30- EFFECT OF CREDIT CONSTRAINT ON PROFIT OF SMALL SCALE RICE-BASED FARMERS IN NIGER STATE, NORTHWESTERN NIGERIA

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Abstract

Credit constraint occurs when a farmer cannot increase expenditure on inputs in order to maximize profit due to lack of farm credit or high cost of credit. Farming households are confronted with credit constraint that results in low crop output and profit. Using a non-parametric measure of efficiency, the Data Envelopment Analysis Programme (DEAP) and a credit-constrained profit function, this study analyses the presence and effect of credit constraint on the profit maximization objective of rice farmers in a 2009 survey conducted in Niger State, Northwestern Nigeria. The differences between profit functions with and without a credit constraint gave a measure of the effect of credit constraint on profit. Results showed that most rice farmers (67.5%) were credit constrained. Credit-unconstrained rice farmers (CUF) that used formal credit spent ₦23,583.87±8662.18/ha and ₦11,806.45±6927.71/ha respectively on fertilizer and herbicides as compared to ₦16,675.00±9627.48/ha and ₦7,591.18±7503.02/ha respectively by informal credit recipients. On the other hand, credit constrained farmers (CCF) spent ₦11,949.78±8488.26/ha and ₦5550.00±5145.61/ha on fertilizer and herbicides. There was significant difference in gross margin of CUF (₦315, 380.60/ ha) and CCF (₦220, 477.85/ha). CCF were less efficient and less profitable. CUF, contrariwise, were able to spend more on improved farm inputs, more efficient and more profitable. It is recommended that suitable credit support and educational programmes for rice farmers should be established to encourage expenditure and efficient use of improved inputs, enhance rice production and increase profitability.

Keywords: credit constraint, rice farmer, profit, DEAP, Northwestern Nigeria

Word count: 233

1 Introduction

In Nigeria only 1.7 million ha of the potential land area for rice of between 4.6 million and 4.9 million ha is cropped to rice because farming is mainly carried out using simple tools rather than mechanization which would have increased cultivation (USAID Report, 2009). In recent years, the over-exploitation of agricultural land has significantly led to reduced yield of rice which supports the need for improving the productivity of available farmland. With a culture of negligible savings, especially among the smallholder farmers who constitute the majority of the agricultural labour force, agricultural credit appears to be an essential input for higher productivity. Successive governments have adopted different policies for rice production which have all functioned to stimulate smallholder rice production. In addition to tariff protection, government heavily subsidized many of the inputs used in the industry, including fertilizers and mechanization, as well as credit support (USAID Report, 2009). Nonetheless, with poor structure of available credit institutions and resulting credit constraint conditions, there exists the issue of whether smallholder rice farmers' objective of profit maximization is achieved.

A credit constraint situation occurs when for a given source of credit, the maximum credit limit is zero while access to credit implies that the maximum credit limit is positive (Diagne, 1999). Smith and Gemma (2007) stated that, a farmer is assumed to be credit constrained or could not afford to pay the high interest rate if he/she is unable to purchase additional needed inputs. Iqbal *et al*, (2003) and Udoh, (2005) posit that the provision of sufficient credit to rice farmers could enable them to be more self-reliant, increase their expenditure on improved agricultural technology to realize the domestic and export rice supply demand as well as increase their profitability. In order to maximize output within the short production season, a rational rice farmer would need to purchase improved agricultural technology and innovation for paddy cultivation. Short-term seasonal loans from informal suppliers of credit which are more readily available to farmers however create unique limitations for the level of projects that can be undertaken such that most rice farmers experience credit constraint early in the planting season. This affects production and profit levels adversely. This study therefore set out to verify the assertion of these authors by exploring the presence and effect of credit constraint on the profit maximization objective of rice farmers in Nigeria.

