Gender inequalities in Efficiency among Cassava farmers

GENDER INEQUALITIES IN TECHNICAL EFFICIENCY AMONG SMALL-HOLDER CASSAVA FARMERS IN ENUGU STATE, NIGERIA.

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ABSTRACT

This study was designed to examine the relative technical efficiency and its determinants on gender basis in cassava production in Enugu state, Nigeria. A multi-stage random sampling technique was used to select 180 cassava farmers (90 males and 90 females) from two out of three agricultural zones in the state. Interview schedules were used in data collection. Data were analysed using descriptive tools and Stochastic Frontier Production Function. The estimated farm level technical efficiency for male and female farmers were 89% and 53% respectively. Result further indicated that the estimated production function revealed that farm size 1%, labour 5%, cassava bundles 1% and quantity of fertilizer 5% significantly influenced the cassava production function for male farmers while farm size 1%, labour 1%, quantity of fertilizer 1% and capital input 1% significantly influenced that of the female. Household size, educational status, farming experience, land ownership and extension contact were found to be positively and significantly related to the technical efficiency of the male farmers while age and farm size were negatively but significantly related to their technical efficiency. For the female farmers, marital statuses, educational status, farming experience and farm size were positively significant while age and household size were negative but significantly related to their technical efficiency. The results therefore call for policies aimed at encouraging the youths who are agile and younger on experience to cultivate cassava. The education is also important especially for girl-child.

KEYWORDS: Technical efficiency, Gender, inequalities and Cassava Small-holders.

INTRODUCTION

Cassava is an indispensable staple food for 500 million people in tropical Africa. It possesses special attributes, which include ability to make returns of root yield even at extreme stress condition (Ekwe et al, 2008). The crop is also suitable to various farming system, available all year round as well as produces efficient food energy (Beeching et al, 2000). Nigeria in the world's largest producer of cassava, with about 45.75 million metric tonnes annually and ranks and after yam in extent of production among the root and tuber crops of economic value in Nigeria (FAO, 2007).

Over the years, agricultural policies and programmes in Nigeria have focused on the ways of increasing the productivity of rural farmers through development and transfer of appropriate technologies. There is a wide body of literature focusing in the impacts of gender discrimination in women's access to recourses in general and to inputs into agricultural production. The most important resource is land; others one' education, credit and technical assistance (Masterson, 2007). Women's ability to obtain agricultural inputs is also directly constrained by gender discrimination. Women have limited access to improved production resources and new technologies (Aye et al; 2006). Also empirical studies of farm household out comes have yielded evidence of inefficient allocation of resources along gender lines, and to the detriment of women (Okoye et al; 2009 and Dimelu et al; 2009). This situation has been attributed to gender insensitivity of technology development and transfer systems (Balakrishnan, 2004). It has been reported that despite the significant roles of female farmers in the third world, their level of productivity is constrained because agricultural technologies has been designed on the assumption that farm managers are men (Saito and Spurling, 1992). Furthermore, most policies aimed at making agro-technological inputs accessible to female farmers in Nigeria were actually directed towards men (Nweke, 1994). Consequently, women have limited access to improved production resources and new technologies (Aye et al, 2006). Therefore, gender becomes the most
important determinant of the distribution of rights, resources and responsibilities among individuals, families and communities. All these could affect ways technologies are being transferred and adopted to increase food production in the rural areas.

Studies addressing gender inequalities in production itself include attempts to measure both differences between men and women, and the costs gender related inefficiencies in agricultural production (Masterson, 2007). Attempts to quantify differences between men and women have employed various measures of farming ability; land productivity (Lastarria-Corlieu, 1988), labour productivity (Okoye et al; 2008) and gender productivity (Okoye et al; 2009). Aye et al (2006) further admitted that efficiency of resource use is the key to effectively addressing the challenges of achieving food security and poverty alleviation. In the other hand, managerial efficiency, which is the ability to use farm resources (land, labour and capital) efficiently, is also relevant in the process. This is measured in terms of the way resource are converted into returns (Mbah, 2006).

