Appendix

Tests of hypotheses

Prior to performing the econometric analysis, the data were checked against econometric problems. The value of variance Inflation Factor for hypothesized continuous variables entered into the model was low and below 10, that shows the absence of a severe Multicollinearity problem among the variables. Besides, to identify the problem heteroscedasticity the Breusch-Pagan test was also used that also shown no heteroscedasticity problem (p-value = 0.93) in the models. Durban-Wu-Hausman $\chi 2$ test was used to detect the Endogeneity. Similarly the test result showed there was no problem with it in the models.

On the other hand, to identify the best functional form, distributional assumptions for the inefficiency term (X_i) and test different hypotheses the generalized likelihood ratio (LR) test statistic specified by Coelli *et al.* (2005) was used and the value of LR was computed (A1):

$$LR = -2[\ln L(H_0) - \ln L(H_1)] \quad \text{(A1)}$$

Where; L (H_0) and L (H_1) denote the values of the likelihood function under the null (H_0) and alternative (H_1) hypotheses, respectively.

The null hypothesis will be rejected when the calculated $\chi 2$ is larger than the critical value with the df at 1, 5, or 10% significance level.

Before estimating the parameters of the model from that individual-level efficiency were computed, the vital test is checking the existence of inefficiency in the production of cassava. The test was conducted by contrasting the OLS and SPF results presented in the Appendix table 1below to suit the data. It was performed by using the LR formula displayed in equation (A1). As specified in Appendix table 1, the critical value of 17.21 at $\chi 2$ at 1 df at a 5% significance level is greater than 3.84, leading to rejection of H_o. Thus, there is technical inefficiency, which shows a statistically significant inefficiency in the observed data. It suggests that the SPF function is the right functional form for the present data.

It is also necessary to test the appropriate functional form best to fit the data. The most common functional forms are CD production and Tran-slog production functions. Thus, first, the functional form that can better hand down to the data was choose by testing the null hypothesis that the coefficients of all interaction terms and quadratic terms in the trans-log functional forms are equal to zero ($H_0 = \beta_{ij} = 0$). The LR test was made for these two functional forms. As indicated in Table 3, the LR value of -58.9 is less than the critical value of $\chi 2$ at 15 df at a 5% significance of 24.996. Hence, this suggests that the null hypothesis that orders all coefficients of the Trans-log functional form is equal to zero is accepted. Thus, this means the CD form best fits the current data.

Further, it was essential to check whether the independent variables in the inefficiency effect model contribute significantly to the inefficiency differences amongst cassava-producers. The test was the null hypothesis of all coefficients that explain inefficiency is equal to zero, the parameters of the frontier model, i.e., H_o: = $\delta_0 = \delta_1 = \delta_2 \ldots = \delta_{14} = 0$. The hypothesis was also tested in the same manner by computing the LR value using the value of the log-likelihood function under the SPF without explanatory variables of inefficiency effects (H_0) and the full frontier model with variables that are supposed to determine the inefficiency level of each farmer (H_1). The LR value of 54.92 gained was again higher than the critical χ^2 value of 23.685 at the 14 degree of freedom (df) equal to the number of restrictions. As a result, the null hypothesis was rejected in favor of the alternative hypothesis that the explanatory variables associated with the inefficiency effects model are simultaneously different from zero. Therefore, explanatory variables of technical inefficiency can determine difference in the production of cassava output in the study area.

Lastly, as indicated in Table 2, the value of gamma (70%) showed that there was technical inefficiency. That is meaning in the study area; cassava production is more affected by those factors under the farmers' control than beyond the farmers' control. Therefore, identifying inefficiency variables was required and involved under the Tobit model estimation procedure.

Appendix table 1: The tests of hypothesis for the parameters.

Null hypothesis	Degree of freedom	LR	Critical value	Decision
H_O:ɣ=0	1	17.1	3.84	Reject H_o
H_0: $\beta_{ij} = 0$	15	-58.9	24.996	Accept H_o
H_o: = $\delta_0 = \delta_1 = \delta_2 \ldots = \delta_{14} = 0$	14	54.92	23.685	Reject H_o