Recent, research efforts (Omonona *et al*., 2010; Oluwatayo *et al*., 2008; Goni *et al*., 2007; Okoruwa *et al.*, 2006) had been directed at examining productive efficiency of farmers that were exclusively focused on technical efficiency of agricultural production in Nigeria with less emphasis on the effect of credit constraint to farmers' profitability which this study focuses on. The differences between profit functions with and without a credit constraint expectedly should give a measure of the effect of credit constraint on profits. The rest of the paper has been organized into five sections. Recent issues on credit constraint would be addressed next while the theoretical concept of profit maximization and Nerlovian efficiency would follow. The empirical model and data would be described in the next section. A discussion of the results would then follow with a conclusion.

2. Issues of credit constraint

Several arguments have been presented as to the definition of a credit constraint condition. Guirkinger (2007) argued that non-price rationing in the credit market may manifest not only as quantity constraints (quantity rationing) but also as risk and transaction cost constraints. Earlier on, Fare *et al* (1990) had also shown that access to credit was revealed by a farmer's expenditure on variable inputs. This study, based on the argument that information on financing production was incomplete, adopted the revealed preference argument (Fare *et al,* 1990). This states that the total expenditure over the accounting period indicates the maximum amount the farmer can spend on organizing production. In other words, assuming that farmers intend to maximize profits, if a farmer spends a limited amount on inputs for production that decision is as a result of having no other source of financing. Otherwise, since it is profitable to spend more on inputs to obtain more outputs, the farmer would have done so. The approach of this study would therefore differentiate between subsets of credit constrained and unconstrained farmers by additionally specifying a credit constraint in terms of lack of access to credit sources and would prove whether farmers experience credit constraint (Blanchard *et al.,* 2006). Existing literature however show that this approach overestimates the presence of credit constraint (Guirkinger, 2007; Blanchard *et al.,* 2006). Credit constraint is said to affect the profit maximization objective of the farmer when there is a difference between observed and optimal profits.

A review of the Nigerian rice system revealed that the provision of credit for investment through public agencies especially under the Agricultural Credit Guarantee Scheme provided substantial credit capital for investment in grains production in general and rice in particular (Akpokodje *et al.* 2001). A study on the Hadejia Valley Irrigation Project (HVIP) which included the cultivation of rice revealed that low performances of irrigation had been observed such that cropping intensities as low as 9 percent had been recorded. However, recent access to credit improved the possibility of the farmers to have access to inputs at the critical period between wet season harvesting and dry season crop establishment (Ilu *et al*., 2001). Credit constraint to farm households in Nigeria imposed high cost on the society in terms of rural unemployment, rural poverty, distortion of production and liquidation of assets (Rahji and Adeoti, 2010). This problem of credit constraint was also aggravated by the absence of perfect information about the financial market among smallholder farmers which encouraged rationing of credit by formal financial institutions to them. Eventually applications from many of the smallholder farmers for farm credit were rejected which has serious implication for the performance of these group of farmers. Given a subset of credit constrained and unconstrained rice farmers in Niger State using similar inputs to produce the same outputs, this study would attempt to substantiate the effect of credit constraint condition on the profit of the former group as against the unconstrained subset of farmers.

2.1 Profit and credit constraint efficiency framework

Figure 1, explains the effect of a credit constraint on farm profit. Given a basic rice production technology set, T, which is formed by the boundary of a non- parametric frontier technology, AHBEF, is formed by the observations of revenue *R* and cost C of three different farmers as illustrated in figure 1. These observations are for different farms while inequalities