Considering resource management at farm levels, Saito et al (1994) reported that female farmers were equally as efficient as male farmers. However, they argued that male farmers perform better only due to lower level of input use on female manage farms, and not necessarily due to any inherent superior managerial abilities in the males. Chukwuji, and Oyaide (2005) also nodded that there were differences in farm size, expenditure on labour and capital between men and women, with men employing more of each input than women. They admitted that the value of output net farm income per head and technical efficiency were not significantly different for men and women. Nwaru (2007) reported that mean technical efficiency for the female farmers was significantly higher than the male farmers in arable crop production in Abia state of Nigeria. However, since production system and efficiency in resource use in the farm determine the nature and amount of agricultural technologies that should be made available to these farmer categories to enhance their productivity, this study was therefore, designed to examine the relative technical efficiency and their determinants on gender basis in cassava production in the state. Technical efficiency here refers to the ability to produce the highest level of output with a given bundle of resources (ability to produce on the production frontier) (Onyenweaku and Nwaru, 2005). It is usually derived by the ratio of total output to total input. For an efficient farmer, this ratio is unity (Nwaru, 2007).

METHODOLOGY

This study was conducted in Enugu State, Nigeria. It is one of the major cassava producing areas in South Eastern Nigeria where the role of women in food production has been conspicuous (Nwaru, 2007). Multi-stage random sampling technique was used for the study. In the first stage, two out of three agricultural zones in the state were randomly selected. In the second stage, two out of six blocks in each of the selected zones were randomly chosen. In the third stage, two out of four functional circles in each of the selected blocks were randomly selected. Finally, twenty (20) farmers (10 males and 10 females) were randomly selected from a list of men and women cassava farmers from the extension agents in charge of the circles. Thus, a total of 160 cassava farmers were chosen for detailed study.

Interview schedules were used to elicit information from the respondents on labour, farm size, agro-chemicals, planting material, other input used, output and capital. Others were farmer's socio-economic characteristics. Technical efficiency was analysed with the aid of the stochastic frontier production function developed independently by Aigner, Lovell and Schmidt (1977) and Meeusen and Van den Broeck (1977) and is defined by:

\[ Y_i = f(X_i, \beta_i) \exp (V_i - U_i), i = 1, 2, ..., n \]  

Where \( Y_i \) is the output of the i-th farmer, \( X_i \) is the vector of input quantities used by the ith farmer, \( \beta_i \) is a vector of unknown parameters to be estimated, \( f(.) \) represents an appropriate function (e.g. Cobb Douglas, Trans log, etc). \( V_i \) is a symmetric error, which accounts for random variations in output due to factors beyond the control of the farmer while \( U_i \) is a non negative random variable representing inefficiency in production relative to the...
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stochastic frontier. For this study, the production technology of farmers in Enugu state, Nigeria was specified by the Cobb Douglas frontier production function defined as follows.

\[ \ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \ldots + \beta_i \ln X_i + V + U_i \] …… (2)

Where:
- \( Y \) is cassava output in kilogram,
- \( X_1 \) is farm size in hectare,
- \( X_2 \) is labour input in mandays,
- \( X_i \) is cassava bundles in kilogram,
- \( X_{i+1} \) is quantity of fertilizer in kilogram,
- \( X_{i+2} \) is capital input in naira measured in term of depreciation of farm tools and equipment, interest on borrowed capital, repairs and rent on land,
- \( \beta_i \) are the regression parameters to be estimated while
- \( V \) and \( U \) are as define in equation (1).

