSPFS objective of increasing farmers output, productivity and income on sustainable basis. This study is therefore, aimed at assessing the impact of the credit programme on profitability of agricultural production enterprises of the smallholder farmers who are largely credit constrained. The result is expected to stimulate policy towards reducing the level of credit constraint caused by inadequate access of small scale farmers.

Problem statement: Smallholder farmers lack adequate capital to finance their farm operations and this inhibited them from realizing their potential income. Credit, therefore, plays an important role in smallholder agricultural production. However, farm households in rural areas do not usually have adequate access to formal sources of credit, which provide funds through formal financial institutions, such as commercial banks. This is mainly due to the inability of the rural households to provide the required personal collaterals to guarantee the loans and the general lack of information by the lending institutions on their creditworthiness (Bastelaer, 2000). This information asymmetry often results in credit rationing (Bell, 1990). The credit rationing of farmers often results in credit constraint condition that lead to low productivity (Akinterinwa, 2005). Therefore, according to Von Pischke *et al.* (1994), smallholders may be perpetually trapped in poverty due to lack of finances needed to undertake productive investments. Credit rationing can cause a misallocation of resources in farm production. The misallocation of inputs in agricultural production may cause the credit rationed or constrained farmer to have lower profit than the credit unconstrained farmer (Carter, 1989; Feder *et al.*, 1990). The above problems therefore, raise the following research questions:

- What factors contribute to credit constrained condition of NSPFS credit beneficiaries in the study area?
- Does credit influence the profitability of agricultural enterprises of NSPFS credit constrained and non-constrained beneficiaries?

- Is there any difference between the profitability of agricultural production enterprises of NSPFS credit constrained and unconstrained beneficiaries?

This study will provide relevant data that highlight the impact of NSPFS credit on profitability of agricultural production enterprises in South-Western Nigeria.

Objectives of the study: The general objective of this study is to investigate the link or relationship between credit and profitability of agricultural production enterprises of smallholder farmers participating in the National Special Programme for Food Security (NSPFS) in South West, Nigeria. The specific objectives are to:

- Examine and compare factors that determine the credit constrained condition of NSPFS participating households in the study area
- Examine and compare the effect of credit on profitability of agricultural production enterprises between NSPFS credit constrained and unconstrained beneficiaries in the study area

Research hypotheses: The following hypotheses were constructed and tested in this study:

Ho₁: Human capital, financial capital, physical capital, natural capital, household characteristics, welfare, institutional and enterprise variables do not affect the credit constrained condition of NSPFS credit beneficiaries.

Ho₂: There is no significant difference in the profitability of agricultural enterprises between NSPFS credit constrained and non constrained beneficiaries.

Research framework: The conceptual basis of this study considers credit as a financial capital resource of the smallholder farming households, which serves as a necessary input for agricultural production. The profitability of agricultural production activities of the households measured by gross margin analysis will determine the performance of households' agricultural enterprises. Participation in borrowing is a function of the household's or individual's demand for credit and access to credit market. The outcome of this process is the amount borrowed and the occurrence of loan rationing. To analyze, the determinants of this outcome, demand and supply factors need to be separated. As a sequential decision process, the household or its member should have access to the source of credit before deciding on, whether to apply for credit. Secondly, the lender decides, whether to give the applicant all the credit he or she asked for, or partially reduce or ration the credit amount, or to

fully reject his or her demand. This decision would affect the profitability of agricultural production activities of the households. Therefore, this framework proves relevant to this study. It is expected (a priori) that access to credit will influence profitability of agricultural enterprises of credit beneficiaries particularly the smallholder farmers who form the bulk of agricultural producers in Nigeria. This study relies much on this framework.