in the constraint yield vertical and horizontal extensions of the original points. The solution occurs at the point of tangency between the hyperplanes and the boundary of the frontier. The three hyperplanes with intercepts Π_E, Π_B, Π_H are the profit levels of individual farmers. When there is no credit constraint, and the inputs employed by the farm are used efficiently, the least cost combination of inputs would yield output at point *E*. Π_E then yields the maximum profit level that the farmers can earn which is also the point of profit efficiency and is determined by the iso-profit line tangent to the point **E**, where $R = \pi_E + C$, with R = py and C = wx. A farm at **I** is said to be inefficient with minimum profit of π_I but can increase profit without increasing expenditure on inputs by moving up to **E**. For the farm at **I**, its loss in profit is due to technical and allocative inefficiencies and is measured as $\Pi_K - \Pi_I$. With the introduction of a credit constraint to the rice production system, maximum allowable expenditure on inputs as a result of the credit constraint will be denoted by D, where the maximum expenditure that B can afford is the observed level of expenditure D. The introduction of a credit constraint results into a lower profit, Π_B which is determined by the iso-profit line tangent to the point B, where $R = \pi_B + C$. The corresponding technology set for B is the line segment DB.

3. Empirical framework

The data enveloping analysis (DEA) is preferred to other methods of efficiency measurement specifically because it produces individual measures of performance which allow the identification of individual farmers that are credit constrained as well as determining profit efficiency given input and output prices (Smith and Gemma, 2007; Coelli, 2002). In other words, the attraction to the DEA model is based on its ability to endogenously distinguish between subsets of constrained and unconstrained farmers. The envelopment form of the DEA model for which efficiency is estimated subject to the constraint that efficiency is not greater than one is specified as follows:

$$\min_{\theta\lambda,} \theta \qquad (1)$$

s.t.
$$-y_i + Y\lambda \geq 0$$
$$\theta x_i - X\lambda \geq 0,$$
$$I1'\lambda=1$$
$$\lambda \geq 0,$$

The value of $\theta \leq 1$ $(or \leq 100\%)$ is the efficiency score with a value of 1(or100%) indicating an efficient farm on the frontier. The DEA frontier is the result of running a linear programme for each farm in the sample. In the DEA problem above, the input vector *x* of the *i*th farm is radially contracted such that it produces a projected point $x\lambda y\lambda$ on the frontier which is a linear combination of the observed data points (all farms in the sample). The constraints ensure that the observed data points cannot lie outside the feasible input set. The farmers' production activity would be represented by a non-parametric piecewise linear frontier technology. The frontier would be formed by observations of inputs and outputs whereby technology transforms inputs into outputs. The production possibility set (T) which is the set of all feasible input and output vectors is given by:

$$T = \{(x,y): \sum_{k=1}^{k} z^k y^k \geq y; \sum_{k=1}^{k} z^k x^k \leq x, n = 1,..,N; \sum_{k=1}^{k} z^k = 1\} \quad (2)$$

where *y* represents the output, *x* represents the input and *z* represents the intensity variable for the production activity which shows to what extent a particular activity is used in the production process. The superscript k represents the farmers.

To explain the effect of credit constraint on profit, individual measures of performance are analysed using the non-parametric linear programming model of the DEA, considering the subsets of credit constrained and unconstrained farmers. Given a set of variable inputs, each farmer intends to choose the input bundle that would maximize profit to the fixed input factor as depicted by the boundary of the typical rice farmer's technology set in equation 2. Given a production possibility set of k farmers who use variable and fixed inputs x_v and x_f respectively to produce outputs (y) where there is no credit constraint, technology transforms inputs into outputs through a convex production set, T which yields the profit maximizing model given by:

$$T = \{(x,y): \sum_{k=1}^{k} z^k y^k \geq y; \sum_{k=1}^{k} z^k x^k \leq x_v, n = 1,..,N-1; \sum_{k=1}^{k} z^k x^k \leq x_f, n = N; \sum_{k=1}^{k} z^k = 1\} \quad (3)$$

where z is the intensity variable for the production activity of using variable and fixed inputs x_v and x_f respectively to produce outputs, y. Given the scenario of a credit constrained rice farming household which implies that expenditure on variable inputs cannot exceed observed expenditure, equation 3, becomes modified by the introduction of the following constraint to the farmer's technology set given by:

$$\sum_{n=1}^{N-1} p_{nx_n}^{i} \leq C^k \quad (4)$$

$$T_c = \{(x,y): \sum_{k=1}^{k} z^k y^k \geq y; z^k x^k \leq x_v, n = 1,..,N-1; \sum_{k=1}^{k} z^k x^k \leq x_f, n = N; \sum_{n=1}^{N-1} p_{nx_n}^{i} \leq C^k \sum_{k=1}^{k} z^k = 1\} \quad (5)$$

This constraint therefore is expected to lower profit relative to the unconstrained profit.