In order to determine the factors contributing to the observed technical efficiency, the following model was formulated and estimated jointly with equation (2) in a single stage maximum likelihood estimation procedure using Computer Software Frontier Version 4.1 (Coelli, 1996).

\[ \ln Y = \ln Y^* + f(V; \theta) \exp(V_i - U_i) \]

Where \( Y^* \) is the observed output and \( Y^* \) is the frontier output. For this study, the production technology of the cassava farmers in Enugu State is assumed to be specified by the cobb-Douglas production function defined as follows.

\[ \ln Y = \beta_0 + \beta_1 \ln X_1 + \ldots + \beta_i \ln X_i + \alpha \ln Y^* + \gamma V + \xi \]

\[ \ln Y^* = \alpha + \alpha_Z \ln Z + \gamma \ln Y + \xi \ln \xi \] …… (3)

Where \( Y^* \) is the observed output, \( Y^* \) is the frontier output, \( \alpha \) is the intercept and \( \alpha_z \) are parameters estimated. The coefficient of age was expected to be negative and those for the other variables positive.

RESULTS AND DISCUSSION

The results of the estimated production function for cassava of the sampled farmers by gender are presented in Table 1. The table shows that the constants were significant at 1% for both male and female farmers. The estimated variance (\( \sigma^2 \)) was also significant at 1% for both farmer groups indicating goodness of fit and correctness of the specified distribution assumption of the composite error terms. The estimated values of the gamma (\( \gamma \)) were highly significant at 1% for females but at 10% for male farmers. The coefficients for gamma were 0.498 and 0.984 for the male and female farmers respectively, implying that 49.8% and 98.4% of the total variation in cassava output for male and female farmers respectively was due to technical inefficiency.

The table also shows that for the male farmers, the coefficient for farm size (\( p = 1.0\% \)), labour (\( p = 5\% \)), cassava bundles (\( p = 1\% \)) and quantity of fertilizer (\( p = 5\% \)) were significant and positive according to a priori
expectations while capital input and other inputs were not significant even at p = 10%. For the female farmers, farm size (p = 01%), quantity of fertilizer (p = 01%) and capital input (p = 10%) were positive and significant whereas cassava bundled was not significant even at p = 10%. However, the coefficient for labour was significant but negative for the female farmers, implying that this input was used beyond the point where its marginal value product equated its unit price. This result agrees with the report of Nwaru, (2007) who reported negative coefficient for labour for female farmers in arable crops production in Abia State, Nigeria.

The significant and positive coefficient for land and fertilizer for both the male and female farmers are expected and agree with Ohajianya and Onyenweaku (2001), Nwaru (2003 and 2004) and Nwaru (2007). The use of more land and fertilizer is expected to lead to greater output of cassava.

Table 1: Estimated production function for cassava production by gender in Enugu state

<table>
<thead>
<tr>
<th>Variables</th>
<th>Parameter</th>
<th>Estimate Male</th>
<th>Estimate Female</th>
</tr>
</thead>
</table>
| Constant X₀        | β₀        | 7.776 (2.706***) | 10.853 (21.119***)
| Farm size X₁       | β₁        | 0.213 (2.998***) | 0.3804 (4.165***)
| Labour X₂          | β₂        | 0.081 (2.206**) | -0.89 (-1.895*) |
| Cassava bundle X₃  | β₃        | 0.615 (2.967***) | 0.023 (0.298) |
| Quantity of fertilizer X₄ | β₄ | 0.041 (2.615**) | 0.133 (3.273***) |
| Capital input X₅   | β₅        | -0.037 (-0.983) | 0.154 (1.689*) |
| Other input X₆     | β₆        | -0.054 (-0.983) | -0.083 (-1.501) |
| Sigma               | δ         | 0.445 (4.516***) | 15.348 (5.304***)
| Gamma               | γ         | —               | —               |

Source: Field Survey 2006

The significant and positive coefficient for land and fertilizer for both the male and female farmers are expected and agree with Ohajianya and Onyenweaku (2001), Nwaru (2003 and 2004) and Nwaru (2007). The use of more land and fertilizer is expected to lead to greater output of cassava.

