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GENDER AND COST EFFICIENCY IN MAIZE PRODUCTION IN OYO STATE OF NIGERIA

[GÉNERO Y COSTO-EFICIENCIA EN LA PRODUCCIÓN DE MAÍZ EN EL ESTADO DE OYO, NIGERIA]

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SUMMARY

The issues of gender in smallholder farmers in Nigeria have been widely debated in terms of marginalization in main input leaving out the efficient use of these resources. In this paper, an empirical assessment of smallholder cost efficiency and its determinants using stochastic cost frontier function was conducted. In addition, regression and paired sample t-test were used to examine the determinants of efficiency. The results indicates that labour is an important factor of production for both male and female farmers and that female are more cost inefficient than their male counterparts The study concluded that there should be a review of the agricultural policy that will address the existing gender bias in assessing agricultural inputs.

Key words: Gender; cost efficiency; maize; stochastic frontier.

RESUMEN

Los aspectos de género en los sistemas de producción de pequeños productores en Nigeria ha sido ampliamente discutido en términos de marginalización de los insumos y dejando a un lado el uso eficiente de estos recursos. Este trabajo hace una evaluación empírica de costo-eficiencia y sus determinantes en sistemas de pequeños productores, mediante el emplero de modelos estocasticos. Adicionalmente se empleo modelos de regresión y pruebas de t para estudiar los factores involucrados en la eficiencia. Los resultados indican que el trabajo es un factor importante de la producción de hombres y mujeres y que las mujeres tienen una menor costo-eficiencia. El estudio concluye que deben revisarse las políticas agrícolas para atiender los sesgos de género empleados estimar los insumos agrícolas.

Palabras clave: Género; costo-eficiencia; maíz, modelo estocástico.

INTRODUCTION

Gender is the term used for socially defined roles of men and women and its system of power over certain capacities of human body and that gender system are interwoven with social structure, norms, belief and practices that are largely male dominated (FOS, 1996). Adepoju (1994) asserts that a typical African woman is probably the most under privileged, illiterate, with limited access to resources. She did not only face discrimination and segregation, both in the organized labour market and informal sector, but also has different legal rights as regard land inheritance.

Although the Nigerian constitution guaranties equal opportunities to both men and women in reality, however women still face limited access to resources and are locked into relatively low productive work (World Bank, 2002). In addition to performing household task and child-bearing duties, women work longer hours for low pay jobs than most men. Both men and women are subjected to vagaries of income earning and distribution, the dimension at the micro level affects men and women differently. The importance of women however, has attained world attention. Ogundele and Yusuf (2002) assert that female farmers are highly discriminated against in the use of critical input such as land, family labour and fertilizer but are favoured in the use of agro-chemical and seeds. Apart from inequalities in access to employment, gender bias in access to technology may hamper the ability of women to increase the productivity of their agricultural domestic or entrepreneurial activities and this reduce economic growth (King and Manson, 2000). Sato (1994) reveals that women farmers in Africa indeed suffer from lack of access to modern technology and inputs, which lowers their productivity.

In Nigeria, women play a dominant role in agricultural production as confirmed by the FAO (1999) that women make up 60-80% of the agricultural labour force in Nigeria, depending on the religion, and produce two-third of the food crop. Despite government efforts in trying to reduce the discrimination between male and female gender, there is still a wide margin between the quantity and quality of crops produce by the male and female farmer. Unimaginative conception about gender especially women create in large way low production in agriculture and rural development programme. This mis-conception reduce the input-output level of women in maize production, people believe that women tend to be marketers than field workers but most times women tend to be the principal manager of the market economy. Maize is one of the major cereal crops serving as staple food and an essential raw material for wide range of consumer product in Nigeria. Therefore, this study examines the difference between gender and cost efficiency in maize production in Oyo state, Nigeria.

MATERIAL AND METHODS

This study was carried out in Oyo State, Nigeria which is located between latitudes 2^0 38^1 and 4^0 35^1 east of the Greenwich meridian. The State covers an area of 28, 454 square kilometer (FOS, 1996). According to NPC (2006), Oyo state had a population of 5,591,585 people. The state has two distinct ecological zones – the western moist forest to the south and the intermediate savannah to the north. The state shares border with the people Republic of Benin in the West, Kwara state in the north, Osun State in the east and Ogun state in the south. The state is divided into four agricultural zones. These are Ibadan/ Ibarapa, Oyo. Ogbomoso and Saki agricultural zones. The climate in the area is of tropical type with two distinct rainfall patterns. The rainy season which marks the beginning of agricultural production season starts between April and October with the heaviest rainfall between June and August while the driest months are November to March. Agriculture is the main occupation of the people and small scale traditional farming system predominates in the area. The bulk of agricultural produce comes from annually cultivated rain –fed farms. The major crops grown are yam, cassava and maize. The minor ones are cowpea, sorghum. Melon, millet, groundnut and vegetables.