MATERIALS AND METHODS

This study was carried out in two randomly selected States (Oyo and Ondo States) of the South West, Nigeria, where NSPFS credit beneficiaries were located. The predominant occupations of the people in these States were farming, trading and artisans. Major food crops grown include maize, cassava, yam, cowpea, sorghum, millet while, the tree crops include cocoa, oil-palm, Kolanut, coffee, cashew etc. Ondo and Oyo States present an appropriate representation of the diverse vegetations, agricultural practices and types of crops, fisheries and livestock found in any part of the South West. The NSPFS was implemented in all the senatorial districts in the six States of the South-Western, Nigeria. The NSPFS sites in Oyo and Ondo States were used for this study. The 3 sites in Oyo State are Akufo Farm Settlement in Ido Local Government Area of Oyo South Senatorial District, Ilora Farm Settlement in AFIJIO Local Government Area of Oyo Central Senatorial District and Ogbomoso Farm Settlement in Ogbomoso South Local Government Area of Oyo North Senatorial District. The sites in Ondo State where NSPFS was implemented were Oba-Akoko in Akoko South West Local Government Area of Ondo North Senatorial District, Ogbese in Akure North Local Government Area of Ondo Central Senatorial District and Okitipupa in Okitipupa Local Government Area of Ondo South Senatorial District.

The sampling frame used for the study was the list of farming households participating in the NSPFS collected from Oyo and Ondo States Agricultural Development Programmes, which are the implementing agencies of NSPFS in the two selected States. The questionnaire was designed to capture information on socio-economic and demographic data like age, gender, household size, size of landholding, household assets, years of formal schooling, household income, agricultural enterprises, access to extension services, household composition, occupational statistics, financial contribution in associations, household expenditure, average monthly income and level of household access to credit. Some of the questions requiring recollection from memory were carefully designed with due consideration

for the shortest length of time possible for effective recall. Primary data were collected from respondents through a structured questionnaire administered by personal interview. Multi-stage sampling method was adopted in selecting 320 farmers for collection of data for this study based on probability proportionate to size of agricultural enterprises. The data collected were analyzed with descriptive, probit and switching regression model.

Determinants of credit constrained condition of NSPFS participating households:

Probit regression model was used to identify factors that determine or contribute to credit constrained condition of households. It was used to determine the relationship between a farming household credit constrained condition and a number of explanatory variables, which include household characteristics, human capital, physical capital, natural capital, financial capital, institutional factors, enterprise factors and welfare variables. The model is expressed as follows:

$$C^* = \delta' \sum_{i=1}^n Z_i + \epsilon_i \tag{1}$$

$$Z_i = f(D_i, H_i, F_i, P_i, N_i, E_i, W_i) \tag{2}$$

In Eq. 1,

C^* = Dichotomous (1, 0), indicating whether observation

i = Credit-constrained or not

Z_i = Represents a vector of explanatory variables such as household characteristics, human capital, financial capital, natural capital, physical capital, institutional factors, enterprise factors, welfare and State location variables

δ' = A vector of parameters

ϵ_i = A random error term

C^* , which is the excess demand function for credit, is not observed, but responses from the survey is used to determine those households whose productive activities are constrained if the demand for credit exceed the supply of credit, that is $C^* > 0$.

Households are credit-constrained if the demand for credit exceeds the supply of credit, which means $C^* > 0$. These responses are used to define a criterion function, which is an observable: dichotomous variable C_1 where:

$$C = 1; \text{ if } C^* = \delta' \sum_{i=1}^n Z_i + \epsilon_i \geq 0 \tag{3}$$

$C = 0$; otherwise

A probit maximum likelihood estimation is used to estimate the parameter δ' in Eq. 3. It is assumed that $\text{var}(\epsilon_i) = 1$ since, δ' is estimable only up to scale factor.

Where:

- C = Credit status of the household (constrained = 1 or non- constrained = 0)
- D₁ = Household characteristics
- D₁ = Age of household head in years
- D₂ = Household size in number
- D₃ = Gender, 1 if male and 0 otherwise
- H₁ = Human capital variable
- H₁ = Years of formal education (years of formal schooling)
- F₁ = Financial capital variables
- F₁ = Amount of NSPFS credit obtained (N)
- F₂ = Access to other credit, 1 = access and otherwise = 0
- F₃ = Financial contribution in the group, 1 if contributed, otherwise = 0
- P₁ = Physical capital variable
- P₁ = Value of other non land assets in Naira
- N₁ = Natural capital variable
- N₁ = Landholding (Hectares of land owned)
- E₁ = Enterprise factors
- E₁ = Farm size for poultry enterprise (No of poultry birds)
- E₂ = Farm size for maize/cassava enterprise (Hectares)
- E₃ = Farm size for fisheries enterprise (size of fish pond) (reference enterprise)
- W₁ = Welfare variable
- W₁ = Household expenditure per month (N)

These variables were selected based on *a priori* expectation, economic theory, study search on related earlier studies, NSPFS implementation manual and evaluation report on NSPFS.

