FARM MANAGEMENT DIVIDENDS IN A FRIENDLY POLICY ENVIRONMENT: THE CASE OF CASSAVA INDUSTRY IN NIGERIA

Umeh, J.C.[1]
Asogwa, B.C.[2]

ABSTRACT

Following the radical reorientation of agricultural policy during the SAP years, beginning in the mid-1980's, cassava emerged as an important crop in the national effort to replace imported foods with domestic production. The policy direction of the Nigerian government has encouraged cassava development leading to a new orientation in research-extension-farmers linkage, especially in the IFAD-assisted Cassava Multiplication Programme (CMP). This study evaluated farm management dividends in a friendly policy environment: the case of cassava industry in Nigeria. Data were collected from randomly sampled 360 cassava farmers in Benue State, Nigeria using a structured questionnaire. The data were analyzed using the stochastic frontier production function. The findings of the study indicated that the elasticity of mean value of cassava output with respect to farm size (1.39) was of increasing function while labour cost (0.19), family labour (0.90), cassava stems (0.95) and fertilizer (0.01) were of decreasing function. Moreover, the coefficients on the variables: labour cost, X1(-0.19), farm size, X3 (1.39), cassava stems, X4 (0.95) and fertilizer, X5 (0.01) were statistically significant at the 1% level while family labour,X2 (-0.09) was not significant. The sum of the coefficients on the significant variables of the stochastic frontier production model (2.63) was higher than unity. The estimated coefficient of cassava variety planted (-0.18) and the estimated coefficient of processing technology available (-0.1) were negative and significant at 1% level, suggesting that technical inefficiency effects declined with the planting of improved cassava varieties and the use of improved cassava processing technology. The estimated sigma squared, б2 (0.16), was significantly different from zero at 1% level. This indicates a good fit and the correctness of the specified distributional assumption of the composite error term. In addition the magnitude of the variance ratio, was estimated to be high at 0.96, suggesting that the systematic influences that are unexplained by the production function are the dominant sources of errors. Thus, given the specifications of the Cobb-Douglas frontier production function, the Cobb-Douglas frontier is an adequate representation of the model for the farm data collected on the cassava farmers in Benue State of Nigeria. Majority of the respondents (63.61%) operated closer to their frontier production function while predicted technical efficiencies varied widely among farms, ranging between 31% and 100%, and a mean technical efficiency of 89%. It is recommended that adequate financial assistance and credit facilities should be made available to the farmers to enable them increase their production. Since there are potentials for cassava growth in the study area, the cassava farmers in Benue State should expand their production because they would obtain more output in the long run. Technical efficiency in cassava production in Benue State could be increased through better use of available resources via improved farm-specific factors, which include access to improved cassava planting material, access to improved cassava processing technology, access to available cassava markets and access to improved extension services.

[1]*Ph.D. Department of Agricultural Economics, University of Agriculture, Makurdi, Benue State, Nigeria. (e-mail: jceu1@yahoo.com*
[2]*B.C. (B.Sc.). Department of Agricultural Economics, University of Agriculture, Makurdi, Benue State, Nigeria.*

INTRODUCTION

According to Nweke (2004), the Nigerian government's policy of subsidized grain imports, undoubtedly, contributed to unstable growth in cassava production from 1971 to 1986. Nweke (2004) also noted that cassava did not benefit from the fertilizer subsidy of the Nigerian government in the early 1980s. However, the declining petroleum revenue in the mid-1980s apparently spurred renewed interest in cassava by the Nigerian government. Following the radical reorientation of agricultural policy during the SAP years, beginning in the mid-1980's, cassava emerged as an important crop in the national effort to replace imported foods with domestic production. In 1984, the National Coordinated Research on Cassava Project (NCRCP) was set up to coordinate the on-farm adaptive research on cassava by the NAFPP, ADP, research institutes, and universities. In 1985, the ADPs were established in cassava-producing states to carry out on-farm evaluation of new technologies including the Tropical Manioc Selection (TMS) varieties, construct roads for input delivery and output evacuation, provide extension services to farmers, as well as multiply and distribute the TMS stem cuttings and seeds of other crops.

The present democratic government of Chief Olusegun Obasanjo has, however, added some impetus to the global efforts in the development of cassava by putting in place a 'Presidential Committee on Cassava for Exports', with the mandate to ensure that the country becomes the world-acknowledged cassava-exporting nation (Abdullahi, 2003). Currently Nigeria is producing 40 million tons of cassava roots up from 36 million tons while the average yield is 10 tons (Eno, 2004).