The study employs multi-stages random sampling technique for the selection of the respondents. The first stage involves random selection of two out of four agricultural zones in the study area. Second stage involves the random selection of two local government areas in each zone making a total of four Local Government areas (LGAs) . In the third stage, five villages were randomly selected from each LGA making a total of ten villages. The last stage involves random selection of twenty farmers (male and female) from each village making a total of two hundred maize farmers (120 males and 80 females). Data were collected with the aid of a structured questionnaire**.**

Analytical framework

Farrell (1957) distinguishes between technical and allocative efficiency (or price efficiency) as a measure of production efficiency through the use of a frontier production and cost function respectively. He defined technical efficiency as the ability of a firm to produce a given level output with a minimum quantity of inputs under certain technology and allocative efficiency as ability of a firm to choose optimal input levels for a given factor prices. In Farrell's framework, economic efficiency (EE) is an overall performance measure and is equal to the product of TE and AE (that is EE = TE* AE).

However, over the years, Farrell's methodology had been applied widely, while it undergoes many refinement and improvement. Such improvement is the development of stochastic frontier model that enables one to measure firm level efficiency using maximum likelihood estimate. The stochastic structure with a two sided symmetry and one sided component. The one sided component reflects inefficiency while the two sided component capture random effects outside the control of production unit including measurement errors and other statistical noise typical of empirical relationship.

Economic application of stochastic frontier model for efficiency analysis include Aigner et al (1977) in which the model was applied to U.S. agricultural data. Battese and Corra (1977) applied the techniques to the pastoral zone of eastern Australia. More recently, Ogundari and Ojo (2005), Ojo (2004), Ajibefun et al (2002), Bravo-Ureta and Pinheiro (1993) and Ali and Byerlee (1991) in which they offer a comprehensive review of the application of the stochastic frontier model in measuring of agricultural producers in developing countries.

The production technology can be represented inform of cost of function. The cost function represents the dual approach in that technology is seen as a constant towards the optimizing behaviour of firms (Chambers, 1983). In the context of cost function any error of optimization is taken to translate into higher cost for the producers. However, the stochastic nature of the production frontier would still imply that the theoretical minimum cost frontier would be stochastic.

The cost function can be used to simultaneously predict both technical and allocative efficiency of a firm (Coelli, 1995). Also, it can be used to resurrect all the economically relevant information about farm level technology as it is generally positive, non-decreasing, concave, continuous and homogenous to degree one to one input prices (Chambers, 1983).

EMPIRICAL MODEL

The stochastic frontier cost function model is specified as follows:

$$In\ C = \beta_O + \sum_{i=1}^{6} \beta_i\ In\ X_i + \beta_7\ In\ Y + V_i + U_i$$

Where :
C is the total cost of maize production per year, P_1 is the average price of per kg of seed, P_2 is the average price per 25kg of fertilizer, P_3 is the average wage rate per man days of labour,P_4 is the average price of liter of agrochemical, P_5 is the average price of farm of equipment,P_6 is the rent per year and Y_i is the total output of shelled maize measured in kg. V_i are random variables such that Vi is normally distributed with a mean of 0 and variance σ_v^2. U_i are non-negative random variables that account for cost inefficiency such that U_i are independently distributed with a mean μ and variance σ_u^2.

To examine the possible relationship between efficiency and selected socio-economic characteristics, multiple regression analysis was used to investigate the association between efficiency indexes and five socio-economic characteristics. The level of efficiency, the dependent variable, lies between 0 and 1. The model is specified as:

$CE = a + b_1\ age + b_2\ educ + b_3\ exprice + b_4\ famsize + b_5\ ext.$

Where:
CE is the cost efficiency index, age is the age of the farmers, educ is the number of years of schooling completed by the household head, exprice is the number of years the farmer has been in maize production, family size is the total number of people in an household (famsize) and frequency of extension visits (Fext) is the number of times visited by the extension agent. The βs and bs are the parameters to be estimated. The cost frontier function is estimated through maximum likelihood methods using computer programme FRONTIER version 4.1

RESULTS AND DISCUSSION

The maximum likelihood estimates of the stochastic frontier cost function are presented in table 1. The estimates of the stochastic frontier cost function revealed that the coefficient of seed was found to be significant and negative in female respondents while it is insignificant in both male and overall data. This implies many farmers purchased and used more seed beyond the optimal level, given the relative input/output prices and thus negatively affecting cost efficiency.