Effect of credit on profitability of agricultural production enterprises of NSPFS credit (constrained and non-constrained) beneficiaries:

Two methods of analysis were adopted to analyze this objective. First, budgetary (Gross margin) analysis was applied to derive the profitability of the farm production investments of the households. The ultimate aim of every business enterprise is to maximize the use of available resources and overall profit. The performance of an agricultural production enterprise is therefore, measured using the output level or profit or gross margin, given the various inputs. The gross margin was adopted in this study for assessment of the profitability of agricultural production enterprises of the households. The farm profit estimates use gross margin function (net revenue), often called pseudo-profit

functions (Carter, 1989), in order to avoid the possible imperfections in capital, land and other fixed factors.

Second, the Switching Regression Model (SRM) was applied to assess the effect of credit on profitability of agricultural enterprises of NSPFS credit constrained and non-constrained beneficiaries. The switching regression model is a useful analytical tool for correcting possible sample selection bias, which may arise from other interventions that provide multiple services to farmers in addition to credit. Sample selection bias arises when factors unobserved by the researchers but known to the farmer affect both the choice of technology as well as other decision variables (Fuglie and Bosch, 1995; Nuryatono *et al.*, 2005). The status of the credit beneficiaries, credit constrained or unconstrained, determines the switch between two different categories describing the dependent variable. The model was used to determine factors that affect profitability of agricultural enterprises of NSPFS credit (constrained and non-constrained) beneficiaries in the study area. The SRM approach is divided into two stages. It has been hypothesized that access to credit markets and liquidity constraints has a significant effect on agricultural production activities. In the first stage of application of switching regression model, a probit model was applied to determine the relationship between household credit constraint conditions and a number of explanatory variables. This was done in the analysis of the second objective of this study, where probit model was used to identify the variables that best characterize credit constraint status of households.

In the second stage of the switching regression model, profitability (gross margin) of agricultural production enterprises of the two groups of farmers is modelled by reduced form equations specified by:

$$P_{cc} = \beta_{1i}X_{1i} + \epsilon_{1i}; \text{ if } I = 1 \tag{4}$$

$$P_{ncc} = \beta_{2i}X_{2i} + \epsilon_{2i}; \text{ if } I = 0 \tag{5}$$

Where:

- P_{cc} and P_{ncc} = Profitability of agricultural production enterprises of credit- constrained and non-credit constrained beneficiaries, respectively
- X_{1i} and X_{2i} = Vectors of exogenous variables
- β_{1i} and β_{2i} = Vectors of parameters
- ε_{1i} and ε_{2i} = Random disturbance terms

Maximizing the bi-variate likelihood function for this model is feasible but time consuming (Madalla, 1983). Therefore, following Nuryatono *et al.* (2005) and Lee (1978), a two stage estimation method was used to estimate the system in Eq. 3-5.

The conditional expected values of the error terms ϵ_{1i} and ϵ_{2i} are:

$$E(\epsilon_{1i} | \epsilon_i = \delta'Z_i) = E(\sigma_1 \epsilon_i | \epsilon_i = \delta'Z_i) = \sigma_1 \epsilon \frac{\phi(\delta'Z_i)}{\Phi(\delta'Z_i)}$$

$$E(\epsilon_{2i} | \epsilon_i = \delta'Z_i) = E(\sigma_2 \epsilon_i | \epsilon_i = \delta'Z_i) = \sigma_2 \epsilon \frac{\phi(\delta'Z_i)}{1 - \Phi(\delta'Z_i)}$$