The current policy direction has, therefore, encouraged cassava development leading to a new orientation in the research-extension-farmers linkage, especially in the IFAD-assisted Cassava Multiplication Programme (CMP) (Abdullahi, 2003); and subsequently in the Roots and Tubers Expansion Programme (RTEP) (Dambatta, 2004). The Raw Materials Research and Development Council (RMRDC) has been sponsoring research projects on cassava processing equipment fabrication (Adullahi, 2003). Federal Ministry of Agriculture and Rural Development information sheet indicates that under the Roots and Tubers Expansion Programme, the cultivation of cassava, yams, sweet potatoes, Irish potatoes and cocoyam would be enhanced through the introduction of improved seedlings, relevant chemicals, better farming techniques and other wider forms of extension services. The Nigerian government signed the loan agreement for the sum of US $23million with IFAD, Rome, in July 2001 and the loan disbursement to agencies had commenced (Dambatta, 2004).

In view of the apparent favourable policy environment in the cassava sub-sector, it has become necessary to evaluate farm management dividends in the cassava industry in Nigeria. Thus, the purpose of this study is to evaluate farm management dividends in a friendly policy environment: the case of cassava industry in Nigeria. The overriding aim of the study is to ascertain the gains of farm management in a friendly policy environment using the case of cassava industry in Nigeria.

Objectives of the Study

The specific objectives of the study are to:

1.determine the effect of specific policy packages on cassava on the resource-use of the cassava farmers in Benue State, Nigeria;

2.analyze the effect of resource-use on the cassava output of the cassava farmers in Benue State, Nigeria;

3.assess the technical efficiency of the cassava farmers in Benue State, Nigeria; and

4.make policy recommendations based on the findings of the study.

To achieve these specific objectives, a few of the hypotheses to be examined are:

1.the government policy packages on cassava have no significant effect on resource-use of the cassava farmers in Benue State;

2.resource-use of the cassava farmers in Benue State have no significant effect on their cassava output;

3.cassava farmers in Benue State are not technically efficient;

4.the Cobb-Douglas frontier is not an adequate representation of the model for the farm data collected on the cassava farmers in Benue State.

Justification of the Study

Empirical determination of the effect of the resource-use of cassava farmers on their cassava output, which will be carried out in this study will serve as a link between the government policy packages for cassava and the cassava output. This will help to show the degree to which the government policies in the cassava sub-sector influence the cassava output of the cassava farmers in Benue State, Nigeria. This knowledge would guide policy makers in designing future development policies in the cassava sub-sector.

Empirical determination of the effect of the policy packages on cassava on resource-use in this study will indicate resources whose use is increased or diminished by virtue of government policies. This will guide future developmental policies in the sector. Moreover, empirical determination of the inefficiency effects of the policy packages on resource-use of the farmers will show whether the policy packages on cassava make the farmers to be more efficient or not.

In addition, this study attempts to determine the technical efficiency of the cassava farmers in Benue State, Nigeria. This will indicate to what degree resources are effectively and optimally utilized. The resource needs of the farmers will be determined from this empirical analysis. Equipped with this knowledge, policy makers will be in a better position to design suitable policies to meet the needs of the farmers.

METHODOLOGY

The Study Area

Nigeria, the area of study, covers a land area of about 923,770km2. It lies between longitude 2075' and 14050' N. It has an estimated population of about 120million. The country is divided into 36 states and Federal Capital Territory. It spans a wide variety of ecological zones, major among which is dry and intermediate Savannah to the North and Western, Central and Eastern moist forest to the South.

Rural residences constitute the largest proportion of the Nigerian population (Idachaba, 1985), and they engage on farm enterprises orgained on household basis (Norman, 1973).

Benue State is referred to as the food basket of Nigeria because of the abundance of its agricultural resources. About 80% of the State population is estimated to be directly involved in subsistence agriculture. The State is a major producer of food and cash crops like cassava, yams, rice, benniseed and maize. Others include sweet potato, millet and a wide range of other crops like soyabeans, sugar cane, oil palm, mango, citrus and bananas.

Nigeria has 3.5 million hectares of cassava land across the country (Eno, 2004). Out of a total area of 310 million hectares, agricultural land in Benue State is estimated to comprise about 1.80 million hectares or about 60% of the total land area (BMANR, 2003). At present only about 1.38 million hectares is used i.e. more than 74% of the cultivable land (BMANR, 2003).