The coefficient of fertilizer has a significant and positive relationship with the cost of maize production in male and pooled data. This implies that fertilizer is a significant cost of production in male farmers and pooled data. Labour was found to have a significant and positive relationship with the cost of maize production in all the respondents. This indicates that labour is a significant determinant of total cost of maize production in the study area. The coefficient of agrochemical was found to be significant and positive in male respondents while it is insignificant in both female and pooled data. Equipment has a significant and negative relationship with the cost of maize production in male and pooled respondents. Output was found to have a significant and positive relationship with cost of maize production in female and pooled data. This implies that output is a significant determinant in female and pooled data. The estimates of sigma-square are significantly different from zero in all the respondents indicating a good fit and the correctness of the specified distributional assumption of the composites error term. The estimate of gamma parameter was found to be significant in all the respondents. This implies that 72.3%, 99.9% and 53.1% of the variation in the total cost of maize production was due to cost inefficiency in male, female and pooled data respectively.

It was also observed that the mean farm specific cost efficiency was 1.24, 1.40 and 1.57 in male, female and pooled data respectively. This implies that there is about 24%, 40% and 57% cost inefficiency in male, female and pooled data respectively. Therefore in the short run, it is possible to decrease the total cost of maize production by the male, female and pooled data in the study area on an average by 24percent, 40 percent and 57 percent respectively by adopting the technology used by the best performers.

The relationship between cost efficiency and some selected socio-economic variables were examined and the findings revealed as shown in Table 2 that the estimated coefficients are of interest and have important implications. The positive coefficients for the age variables in male and pooled data imply that older farmers are more cost efficient than the young farmers. This could be explained in terms of the adoption of modern technology. Older farmers tend to be more conservative and less receptive to modern and

newly introduced agricultural technology. This is because newly introduced technology comes with additional cost. The negative coefficient in female farmers implies that younger farmers are more cost efficient than older farmers. Coefficients for age variable in all are not significant even at 10% level.

The variables of education showed positive relationship with cost efficiency in male and female maize farmers while it shows negative relationship with cost efficiency in pooled data. The positive coefficient of education reveals that high level of education results in increase in cost efficiency while negative coefficient implies that high level of education results in decrease in cost efficiency. However, the coefficient of education is not significant in male and pooled data.

Table 1: Stochastic Cost Frontier for Maize Farmers

Variable	Male	Female	Pooled data
Constant	1.082 (0.335)	1.133 (1.136)	-0.332 (-0.327)
Seed	0.058 (0.497)	-0.273 (-1.935)*	0.053 (0.633)
Fertilizer	0.367 (3.396)***	-0.010 (-0.081)	0.337 (4.650)***
Labour	0.723 (3.483)***	0.921 (1.98)**	0.786 (6.630)***
Agrochemical	0.014 (2.104) **	0.019 (0.124)	-0.021 (-0.227)
Equipment	-0.293 (-1.787)*	0.164 (0.596)	-0.188 (-1.826)*
Rent	0.036 (0.573)	0.0092 (0.116)	0.142 (2.222)**
Output	-0.089 (-0.598)	0.309 (2.672)***	0.451 (-2.446)**
Sigma-squared	0.133 (4.797)***	0.091 (2.330)***	0.114 (-3.446)***
Gamma	0.723 (3.294)***	0.999 (30.123)***	0.531 (3.170)***
Log likelihood	-20.435	-24.121	-26.448

Source: result from data analysis, 2007
*** Significant at 1%
** Significant at 5%
* Significant at 10%
The figures in the parenthesis are t-values

Table 2. Regression Result of Relationship between Cost Efficiency and some Socio- economic Variable.