3.1 Specification of the DEA model

The maximum profit attainable by a rice farming household given fixed inputs (x^f), expenditure on variable and fixed inputs (wx) and revenue from rice output (py) subject to the technology available is the solution to the following linear programming problem:

$$max_{\lambda,qi*,xi,} \; PY - WX \quad (6)$$

subject to
$$-y^* + Y\lambda \geq 0$$
$$x^v - X^v\lambda \geq 0,$$
$$x^f - X^f\lambda \geq 0,$$
$$I1'\lambda=1$$

$$\lambda \geq 0,$$

In (6) there are no constraints, this problem therefore yields the profit maximizing model.

For a typical rice farming household, given fixed inputs (x^{fi}), expenditure on variable inputs ($w^i x^{vi}$) and revenue from rice output ($p^i y^i$) subject to the technology available, the short term profit attainable is the solution to the following linear programming problem:

$$max_{\lambda, qi*, xi,}\ p^i y^{i*} - w^i x^{vi*} \quad (7)$$

subject to
$$-y^{i*} + Y\lambda \geq 0$$
$$x^{vi*} - X^{vi}\lambda \geq 0,$$
$$x^{fi} - X^{fi}\lambda \geq 0,$$
$$I1'\lambda=1$$
$$\lambda \geq 0,$$

Similarly, for a credit constrained rice farming household, profit is maximized as the solution to the linear programming problem given by:

$$max_{\lambda, qi*, xi\ C^k,}\ PY - WX \quad (8)$$

subject to
$$-y^{*} + Y\lambda \geq 0$$
$$x^{v} - X^{v}\lambda \geq 0,$$
$$x^{f} - X^{f}\lambda \geq 0,$$
$$p_n^i\ \ x_n \leq C^k$$
$$I1'\lambda=1$$
$$\lambda \geq 0,$$

Having defined the basic elements for measuring performance, we now define the efficiency measures for the subsets of credit unconstrained and constrained rice farmers following Chambers *et al.*, 1998 presented as follows:

Unconstrained profit efficiency

Maximum profit of farmers, $\pi = PY - WX$ (9)

For each farmer, *i*, the observed profit, $\pi^i = p^q y^i - \left(p^i x_v^i\right)$ (10)

Unconstrained Profit Efficiency, $NE = \frac{\pi - \pi^i}{p^i + p^q}$ (11)

Constrained profit efficiency

Maximum profit of farmers, $\pi_c = PY_c - WX_c$ (12)

Constrained profit efficiency, $CrE = \frac{\pi c - \pi_i}{p^i + p^q}$ (13)

4. Data and variables description

Data collected by Africa Rice Centre in a survey conducted in 2009 was used for empirical analysis. The Agricultural Development Programme (ADP) in Niger State was involved in the survey process. Information generated from a sample size of three hundred and seventy three out of four hundred and seventy rice-producing households was used for socioeconomic analysis. Due to the reported inconsistencies in the original sample, a total of two hundred and twenty eight rice-producing farming households whose production technology was fairly homogenous were used for the DEA analysis. Information extracted from the respondents included, socio-economic characteristics of the farmers', production activities and producer income, cultivated land area in hectares, expenses on inputs used for rice production in naira and output quantities in kilograms. Others were on income generated from rice and other crops in naira, access to credit from formal and informal sources and amount of credit in naira obtained by the rice farming households. The last two (credit access and amount obtained) were used to indicate whether a farmer was credit constrained or not following Blanchard *et al.,* 2006. The formal credit market comprises those intermediaries that are regulated by any public or monetary authority while the informal credit market refers to those intermediaries that are not in the formal group.