Nigeria is the largest producer of cassava tuber in the World with an estimated production figure of 40 million metric tons of cassava tubers per annum (Eno, 2004) and Benue State is undoubtedly the leading producer of cassava in Nigeria (BMANR, 2003). Apart from the ecological support for cassava growth and population, Benue State has mounted deliberate strategies such as distribution of improved varieties to sustain its leading role in cassava production in the country (BMANR, 2003).

Sampling Technique

Benue State is divided into three zones namely, Zone A, Zone B and Zone C.A total of nine local government areas were selected for the study under the guide of ADP workers in BNARDA. Particularly, areas that apparently have benefited from the IFAD-assisted Cassava Multiplication Programme (CMP) and other government policy interventions focused on cassava were selected for the study. From each Zone, three Local Government Areas were selected using randomized sampling design in the first phase multistage sampling design.

From each of the nine selected local government areas in Benue State, two communities that typify the State in terms of cassava production were drawn employing a randomized sampling design. Finally, from each community, 20 households were drawn for the study through a randomized sampling design. A total of 360 cassava farmers were selected for the study using the randomized sampling design. This consists of both male and female farmers.

Data Collection

Primary data was use in the study. Specifically, the data and information on the effect of the policy packages on cassava (improved cassava variety, improved cassava processing technology, improved market access and improved extension services) on the resource-use of the cassava farmers in Benue State, Nigeria (Objective1); data and information on the effect of resource- use on the cassava output of the cassava farmers in Benue State, Nigeria (objective 2); data and information on the technical efficiency of the cassava farmers in Benue State, Nigeria(objective3) were gathered through questionnaire administration.

METHOD OF DATA ANALYSIS

Data gathered for the achievement of objectives 1 - 3 were analyzed using the stochastic frontier production function.

Model Specification

Resource and policy linkage equation.

The policy structure of the model is embedded in equations linking cassava output to resources (inputs) on one hand and cassava output to inefficiency model on the other hand. In the inefficiency model, inefficiency effects is linked with the policy packages on cassava (improved cassava variety, improved cassava processing technology, improved market access and improved extension services). Policies on cassava are captured through links to agricultural innovations in the cassava sub-sector arising from the government agricultural development policies focused on cassava (which includes the development of improved cassava varieties, the development of improved cassava processing technologies, the development of improved market access and the provision of improved extension services, for the purpose of this study). For this exercise, only four categories of agricultural development policy packages focused on cassava are considered in the model: improved cassava variety, improved cassava processing technology, improved market access and improved extension services.

In this study, it is assumed that the policy packages on cassava have influence on the inefficiency effects of resource-use of the cassava farmers in Benue State. Thus, in this study, Cobb-Douglas stochastic frontier production function is assumed to be the appropriate model for the analysis of the farm data collected on the cassava farmers in Benue State. The model to be estimated is defined by:

Lny = β0 + β1 Ln LABOUR COST + β2 Ln FAMILY LABOUR + β3 Ln FARM SIZE + β4 Ln CASSAVA STEMS + β5 Ln FERT + Vi - Ui……………………………………………………………(1)

Where

Ln – denotes natural logarithm to base e

Y – represents the total cassava output of the farmers (in kilograms)

βi – represent the unknown parameters associated with the explanatory variables in the production function (i = 0,1,2,3,4,5)

LABOUR COST – represents the total cash expenditure on hired labour (in Naira)

FAMILY LABOUR – represents the total number of man- days of family labour use for production

FARM SIZE – represents the total amounts of land under cassava production (in hectares)

CASSAVA STEMS – represents total number of cassava stems used as planting material

FERT – represents the total amounts of fertilizer used for production (in kilograms)

Vi – represents random errors, which are assumed to be independently and identically distributed as N (0, 62v), independently distributed of the Ui.

Vi - Represents non-negative random variables, associated with technical inefficiency of production, which are assumed to be independently distributed, such that Vi is obtained by truncation (at zero) of the normal distribution with variance, 6u2 and mean μi where the mean is defined by:

μi = δ0 + δ1 CASSAVA VAR + δ2¬ PROCESSING TECH + δ3 MARKET ACCESS + δ4 EXTENSION. …………………………………………(2)

Where

δ is a (5 x 1) vector of unknown parameters to be estimated

CASSAVA VAR – Cassava variety planted (a dummy variable) Improved variety = 1, local variety = 0

PROCESSING TECH – Processing technology available (a dummy variable). Improved processing technology = 1, local processing technology = 0

MARKET ACCESS – Access to cassava markets (a dummy variable) Good access to markets = 1. Poor access to markets = 0

EXTENSION –Extension services (a dummy variable) Access to extension services = 1. Non – access to extension services = 0

The cassava output is expected to be influenced positively by labour costs, family labour, farm size, cassava stems and fertilizer.