where, ϕ and Φ are the probability density function and the cumulative distribution function of the standard normal distribution, respectively. The ratio ϕ/Φ evaluated at $\delta'Z_i$ for each i is the Inverse Mills Ratio (IMR). For convenience:

$$\lambda_{1i} = \phi(\delta'Z_i)/\Phi(\delta'Z_i) \text{ is} \tag{6}$$

defined for credit constrained and

$$\lambda_{1i} = \phi(\delta'Z_i) / [1 - \Phi(\delta'Z_i)] \tag{7}$$

for non- credit constrained

These terms are included in the specification of Eq. 4 and 5:

$$P_{cc} = \beta_1 X_{1i} + \sigma_{1u} \lambda_{1i} + \epsilon_{1i}; \text{ if } I = 1 \tag{8}$$

$$P_{ncc} = \beta_2 X_{2i} + \sigma_{2u} \lambda_{2i} + \epsilon_{2i}; \text{ if } I = 0 \tag{9}$$

$$X_i = f(D_i, H_i, F_i, P_i, N_i, E_i) \tag{10}$$

where, $D_i, H_i, F_i, P_i, N_i, E_i$ and W_i are as specified above.

RESULTS AND DISCUSSION

Socio-economic and other assets of the farming households: Household demographic characteristics, financial capital, human capital, natural capital, physical capital, institutional, farm enterprise, welfare and location variables are important variables that influence farm households' credit constraint condition and profitability of farm business. The study examined these variables in the study area.

Household demographic characteristics: The three main household characteristics considered in the study were age of the household head, household size and gender composition of the household. The description of the variables is contained in Table 1. The mean age of NSPFS credit beneficiaries was about 52 years, credit-constraint-beneficiaries (50 years) and non-credit-constraint-beneficiaries (51 years). The average household size for NSPFS credit beneficiaries was 6 and 7 for non-credit

beneficiaries. The mean household size for credit constraint beneficiaries was 7 as against 6 for the non-credit-constraint-beneficiaries. Gender analysis indicates that 94.69% of the credit beneficiaries, 95.53% of credit constrained and 91.89% of credit unconstrained benefiting households were male-headed.

Human capital/assets of households: Level of education of the household heads, measured by years of formal education as shown in Table 1, was the major human capital variable examined. About 54% of the non-constraint beneficiaries of NSPFS credit and 49% of the credit-constraint-beneficiaries had no formal education.

Financial capital/assets of the households: The analysis of financial capital variables shows that 9.46% of the credit constrained farmers as against 15.85% of the credit unconstrained farmers had access to other sources of credit. The analysis of household head financial contribution to his or her NSPFS primary farming group revealed that majority of NSPFS credit beneficiaries (95.63%), credit-constraint-beneficiaries (94.31%) and non-credit-constraint-beneficiaries (100%) contributed financially to his or her group. On amount of NSPFS credit rationing of benefiting households, the mean amount of credit rationed for all categories of beneficiaries was N53,778.70 and credit-constraint-beneficiaries (N69,956.04). The analysis of amount of NSPFS credit obtained by beneficiaries was averaged N80,695.47, credit-constraint-beneficiaries (N75,076.81) and non-credit-constraint-beneficiaries (N99,373.51). The mean amount of credit requested by NSPFS credit beneficiaries was (N134,474.18), credit-constraint-beneficiaries (N145,032.91) and non-credit-constraint-beneficiaries (N99,373.51).

Natural capital/assets of the households: Size of landholding was the natural capital variable examined in this study. This is measured by the size of land owned as shown in Table 1 and the average for all categories of NSPFS credit beneficiaries was 5.05 ha. A further analysis of the result indicates that credit constrained farmers had 5.26 ha while, credit unconstrained farmers had 4.34 ha.