Input quantities were generated for technical efficiency analysis using farm gate unit prices of inputs during the 2009 farming season in Niger State which were obtained from the ADP. However, the impact of interest rates could not be captured as this variable was not found in the data. Information extracted and used for analysis was selected based on review of previous literature on related studies (Fare *et al.*1990, Smith and Gemma, 2000; Mpuga 2004; Linh 2004; Udoh 2005; Blanchard *et al.* 2006; Tang *et al.,* 2010). In order to obtain more direct information on performance of various input and output quantities as well as of costs, revenues and profits these variables were normalized before being used for analysis. Both the STATA statistical software (release 11) and Microsoft Excel were used to filter credit unconstrained farmers who were recorded to have used credit from credit constrained farmers, who had zero values for amount of credit according to Blanchard *et al.,* (2006). This process was taken to avoid a bias that might be created in the estimation of credit constraint since no information on credit constrained or unconstrained status of farmers were available in the survey instruments administered to farmers in the study area. Hence the interpretation of results is done with some caution.

5. Empirical results

5.1 Socioeconomic characteristics of rice farmers

Table 1, shows the average age of rice farmers in the study area was 46 years implying that farmers were still in their productive years thus agreeing with findings by Ogundari, (2006) and Tiamiyu *et al*., (2010) among rice farmers in Kwara and Kaduna states which are equally located in North Central Nigeria. However, the farmers that had access to informal sources of credit had a higher mean age of 48 years. The average household size of 9 for the group that did not have access to credit was the highest. Those farming households that had access

to formal credit facilities had a mean household size of 5 which happened to be the least. This however, supports evidences from of Tang *et al.*, (2010) as well as Adebayo and Adeola, (2008) that, the larger the farming household size the lower their access to formal credit facilities due to the high risk of loan default resulting from a higher level of family consumption.

About 5.7 percent of rice farmers indicated that they had access to formal credit and that 5.4 percent of these were male while 0.3 percent were female rice farmers (Table 1). Of the 20.9 percent rice farmers that had access to informal credit, 16.6 percent were male farmers while about 4.3 percent were female farmers. This discovery can be tied to cultural settings that do not allow women to own assets such as land or retain land tenureship rights for too long (Udoh, 2005). However, about two third (73.5 %) of the rice farmers did not have access to credit for production activities.

Rice farms were small with a mean farm size of about 4.4 ha cultivated by farmers that had access to formal credit while those that did not have access to credit had mean farm size of 3.2 ha (Table 1). This small land holding might not be unconnected with the fact that the farmers do not have access to sufficient land for cultivation and many of them also cultivate other crops for food and additional income which reduced share area cultivated with rice crop. Furthermore, due to land tenureship agreements, disputes on land and inheritance, rice farmers' share of land may have been constrained. Table 2 also shows farmers that had access to formal credit in the study had higher output of 3535.81 kilogrammes and spent on average ₦11806.45/ha, ₦23583.87/ha and ₦7277.42/ha respectively on herbicides, fertilizers and seeds as an indication that access to formal credit facilities increased the purchasing power of rice farmers such that they were able to purchase more inputs as well. The overall effect of this is seen in the mean higher income of ₦306,956.50/ha for farmers that had access to formal credit facilities and ₦224,605.90/ha for those that had access to informal credit facilities as compared to the sum of ₦188,915.9/ha0 for farmers who never had access to credit.