The cassava variety is expected to have a negative effect on the size of the technical inefficiency effects. This is so because as the farmer switches from planting local cassava variety to planting improved cassava variety, an effective utilization of inputs would be achieved, which in turn, increases the technical efficiency of the farming operations. The processing technology is expected to have a negative effect on the technical inefficiency. This is because switching from the use of local processing methods to the use of processing machines for processing helps to conserve time and resources which would be transferred to the farming operations, which in turn, would help in the achievement of effective utilization of inputs. This in turn, increases the technical efficiency of the farming operations. Market access is expected to have a negative effect on the technical inefficiency. This is because a switch from a poor access to markets to a good access to markets would help to conserve time and resources as well as boost morale for farm productions, which in turn, would be transferred to the farming operations. The result of this would be effective utilization of inputs, which in turn, increases the technical efficiency of the farming operations. Extension services are expected to have a negative effect on the size of the technical inefficiency effects. This is because as the farmers have access to improved extension services, the more knowledge and information they would have about modern farming, and hence, more disposed to adopting improved farm technologies. This would lead to effective utilization of inputs, which in turn, increases the technical efficiency of the farming operations.

The model defined by equations (1) and (2) was proposed by Battese and Coelli(1995). The parameters of the model, i.e. the β's, the δ's, and the variance parameters $\sigma^2 = \sigma^2_u + \sigma^2_v$ and $\gamma = \sigma^2_u / (\sigma^2_u + \sigma^2_v)$ are simultaneously estimated using the method of maximum likelihood. The computer programme FRONTIER 4.1 developed by Coelli (1994) that computes the parameter estimates by iteratively maximizing a nonlinear function of the unknown parameters in the model subject to the constraints was used. The generalized likelihood-ratio statistic is computed as $\lambda \equiv -2\log [L(H_0) / L(H_1)]$, where $L(H_0)$ and $L(H_1)$ are the likelihood functions evaluated at the restricted and unrestricted maximum-likelihood estimator for the parameters of the model. If the null hypothesis, H_0, is true, then the statistics has approximately a chi-squared distribution with parameter equal to the number of restrictions imposed by H_0 and with the degrees of freedom equals to the difference between the parameter estimated under H_1 and H_0, respectively. The value of the γ indicates the relative magnitude of the variance associated with the distribution of inefficiency effects, μ_i. If μ_i in the stochastic frontier are not present or alternatively, if the variance parameter, γ, associated with the distribution of μ_i has value zero, then σ^2_u in (1) – (2) is zero, and the model reduces to a traditional production function with the variables cassava variety, cassava processing technology, market access, and extension services all included in the production function meaning that inefficiency effects are not stochastic.

RESULTS AND DISCUSSION

Maximum Likelihood Estimates

Output elasticity and return to scale

The result in Table 1 shows that the elasticity of mean value of cassava output with respect to farm size (1.39), was of increasing function while labour cost (0.19), family labour (0.90), cassava stems (0.95) and fertilizer (0.01) were of decreasing function.

Moreover, the coefficients on the variables: labour cost (X1) farm size (X3) cassava stems (X4) and fertilizer (X5) were statistically significant at the 1% level. This implies that hired labour, farm size, cassava stems and fertilizer were the significant variables in cassava production in the studied area. Thus, increasing the farm size, the number of cassava stems planted and the amount of fertilizer would increase cassava output. However, the level of hired labour should be maintained.

Contrary to the expectation, the labour cost had a negative and significant coefficient. According to Olayide et.al. (1980), a negative relationship exists between family labour and hired labour because the consumption of hired labour start increasing when the consumption of family labour starts decreasing. This is so because hired labour is used when available family labour has been utilized such that as more hired labour is consumed less family labour is consumed. Owing to the high cost of hired labour, if the amounts of hired labour use must be increased, more costs must be incurred. This implies that to maintain the cost of production at the limit of the poor rural farmers lean resources when hired labour use is to be increased, the level of production must be reduced. This explains the negative influence of hired labour on

Table 1: maximum likelihood estimates for the parameter in the stochastic frontier production function model for the cassava farmers in benue state, 2005.