The results of estimated determinants of technical efficiency in cassava production by gender in Enugu state, Nigeria are presented in Table 2. The coefficient for land ownership for the male farmers is positive and significant at 1% level while that of the females though positive but not significant. The coefficients for household size for the two farmer groups presented mixed results. For the male farmers it is positive and significant at 1%, which is consistent with a priori expectations because according to Onyenweaku and Nwaru (2005), large household size eased labour constraints thereby leading to increases in productivity and income of the farm household. For the female farmers, the coefficient of household size is negative and significant at 1%, which is contrary to a priori expectations and suggesting that larger households might have utilized household labour beyond the point where the marginal value product of labour was equal to the wage rate (Nwaru, 2007).

The coefficient for extension visit is positive and significant at 1% level for male farmers these agrees with expectations that those who have more contact with extension agents have more access to agricultural information, credit and other production inputs as well as more enhanced ability to increase their productivities. However, for the females, the extension contact though not significant but is positive.

The coefficients of age for both farmer groups are negative and significant at 1% implying that age is inversely related to technical efficiency. This result is consistent with a priori expectations that the older farmers are less technically efficient than the younger ones. This is because the older farmers are less likely to have contacts with extension agents and are less willing to adopt new technologies to improve their productivities (Hussain, 1989). The result agrees with those of Okike (2000) for crop and livestock farmers in the savannah zones of Nigeria, Onu et al (2000) for cotton farmers in Nigeria, Nwaru (2004) for arable crop farmers in Imo State of Nigeria.
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Nigeria and Onyenweaku and Nwaru (2005) for food crop farmers in Imo State of Nigeria; Nwaru (2004). However, it was not consistent with Nwaru (2007); Onyenweaku and Nwaru (2005).

The coefficient of marital status for male farmers is not significant but positive and significant at 1% level for female farmers. The coefficients of farming experience are positive and significant at 1% for both male and female farmers indicating that these variables are directly related to technical efficiency and are in consonance with *a priori* expectation that farmers with more farming experience are more technically efficient. This result agrees with those of Onyenweaku and Nawaru (2005); Nwaru (2007); Nwaru (2004); Onyenwaeku, (2004); Onyenweaku and Ohajianya (2005). However, the result differs from that of Onu et al (2000) who reported negative relationship between technically efficiency and farming experience.

The coefficients for farm size for both farm groups have mixed results. For the male farmers, it was negative and significant at 1% indicating inverse relationship with technical efficiency. For female farmers, the coefficient for farm size was positive and significant at 1% level indicating direct relationship with technically efficiency; this result is in consonance with *a priori* expectations that larger farmers are more technically efficient than small ones and agrees with Onyenweaku and Nwaru (2005).

Table 2: Estimated Determinants of Technical Efficiency by gender in cassava production.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Parameter</th>
<th>Estimate male</th>
<th>Estimate female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant (Zo)</td>
<td>a0</td>
<td>3.004 (4.738*** )</td>
<td>9.027 (2.135*** )</td>
</tr>
<tr>
<td>Landownership (Z1)</td>
<td>a1</td>
<td>0.005 (2.744*** )</td>
<td>0.092 (0.089 )</td>
</tr>
<tr>
<td>Household size (Z2)</td>
<td>a2</td>
<td>0.011 (2.409*** )</td>
<td>-2.328 (-3.000*** )</td>
</tr>
<tr>
<td>Membership of corporative (Z3)</td>
<td>a3</td>
<td>-0.036 (-1.339)</td>
<td>-5.368 (-1.567)</td>
</tr>
<tr>
<td>Extension contact (Z4)</td>
<td>a4</td>
<td>0.072 (2.513*** )</td>
<td>1.372 (0.947)</td>
</tr>
<tr>
<td>Age (Z5)</td>
<td>a5</td>
<td>-0.218 (-2.160*** )</td>
<td>-0.665 (-4.478*** )</td>
</tr>
<tr>
<td>Marital status (Z6)</td>
<td>a6</td>
<td>0.173 (0.421 )</td>
<td>8.954 (3.006*** )</td>
</tr>
<tr>
<td>Educational status (Z7)</td>
<td>a7</td>
<td>0.811 (1.927)</td>
<td>0.526 (2.77*** )</td>
</tr>
<tr>
<td>Credit access (Z8)</td>
<td>a8</td>
<td>-0.316 (-0.432)</td>
<td>-0.904 (-1.299)</td>
</tr>
<tr>
<td>Farming exp (Z9)</td>
<td>a9</td>
<td>0.316 (4.319*** )</td>
<td>0.414 (2.541*** )</td>
</tr>
<tr>
<td>Farm size (Z10)</td>
<td>a10</td>
<td>-0.025 (-2.350*)</td>
<td>0.039 (2.583** )</td>
</tr>
</tbody>
</table>