5.2 Efficiency of rice farmers

In table 3, the mean technical efficiency score of 73 percent showed that the rice farmers in the study had a 27 percent potential to increase rice production considering the existing level of resources if they are to operate at the frontier. These high technical efficiency scores also indicate that the level of wastage of rice output had been minimized. These findings are consistent with those of Tiamiyu *et al.,* 2010 and Okoruwa *et al.,* 2006 with mean technical efficiency of 65 percent and 72.9 percent respectively for lowland rice in Niger State. Allocative efficiency indices revealed that the mean allocative efficiency of the rice farmers used in the study was 31 percent. The mean score however revealed that rice farmers in the study have not been using the resources available to them optimally and were allocatively inefficient. When farmers are credit constrained, they cannot purchase sufficient inputs at the appropriate time and this would affect their utilization of inputs and cause input

inefficiencies. This may have been due to the political intrigues involved in the implementation of the Presidential Initiative on Rice which led to resources meant for rice farmers being diverted. In addition the problem could be traced to inefficient input markets in the rural areas with high cost of resources such as fertilisers and hired labour which could have led to farmers rationing fertilizer and depending on their children for the required labour. With data on input prices, cost efficiency of the rice farmers was also estimated. The mean cost efficiency of rice farmers in the study was 23 percent which presented a picture of rice farmers producing at inefficient input prices probably due to inefficient input markets. This confirms the results of allocative efficiency which implied the possibility of high costs of inputs. Therefore, input prices would have to be further reduced by 77 percent for the rice farmers to operate at the frontier by not purchasing inputs from middlemen who usually inflate the prices of inputs. Revenue efficiency of the rice farmers was estimated given output price. The results showed that the rice farmers were not revenue efficient as the mean revenue efficiency was 20 percent. This meant that the farmers were not able to fully maximise revenue realized from rice harvest and could therefore increase revenue further by 80 percent in order to reach the revenue frontier. This inefficiency is expected considering that they were allocatively inefficient as well as cost inefficient and produced rice at a less than optimal level during the on-farm season. Therefore, high costs of production would affect the expected revenue from rice production adversely.

5.3 Effect of credit constraint on profit

As mentioned earlier, having reduced the sample size for DEA analysis because of reported inconsistencies, seventy four rice farmers were revealed to have had access to credit, and were not constrained, while one hundred and fifty four rice farmers did not have access to credit and were credit constrained. In table 4, for the unconstrained farmers, mean profit efficiency was thirty six per cent while mean profit efficiency score for the constrained rice farmers was twenty one per cent which as expected was lower. In addition there was a significant difference between the sample means of the efficiency score for credit constrained and unconstrained farmers. This further confirmed that unconstrained farmers performed better than constrained farmers. Sixty five per cent of credit constrained farmers had profit efficiency less than twenty percent and only four farmers were actually profit efficient. This goes to confirm that credit constraints reduce allocative and production efficiency which eventually decrease profit efficiency. Again only about twenty one per cent of unconstrained farmers had profit efficiency scores above fifty per cent.

The study revealed that the rice farmers were profit inefficient generally and that credit unconstrained rice farmers performed slightly better than their credit constrained counterparts. This was reflected in the higher mean profit per hectare of three hundred and fifteen thousand three hundred and eighty naira sixty kobo as compared to a mean profit of two hundred and twenty thousand four hundred and seventy seven naira eighty five kobo for credit constrained farmers. This is not unexpected considering that most of the farmers in the area were allocatively inefficient, did not have access to credit and performed poorly and this agrees with findings by Tiamiyu *et al.* (2010).

6 Conclusion

This study analysed the presence and effect of credit constraint on the profit maximization objective of rice farmers in Nigeria. Empirical findings revealed that rice farmers in the study had small farm sizes. They also preferred informal sources of credit confirming the view that banking institutions have contributed insignificantly to the supply of credit. Gender considerations in credit access were found to be biased towards male rice farmers both in the formal sector and informal sector even though all male and female farmers were still in their productive years. Using information on access of farmers to credit, farmers were classified as being credit constrained or not and it was discovered that sixty eight percent of the farmers were credit constrained and did not operate on the profit frontier. Empirical analysis of the effect of credit constraint on profit of small scale rice farmers in Niger State, Northwestern Nigeria revealed that credit constraint reduced profit and that the farmers experienced allocative inefficiency that resulted in their inability to be revenue and cost efficient in order to maximize profit from rice production. The Data Envelopment Analysis Programme (DEAP) identified the level of efficiency resulting from credit constraint on profit (overall efficiency) as 21 percent. Overall efficiency for credit unconstrained farmers was slightly higher at 36 percent implying that these farmers performed better than their credit constrained counterparts and made more profit.