Physical capital/assets of the households: Household endowment of physical capital is an indicator of the asset endowment and livelihood strategy choice of the rural households. The physical capital examined in this study was the quantity of other non land assets such as number of small animals, poultry birds etc. estimated by the current market value of the asset equivalent. The mean value of other non land assets owned by all categories of beneficiaries was N34,082.50. On the other hand, the mean

Table 1: Description of explanatory variables

Variables	Type	Description
Age	Continuous	Age of household head/respondent
Gender	Binary	Sex of respondent, 1 if male and 0 otherwise
Household size	Continuous	Household size
Landholding	Continuous	Hectares of land owned
Value of other non-land assets	Continuous	Naira amount of other non-land assets owned by the household
Years of formal education	Continuous	Years of formal schooling
Financial contribution of household head in his/her group	Binary	1 if respondent contributes in his/her group and 0 otherwise
Access to other sources of credit	Binary	1 if respondent has access to other sources of credit and 0 otherwise
Amount of NSPFS credit obtained	Continuous	Naira amount of production credit obtained from NSPFS
Household expenditure per month	Continuous	Naira amount expended by household on food and other basic necessities
Poultry enterprise	Binary	1 if respondent major enterprise is poultry and 0 otherwise
Cassava/maize enterprise	Binary	1 if respondent major enterprise is cassava/maize production and 0 otherwise
Fishery enterprise (reference enterprise)	Binary	1 if respondent major enterprise is fishery production and 0 otherwise

value of other non-land assets of NSPFS credit constrained farmers was N27,948.37, while the unconstrained farmers was N54,474.32.

Institutional factors of the households: Two institutional variables were examined and the result shows that all the NSPFS credit beneficiaries (100%) belonged to registered primary farming groups and had access to extension services.

Gross margin analysis of households farm production enterprises: The mean gross margin for all categories of NSPFS credit beneficiaries in the study area was N20,4392.43. On category basis, the gross margin for livestock farmers shows that the mean gross margin of credit beneficiaries was N327,542.67. A further disaggregation of the gross margin for credit beneficiaries shows that the non-credit constrained beneficiaries recorded a gross margin of N355,206.06, while that of the credit constraint beneficiaries was N293,731.85.

On the other hand, the analysis of gross margin for crop farmers shows that the mean gross margin of credit beneficiaries was N119,395.98. The gross margin of the non-credit constrained beneficiaries was N144,966.67, while that of the credit constrained beneficiaries was N115,999.23.

Analysis of gross margin for fish farmers indicates that NSPFS credit beneficiaries recorded a gross margin of N224,467.86. A further analysis of the gross margin of the credit constrained beneficiaries was N188,334.29 as against N236,512.38 for the unconstrained beneficiaries.

Welfare factors of the households (household expenditure on food and basic non-food items): The analysis of monthly expenditure and per capita expenditure of the sampled households indicated that NSPFS credit beneficiaries recorded a mean per capita expenditure of N6,454.91. The credit constrained beneficiaries have a mean per capita expenditure of

N6,238.56, while that of the unconstrained beneficiaries was N7,174.15. On household basis, the total monthly expenditure of beneficiaries averaged N39,773.27, while that of the non-beneficiaries was N35,043.33. A further decomposition of the credit beneficiaries shows that the credit constrained beneficiaries had monthly expenditure of N38,859.58 as against N42,809.32 for the unconstrained beneficiaries.

Probit regression model was used to analyze factors that determine the credit constrained condition of households in the study area. Table 2 shows, the maximum likelihood estimates of the probit model. The significance of the log-likelihood ratio and chi-square (χ^2) shows that the probit model is fit and appropriate for the analysis. Nine out of the eleven explanatory variables specified in the model were found to be significant in explaining variations in the credit constraint conditions of NSPFS credit beneficiaries.

The three household characteristics (age, gender and household size) examined in this study were found to have significantly positive influence on credit constrained condition of NSPFS credit beneficiaries. Table 2 indicates that male headed households are likely to be more credit constrained than female headed households. The result indicates that female headed households are encouraged to participate in the programme. The significance of the coefficient ($p < 0.01$) and the marginal effect shows that gender is an important factor influencing credit constrained status of NSPFS credit beneficiaries. The result is consistent with the findings of Omonona *et al.* (2008b).