Variable	Male	Female	Pooled
Constant	1.000 (26.682)	1.624 (2.249)	1.009 (11.661)
Age	6.524 (0.616)	-1.196 (-0.384)	2.206 (1.109)
Education	7.993 (0.599)	1.737 (1.930) *	-8.230 (0.379)
Experience	-1.849 (-1.466)	-1.530 (-0.812)	-5.821 (-2.569)**
Family size	1.706 (0.699)	8.182 (1.176)	-4.462(-0.096)
Extension visit	2.056 (2.260)**	-0.141 (-1.019)	2.032 (1.315)
Adjusted R^2	8.9%	4.2%	6.3%

Source: Result from data analysis, 2007
*** - Significant at 1%
** - Significant at 5%
* - Significant at 10%
The figures numbers in the parenthesis are t-values

The variable of farming experience showed negative relation with cost efficiency in male, female and pooled data. This implies that farmers with more years of experience tend to be less cost efficient. Experience in maize production is insignificant in determining the cost efficiency of male and female maize farmers but significant in pooled data in the study data. There was a positive relation between family size and cost efficiency in male and female farmers while it is negative in pooled data. Family size is insignificant in determining the cost efficiency in all the farmers in the study area.

There was a positive relationship between frequency of extension visit and cost efficiency in male and pooled data while it is negative in female farmers. This implies that frequency of extension visit tends to increase the cost efficiency of male and all respondents while it decrease the cost efficiency in female maize farmers.

CONCLUSION

This study uses stochastic cost function to investigate whether the issue gender is really important in estimating the cost efficiency of farmers in Oyo state-Nigeria and concluded that there is the need for a renew efforts in addressing the problem of gender imbalance in smallholder agriculture in Nigeria . Findings from this study indicates that estimates of the stochastic frontier cost function revealed that the coefficient of seed was found to be significant and negative in female respondents while it is insignificant in male. This further confirm the fact that the female farmer do not have continuous access to farm inputs (seed) and tend to use the seed from the previous harvest. The policy implication from this study is that there should be a comprehensive review of agricultural policy that will correct the imbalance in the gender access to farm inputs. Also there should be renewed interest and public support for the Women-in-Agriculture (WIA) programme of Agricultural development programme which has been neglected and phased out over the years.

REFERENCES

Adepoju, S.O. 1994. Gender, Work and Population in Sub-Saharan African. Heineman Publication, Ibadan Pp. 18

Ajibefun, I.A., Battese, G.E. and Daramola, A.G. 2002. Determinants of Technical Efficiency in Small holder crops farming: Application of Stochastic Frontier Production function". Quarterly Journal of International Agriculture, 41: 225-240.

Aigner, D.I.C., Lovell, A.K. and Schmidt, P. 1977. Formation and Estimation of Stochastic Frontier Production Models. Journal of Econometrics 6: 21-37.

Ali, M. and Byerlee, D. 1991. Economic Efficiency of small scale farmers in a Changing World: A Survey of Recent Evidence. Journal of Development Studies 4:1-27.

Battese, G.E. and Corra, G.S. 1977. Estimation of a Production Function Model with Application to the Pictorial Zone of Eastern Australia. Australian Journal of Agricultural Economics, 21:169-179.

Bravo-Ureta, Boris E. and Antonio Pinheiro, E. 1993. Efficiency Analysis of Developing Country Agriculture: A Review of the Frontier Function Literature. Agricultural and Resource Economics Review, 22: 88-101.

Chambers, R.G. 1983. Applied Production Analysis: A Dual Approach. Cambridge University Press.

Coelli, T.J. 1995. Recent Development in Frontier Modeling and Efficiency Measurement. Australian Journal of Agricultural Economics, 39:219-245.

F.A.O. 1999. Participation and Information. The key to Gender Responsive Agricultural Policy ,FAO, Rome.

Federal Office of Statistics (FOS) 1996. Nigeria Human Development Report (NHDR) Draft Report Lagos, Nigeria.

Farrell, J.M. 1957. The measurement of Productive Efficiency. Journal Royal Statistics, 120 (Part III); 253-290.

King Elizabeth M., and Mason Andrew, D. 2000. Engendering Development through Gender Equality in Rights and Voice Policy Research on Gender and Development Working Paper Series No.1.

NPC 2006. Census Provisional Result. National Population Commision, Abuja. Nigeria.

Ogundari, K. and Ojo, S.O. 2005. The Determinants of Technical Efficiency in mixed Crop Food Production in Nigeria: Journal of Social Sciences 13: 131-136.

Ojo, S.O. 2004. Improving labour productivity and technical efficiency in food crop production: A panacea for poverty reduction in Nigeria. Journal of Food, Agriculture and Environment 2(2).

Sato, K. 1994. Raising the productivity of Women Farmers in Sub-Saharan Africa World Bank Discussion Paper N0 230.

World Bank, 2002. World Development Indicators, Washington Dc. The World Bank.

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