Based on the findings of this study, and the inclusion of rice in the presidential initiative, it is recommended that a programme should be put in place to improve access to information, improved inputs and farm mechanisation through vocational education. This would enhance exposure to and encourage efficient use of improved inputs, at lower costs and exclude middlemen who are often responsible for inflated input costs Vocational education would provide skills for processing of harvested rice as well. The resultant better output quality and value addition would enhance rice production, increase profitability and better position these farmers for better credit facilities. In addition, necessary intervention in form of subsidy on production inputs, especially fertilizer, such as through the proposed *eWallet* input programme for fertilizer supply. should be implemented as this would improve rice production and loan repayment ability through enhanced production and profitability for better access to credit facilities. Notably, a suitable credit support programme put in place would in no small measure encourage expenditure on improved production inputs and technology which would ensure timeliness of production activities and generally improve the household welfare of this category of rice farmers.

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Appendix I

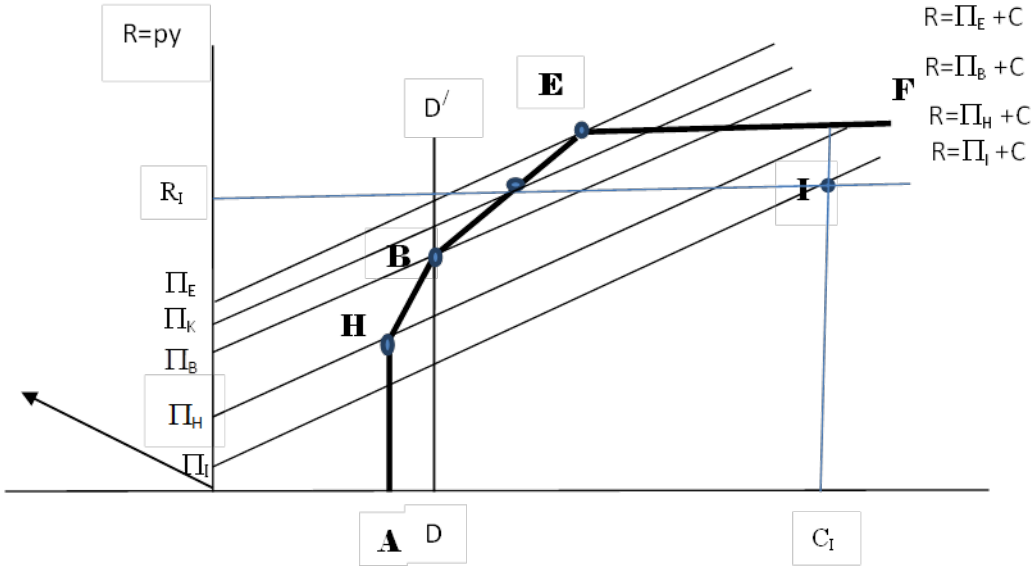

Figure 1. Effect of credit constraint on profit efficiency of a farm

Appendix II

Table 1: Socioeconomic characteristics of rice farmers

N=373	**Source of Credit**		
	Formal	**Informal**	**No credit**
Socioeconomic characteristics			
Proportion of male farmers n= 284	20[5.4%]	62[16.6%]	202[54.2%]
Proportion of female farmers n= 89	1[0.3%]	16[4.3%]	72[19.3%]
Mean Age	46(**4.34**)	48(**6.44**)	46(**7.40**)
Mean household size	5(**2.02**)	8(**4.35**)	9(**4.75**)
Mean Area of land cultivated to Rice (ha)	*4.39**(1.56)***	2.92(**2.07**)	3.21(**1.85**)
Mean Number of years of residence in the village	45(**4.55**)	48(**6.32**)	44(**10.54**)