Age of the household head positively and significantly ($p < 0.1$) influences credit constrained condition of the NSPFS credit beneficiaries. The result implies that older farmers are more likely to be credit constrained. The marginal effect indicates that a year increase in the age of the farmer increases the probability of the households being credit constrained by 0.003. This result confirms the earlier findings of Zeller (1994) and Omonona *et al.* (2008a).

Table 2: Determinants of credit constraint condition of households benefiting in NSPFS credit (Probit model)

Independent variables	Coefficient	SE	t-value	Marginal effect
Household characteristics				
Age	0.0327893	0.0193543	1.69*	0.002543
Household size	0.1098114	0.0537958	2.04**	0.0085165
Gender	3.1397150	0.7338031	4.28***	0.8535547
Human capital				
Years of formal education	0.0159104	0.0503563	- 0.32	0.0012339
Financial capital				
Access to other credits	0.8075405	0.3834582	-2.11**	0.0389662
Financial contribution	0.5057736	0.6051266	-0.84	0.0259994
Natural capital				
Landholding	0.0549668	0.0335107	1.68***	0.004263
Physical capital				
Value of other assets	0.0000177	0.0000057	- 3.11***	0.0000012
Welfare variable				
Household exp per month	0.0000323	0.0000101	- 3.20***	0.0000015
Enterprise variables				
Livestock enterprise	5.880573	0.9284884	6.33***	0.9967089
Crop enterprise	1.559119	0.4180136	-3.73***	0.1690921
Constant	3.216671	1.5662380	2.05**	
Log likelihood	78.586462***			
Chi square (χ^2)	258.42***			
Pseudo R ²	0.6218			

Result of data analysis 2007/2008. ***, **, *Significant at 1, 5 and 10%, respectively

Household size has a positive coefficient, which significantly ($p < 0.05$) influences credit constrained status of the NSPFS credit beneficiaries in the study area. The positive sign and significance of the coefficient imply that NSPFS households with more household members have high probability of being credit constrained. This result agrees with that of Nuryatono *et al.* (2005).

The coefficient of landholding (hectares of land owned), a natural capital variable is positive and significantly ($p < 0.01$) influences credit constrained condition of households. The result indicates that large landholders have high probability to be more credit constrained. This result deviates from the earlier findings of Nuryatono *et al.* (2005) and consistent with that of Omonona *et al.* (2008b).

The coefficient of value of other non-land assets, a physical capital variable, negatively and significantly ($p < 0.01$) influences the probability of households being credit constrained. The result implies that as the value of other non-land assets owned by the household increases the probability of households being credit constrained decreases.

Household expenditure per month, a proxy for welfare status, negatively and significantly ($p < 0.01$) influences credit constrained condition of the households. The result implies that households with higher welfare status are less likely to be credit constrained. It could also imply that higher household income or welfare levels, proxied by expenditure, would seem to increase credit supply more than credit demand. This agrees with the findings of Nuryatono *et al.* (2005) and Foltz (2003).

Two financial capital variables (access to other sources of credit and financial contribution of household head in his or her group) were examined in this study. The coefficient of access to other sources of credit is negative and significant ($p < 0.05$) implying that the greater the degree of access to other sources of credit the lower the probability of households being credit constrained and vice versa. This finding confirms the a priori expectation that access to other sources of credit would reduce the amount of NSPFS credit demanded and the likelihood to be credit constrained.

The significance of the enterprise variables (livestock and crops) suggests that economic interest or enterprise type is a significant determinant of the credit constrained status of the households. The positive coefficient for livestock enterprise implies that poultry farmers are more likely to be credit constrained while, the negative sign of the coefficient for crops enterprise suggests that cassava/maize farmers are less likely to be credit constrained relative to the fisheries enterprise, which is the reference enterprise.

In summary, the credit constrained condition of NSPFS farming households in the study area is determined by age, household size, gender, size of landholding (owned land), access to other credit, value of other assets, household expenditure per month and enterprise variables.