Variable	Parameter	Estimate	T- Ratio
Stochastic Frontier			
Constant	β_o	3.23	2.81**
Ln (labour cost)	β_1	-0.19	- 3.1**
Ln (family labour)	β_2	- 0.09	- 1.41
Ln (farm size)	β_3	1.39	39.82**
Ln (cassava stems)	β_4	0.95	7.61**
Ln (fertilizer)	β_5	0.01	4.46**
Inefficiency Model			
Constant	δ_0	- 2.83	- 12.78**
Cassava variety planted	δ_1	-0.18	- 6.38**
Processing technology	δ_2	-0.1	- 13.81**
Market access	δ_3	0.03	1.78
Extension Services	δ_4	0.01	0.76
Variance Parameters			
Sigma squared	σ^2	0.16	17.46**
Gamma	γ	0.96	289.02**
Log Likelihood function		164.5	

Source: Field Survey, 2005.

** t-ratio is significant at 1% level

cassava output among the respondents.

The sum of the coefficients on the significant variables of the stochastic frontier production model (2.63) was higher than unity. This suggests that a proportionate increase in all the inputs would result to more than proportionate increase in output. This means that there are potentials for cassava growth in the study area and hence, it is an advantage for the cassava farmers in Benue State to expand their production since they would obtain more output in the long run.

Inefficiency Model

The result in Table 1 also shows that the estimated coefficient of cassava variety planted is negative which means that technical inefficiency effects declined with the planting of improved cassava varieties. This implies that, improved cassava varieties have positive effect on technical efficiency, which suggests that planting of improved cassava varieties is important for achieving effective utilization of inputs.

The estimated coefficient of processing technology available is negative, and indicates that technical inefficiency in cassava production decreases with the use of improved processing technology for cassava processing. This result suggests that the cassava farmer that invests relatively more into the use of improved cassava processing technology achieve higher levels of technical efficiency in cassava production in the studied area.

The estimated sigma squared, $\sigma 2$ (0.16), is significantly different from zero at the 1% level. This indicates a good fit and the correctness of the specified distributional assumption of the composite error term. This implies that technical efficiency in cassava production in Benue State, Nigeria could be increased by 16% through better use of available resources given the current state of technology – through improved farmer-specific factors, which include access to improved cassava varieties, access to improved cassava processing technologies, access to available cassava markets and access to improved extension services. In addition, the magnitude of the variance ratio, □ is estimated to be high at 0.96, suggesting that the systematic influences that are unexplained by the production function are the dominant sources of errors. This means that more than 96% of the variation in input among the farms is due to differences in technical efficiency. Thus, the results of the diagnostic statistics confirm the relevance of stochastic frontier production function, using Maximum Likelihood Estimator (MLE).

Efficiency Estimates for the Stochastic Frontier

Table 2 shows that majority of the respondents (63.61%) operated closer to their frontier production function. This is attributable to the planting of improved cassava varieties and the use of improved cassava processing technology for cassava processing. Besides, most of the farmers are relatively young people with the sufficient energy required to cope with cassava farm operations, and have long experience in farming, having been growing cassava for a very long time. In addition, most of the farmers are literate. Thus, they were able to manage their farms well, such that they achieved a high level of technical efficiency in their farm productions.

The technical efficiencies vary widely among the farms ranging between 31% and 100%, and a mean technical efficiency of 89%, suggesting that the technical inefficiency was associated with high variance among farms, and that the farms, in most cases, operated close to their frontier production function.

CONCLUSION AND RECOMMENDATION

The study revealed that there are potentials for cassava growth in Benue State, Nigeria. Given the specifications of the Cobb-Douglas frontier production function, the result of the pa-

Table 2: ditribution of respondents by technical efficiency estimates

Technical Efficiency	Frequency	Percentage
< 0.31	0	0
0.31 – 0.50	6	1.67
0.51 – 0.70	26	7.22
0.71 – 0.90	99	27.50
> 0.90	229	63.61
Total	**360**	**100.0**
Mean efficiency =	0.89	
Minimum efficiency=	0.31	
Maximum efficiency=	1.00	

Source: Field Survey, 2005.

rameter estimates indicates that the Cobb-Douglas frontier is an adequate representation of the model for the farm data collected on the cassava farmers in Benue State, Nigeria. The implication of the study is that technical efficiency in cassava production in Benue State, Nigeria cold be increased by 16% through better use of available resources, given the current state of technology. This can be achieved through improved farmers-specific factors, which includes access to improved cassava varieties, access to improved cassava processing technology, access to available cassava markets and access to improved extension services. Adequate financial assistance and credit facilities should be made available to the farmers to enable them increase their cassava production.

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