Figures in bold parentheses [ ], ( ) are percentages and standard deviations respectively

Table 2 Description of production data

N=373	**Source of Credit**		
	Formal	**Informal**	**No credit**
Rice Production			
Mean area of land cultivated to Rice (ha)	4.39(1.56)	2.92(2.07)	3.21(1.85)
Mean expenses on land rental (₦/ha)	465.29 (1353.22)	1166.88 (2205.68)	1305.29 (2050.62)
Mean revenue from rice (₦/ha)	306956.50 (50612.28)	224605.90 (101985.6)	188915.90 (94479.78)
Mean revenue from other crops (₦/ha)	98956.39 (67479.45)	54617.65 (43989.25)	36141.94 (24559.65)
Mean expenses on herbicide (₦/ha)	11806.45 (6927.71)	7591.18 (7503.02)	5550.00 (5145.61)
Mean expenses on fertilizer (₦/ha)	23583.87 (8662.18)	16675.00 (9627.48)	11949.78 (8488.26)
Mean expenses on seeds(₦/ha)	7277.42 (6274.05)	4301.47 (3744.86)	4664.90 (4926.99)
Mean expenses on labour for seeding and transplanting (₦/ha)	1720.69 (2915.27)	2079.10 (2252.30)	1448.16 (2270.86)
Mean expenses on labour for Harvesting (₦/ha)	10206.67 (5228.30)	7136.77 (4996.39)	3671.06 (4795.62)

Figures in parentheses are standard deviations

Table 3 Frequency Distribution of Efficiency Indices

	Technical Efficiency		**Allocative Efficiency**		**Cost Efficiency**		**Revenue Efficiency**	
N=228	Frequency	%	Frequency	%	Frequency	%	Freq.	%
0.01<0.20	0	0	77	33.88	140	61.40	140	61.40
0.20<0.30	0	0	61	26.84	40	17.55	40	17.55
0.30<0.40	9	3.95	35	15.40	10	4.38	8	3.33
0.40<0.50	36	15.84	18	7.92	15	6.58	10	4.38
0.50<0.60	32	14.08	15	6.60	11	4.84	18	8.04
0.60<0.70	23	10.12	9	3.96	4	1.76	4	.76
0.70<0.80	36	15.84	6	2.64	3	1.32	3	1.32
0.80<0.90	25	10.99	2	0.88	0	0	0	0
0.90<0.99	23	11.00	2	0.88	2	0.87	2	0.88
1.00	44	19.30	3	1.32	3	1.32	3	1.32
Total	228	**100.0**	228	**100**	228	**100**	228	**100**
Mean	0.73		0.31		0.23		0.20	
S.D.	(**0.20**)		(**0.20**)		(**0.19**)		(**0.19**)	
Minimum	0.35		0.01		0.009		0.014	
Maximum	**1.00**		**1.00**		**1.00**		**1.00**	

Table 4 Frequency distribution of profit efficiency indices

N =228	**Unconstrained Farms-Profit Efficiency n= 74**		**Constrained Farms-Profit Efficiency n= 154**	
	Frequency	%	**Frequency**	%
0.01<0.20	21	28.38	102	65.54
0.20<0.30	11	14.86	28	18.18
0.30<0.40	15	20.27	5	3.24
0.40<0.50	11	14.86	14	9.09
0.50<0.60	4	5.41	1	0.65
0.60<0.70	5	6.76	3	1.30
0.70<0.80	2	2.7	0	0
0.80<0.90	0	0	1	0.65
0.90<0.99	1	1.35	0	0
1.00	4	5.41	0	0
Total	**74**	**100.0**	**154**	**100.0**
Mean	**0.363 (0.21)**		**0.211 (0.17)**	
Minimum	**0.036**		**0.035**	
Maximum	**1.00**		**1.00**	
	***4.85**			
Mean Profit/ha (₦)	**315,380.6**		**220,477.85**	

*Difference in the means significant at 1%