The Switching Regression Model (SRM) was adopted for the analysis of the determinants of profitability (proxied by gross margin) of agricultural enterprises among NSPFS credit beneficiaries (credit constrained and

Table 3: Effect of credit on profitability of agricultural production enterprises of NSPFS credit (constrained and unconstrained) Beneficiaries-switching regression model

Independent variables	Credit constraint	Non-credit constraint
Household characteristics		
Age	891.1999 (794.0672)	4747.71 (1377.748)***
Household size	-15611.04 (4143.141)***	-2238.009 (3345.322)
Gender	-49316.42 (31360.49)	-12936.23 (40657.98)
Human capital		
Years of formal education	-805.5447 (2127.985)	9386.673 (3927.845)**
Financial capital		
Amount. of NSPFS credit obtained	0.0607227 (0.1562719)**	0.293918 (.2344226)
Access to other credit	13858.42 (16365.91)**	-77099.06 (38282.79)**
Financial contribution	-25426.24 (24415.74)	-8463.029 (97382.38)
Natural capital		
Landholding	2178.744 (1981.957)	-4810.126 (2406.872)**
Physical capital		
Value of other assets	0.6488191 (0.2405087)	2.675649 (.4012166)***
Welfare variable		
Household exp. per month	2.100759 (0.41705)***	0.3178684 (.4949488)
Lambda	384491.8 (28340.5)***	4.087698 (1.568498)***
Adjusted R ²	0.7576	0.8972
F-value	333.40***	412.17***
Observations	207	113
Constant	334557.9 (69981.25)***	48841.3 (125692.9)***

Result of data analysis 2007/2008, ***, **, *Significant at 1, 5 and 10%, respectively; Standard errors are in parentheses

non-constrained households). It was hypothesized that households' characteristics, human capital, financial capital, natural capital, physical capital and welfare variables have significant effects on profitability of agricultural production enterprises (gross margin).

Table 3 shows the estimated coefficients for a pseudo-profit function of the agricultural production activities of sampled NSPFS credit beneficiaries, which are distinguished between credit constrained and non-constrained households. Table 3 shows, the result of the second stage of the probit switching regression model. The relevant significant variables influencing the profitability of agricultural enterprises of NSPFS farmers (credit constrained and non-credit constrained) in the study area were identified. The significance of the estimated lambda confirms the appropriateness of the use of switching regression model and that the use of ordinary least square method would have produced biased estimates.

Three household characteristics (gender, age and household size) were examined. The coefficient of age is positive and significantly ($p < 0.01$) influences profitability of agricultural activities of the NSPFS credit non-constrained beneficiaries.

This implies that the older the credit unconstrained household head the higher the level of profit. Better knowledge of agricultural production accumulated over the years may account for higher level of profit of the older households' heads. On the other hand, household size negatively and significantly ($p < 0.01$) influences profitability of agricultural activities of the NSPFS credit constrained beneficiaries. This result suggests that family labor do not have significant contribution to agricultural

activities and profit of the households. This result contradicts the earlier findings of Nuryatono *et al.* (2005).

Years of formal education of the heads of households, a human capital variable has positive coefficient for credit unconstrained households and significant at the 5% level. However, the coefficient of this variable is negative and insignificant for credit constrained households. This result suggests that credit unconstrained households have an advantage along with increasing level of education of households heads. Level of education contributes significantly to the level of agricultural activities of the households and increases profit. This result agrees with the findings of Foltz (2003) and contradicts the result of Nuryatono *et al.* (2005).

In an imperfectly operating land markets, landholding, a natural capital, is expected to be a significant determinant of profit. In this study, size of land owned (landholding) has a significant ($p < 0.05$) negative coefficient for credit unconstrained households implying that the profitability of agricultural production activities of credit unconstrained households decreases with increase in the size of land owned. This result confirms the earlier findings of Nuryatono *et al.* (2005).