Sources: field Survey 2006

Figures in parameter are t-ratios; ***, **, and * are significant levels at 1%, 5% and 10% respectively.

Table 3 shows the results of the elasticity and returns to scale for cassava production of farmers by gender. The regression coefficients in the Cobb-Douglas production function are the production elasticities and their sums indicate the returns to scale (Hazarika and Subramanian, 1999). The Table shows that cassava bundle and farm size has the highest elasticity of production for the males and females farm respectively. This implies that they contributed the most to farm returns when compared with the other inputs in each case. The sum of output elasticity (returns to scale) on male and female farms were 0.86 and 0.52 respectively. This indicates decreasing returns to scale in both cases.

However, the elasticity for the males was higher than the females. The mean technical efficiencies of both the male and female farmers, the table shows that the males (89%) counterparts were more technically efficient than the females (53%).
CONCLUSION

The results of this study reveal that technical efficiency in cassava production in Enugu state across gender is relatively low for the female farmers. Although the average male farmer is technically more efficient than his female counterpart, maximum technical efficiency was not achieved by both farmer categories. Thus suggests that opportunities still exist for increasing productivity of cassava farmers in the State by increasing the efficiency with which resources are used at the farm level.

Important factors directly related to technical efficiency were age and farming experience for both sexes. However, land ownership, household size and extension contacts are directly related to technical efficiency of the male farmers while farm size is directly related to the technical efficiency of the females. Therefore, policies aimed at improving the women farmers’ access to land, extension contact and education will be useful in increasing their technical efficiency. Since the study revealed that an increase in the age of the farmer groups would lead to decline in their technical efficiency, policies that would focus on ways of attracting and encouraging the youths, who are agile and stronger to embark on cassava production, will help to increase technical efficiency and productivity. Those who are experienced should also be encouraged to remain in the production process. Policies also call for education especially to the girl-child while women’s access to production input and relevant technologies should be increased to enhance their technical efficiency and productivity in the study area.

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### Table 3: Elasticity and Returns to Scale for Cassava Production of Farmers by Gender in Enugu State.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Elasticity Male</th>
<th>Elasticity Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm size</td>
<td>0.213</td>
<td>0.380</td>
</tr>
<tr>
<td>Labour</td>
<td>0.081</td>
<td>-0.089</td>
</tr>
<tr>
<td>Cassava bundles</td>
<td>0.615</td>
<td>0.023</td>
</tr>
<tr>
<td>Quantity of fertilizer</td>
<td>0.041</td>
<td>0.133</td>
</tr>
<tr>
<td>Capital input</td>
<td>-0.037</td>
<td>0.154</td>
</tr>
<tr>
<td>Other input</td>
<td>-0.054</td>
<td>-0.083</td>
</tr>
<tr>
<td>Sum elasticities</td>
<td>0.859</td>
<td>0.518</td>
</tr>
<tr>
<td>Mean Technical Efficiency</td>
<td>0.89</td>
<td>0.53</td>
</tr>
</tbody>
</table>
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