Out of the three financial capital variables examined in this study, the coefficients of amount of NSPFS credit obtained and access to other sources of credit were found significant. Access to other sources of credit and amount of NSPFS credit obtained were positive and significant ($p < 0.05$) for credit constrained households implying that the greater the degree of access to other sources of credit and amount of NSPFS credit obtained by credit constrained households the higher the profit. This finding confirms the fact that additional loans are used to finance

Table 4: Test for differences in profitability (gross margin) of credit constrained and credit non-constrained beneficiaries

Descriptive statistics	Credit constrained	Credit non-constrained
Mean	199526.49	220568.38
SD	154330.23	140938.315

households’ agricultural production activities, which consequently increases profitability. This result is in consonance with the findings from the earlier research of Nuryatono *et al.* (2005) and Nuryatono (2005).

The coefficient for value of other assets, a physical capital variable, is positive for both categories of NSPFS credit beneficiaries. However, the coefficient is significant for only non-constrained households as the result confirms that credit unconstrained households have more other assets, which tend to positively influence their profit. This result is in consonance with the earlier findings of Nuryatono *et al.* (2005), in which credit unconstrained households have positive and significant coefficient for value of other assets.

Household expenditure per month, a welfare variable, has positive effect on profit for both credit constrained and credit unconstrained households. The effect is stronger and significant for the credit constrained as expected if liquidity effects were present. The coefficient is positive and statistically significant at 1% level for credit constrained households.

Other variables such as gender and financial contribution of the household head have no significant influence on the profit of both categories of households.

$$Z_{ca} = 3.391$$

$$Z_{tab} = 1.964$$

Hypothesis:

$$H_0: \bar{X}_1 = \bar{X}_2$$

$$H_1: X_1 \neq X_2$$

Where:

X1 = Credit constrained

X2 = Credit non-constrained beneficiaries

Table 4 shows the result of test of hypothesis for difference in profitability of credit constrained and unconstrained beneficiaries. The result shows that profitability of credit unconstrained beneficiaries is significantly different from that of constrained beneficiaries of NSPFS credit. Therefore, profitability of credit unconstrained beneficiaries is higher than that of constrained beneficiaries.

Summary of major findings: The results of the descriptive analysis indicated that the mean age of credit beneficiaries was 52 years, credit constrained beneficiaries

(50 years) and non credit constrained beneficiaries (51 years). Also, majority of credit beneficiaries (48%), 54% of the non-credit-constraint beneficiaries and 49% of the credit constraint beneficiaries had no formal education. The analysis of financial capital variables shows that only 14.38% of the NSPFS credit beneficiaries, 15.85% of the credit constraint and 9.46% of non-credit constraint beneficiaries have access to other sources of credit.

The switching regression analysis of determinants of credit-constrained conditions of households revealed that age, gender, landholding (size of land owned), access to other credit, household size, value of other non-land assets and average monthly expenditure are the important factors that influence credit constrained conditions of households.

The result of the impact of credit on profitability of agricultural enterprises of credit constrained and non constrained households obtained at the second stage of the switching regression model showed that age, years of formal education, landholding, household size, access to other sources of credit, value of other assets and household expenditure per month are the important variables that influence the profitability status of the two categories of NSPFS credit constrained and unconstrained beneficiaries.

CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study a number of policy implications and recommendations are hereby made to ensure improved performance and profitability of the farm business. The most important ones are:

- The mean age of 52 years for beneficiaries of NSPFS credit implies that most of the farmers are old and this has serious implication for sustainable agricultural development. Efforts to ensure sustainable agricultural production should be targeted at the active population who are relatively young to carry out the business of farming. There is therefore, the need for policy support for empowerment and more active involvement of the youth and younger population in the NSPFS. This would also serve as a succession arrangement to ensure that there is no generational gap in agricultural production
- The descriptive analysis indicates that majority (77%) of the beneficiaries are credit-constrained. This implies that the credit needs of the beneficiaries are not adequately met with adverse consequences on benefiting households’ agricultural production activities and profit. This suggests the need for policy support to increase the volume of fund available to beneficiaries under the programme

- The findings from the study also revealed that the mean household size of 6 members per household is relatively large and negatively affects the credit constrained status and profitability of the households farm business. There is therefore, the need to improve programmes and policies that will ensure proper family planning, which will reduce the number of dependants to that which, the household can adequately cater for. It also calls for sustained enlightenment campaign on the consequences of large family size

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