An examination of technical efficiency of farmers under different multi-cropping systems in Nigeria

Ogundari Kolawole

Georg August Universitat, Department für Agrarökonomie und Rurale Entwicklung, *Göttingen, Germany* - ogundarikolawole@yahoo.co.uk

Abstract: *The study examined technical efficiencies of farmers under different multiple-cropping systems in Nigeria. A total of 200 farmers were sampled. The farmers were group on the basis of numbers of crops on their farms. The results showed that farmers with 5 enterprises perform better in terms of the resource-use efficiency indicators examined such as the estimated input elasticities as well as the returns to scale and average technical efficiency (TE) from the analysis. Marginal analysis of farmer's years of education, recorded highest simulated technical efficiency across the farms follows by numbers of the extension contacts and credit. However, policies that will strengthen present institutional framework on credit delivery and extension systems should be embraced as the productivity effects of extension visits and credit are expected to generate a large increase in the overall performance of the system in the future*

Keywords: *subsistence farmers, technical efficiency, socio- variables, marginal effects.*

Introduction

Vertical integration is defined as the degree at which firms participate in more than one successive stages of production of goods and services (Nor Ghani Md *et al.,* 2006). Subsistence farmers, move along vertical chain of production process (i.e., increasing or decreasing the number of enterprises on their farm) because of their decision to assess the security of their farm enterprises. Against this background, this study examines technical efficiency and marginal effects of farmer´s socio-economic variables on their technical efficiency under different multiple-cropping systems in Nigeria. The study was carried out in Ondo State Nigeria in 2005. Ondo State climatically falls within the rainforest belt of the country and has vast agricultural potentials. The people are predominantly peasant farmers, cultivating mainly food crops. The data were collected with the aid of a well-structured questionnaire distributed to randomly selected 200 farmers across the state.

Model Specification

The data were analyzed using a stochastic frontier model (SFM). Following the specification of Battese and Coelli, (1988), the model used for the analysis can be defined as: $Y_i = f(X_i; \beta_i) \exp(V_i - U_i)$. Where- Y_i is the output (for this study our output equals the total farm value of all food crops produced in naira) ; f is the functional form (we assume Cobb-Douglas for this study); X_i is input used (farm size, labor, planting materials, pesticides, and fertilizers); β_i is unknown parameters; v_i are random errors as $v_i \sim$ iid $N(0,\sigma^2)$, while u_i are non-negative random error associated with technical inefficiency as $u_i \sim$ iid $N(\mu_i,\sigma^2)$. Technical efficiency (TE) is defined as the maximum output obtained from a given level of inputs. That is, $TE_i = [Y/ f(X_i; \beta_i) \exp(V_i)] = \exp(-U_i)$. Distribution of mean inefficiency (μ_i,) is related to the farmers' demographic variables by allowing heterogeneity in the mean inefficiency term to investigate sources of differences in technical efficiencies of the farmers.A vector of farmer's demographic variables (Z_{ij}); age, years of education, amount of credit accessed and numbers of extension contacts that determines his technical inefficiency (μ_i) is specified as: $\mu_i = \delta_0 + \delta_j Z_{ij}$.

Results and discussions

We observed 2 to 5 different multi-cropping patterns among the respondents as none practiced the mono-cropping system. About 13% of the respondents planted -cassava and maize (called Group A for easy identification). Also 15% planted -cassava, cocoyam and maize (Group B); about 30% planted- cassava, cocoyam, maize and yam (Group C) while 42% planted- cassava, cocoyam, maize, potato and yam (Group D). The estimated elasticities from the specified regressions for the each of the

groups shows that Group D farmers with the most diversified enterprise have the highest elasticities of production with respect to land, labour and fertilizer. The returns to scale computed from the summation of the input elasticities shows that an average farm in Group A (0.893), Group B (0.861) and Group C (0.923) exhibits decreasing return to scale while such in Group D (1.112) exhibit increasing return to scale. Also presented in Figure I are the distributions of the TE across the groups. Group D recorded the highest TE of 0.868, followed by Group C with 0.813, Group B with 0.682 and Group A with 0.523. This suggests that, 13.2%, 18.7%, 31.8 and 47.7% of yields of the farms in Groups D, C, B, and A respectively compare to the yields of the most efficient farms across their respective groups are forgone due to inefficiency.

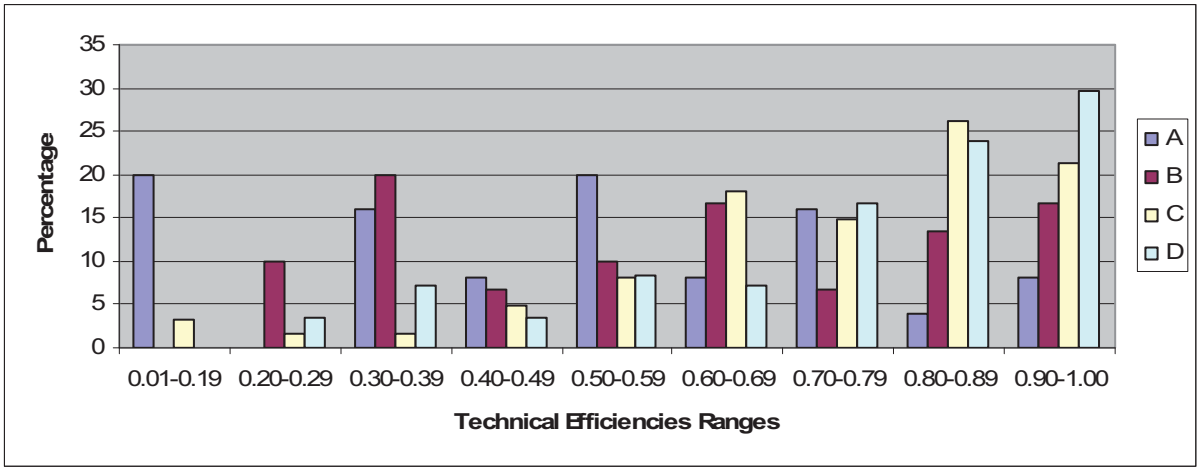

Figure 1. Distribution of the predicted Technical efficiencies across the groups

The examination of the effect of farmer`s demographic variables on their technical inefficiency shows that TE of the farmers increased significantly with years of education ,extension, and credit for Group A while it increased with age, education, extension, and credit for the Groups B, C and D. However, the marginal analysis of change in the level of estimated TE with respect to the change in the selected demographic variables show that, marginal gain in technical efficiency for an increase in the variables for Group A farmers is -4% for age; 0.9% for education; 11.7% for extension; and 17.3% for credit. For Group B farmers: 31% for age, 1.6% for education, 45.8% for extension, and 1.3% for credit. For Group C farmers: 1.2% for age, 1.1% for education, 32.3% for extension, and 3.9% for credit. For Group D farmers: 21% for age, 48.2% for education, 20.1% for extension, and 6.5% for credit. In all, marginal analysis of years of education recorded the highest simulated technical efficiency across the groups followed by numbers of the extension contacts and credit.

The findings suggest that the more a farm is vertically integrated (i.e. increase in degree of enterprise diversified), the higher the technical efficiencies and the higher is the output obtained from given level of inputs. This suggests that the subsistence farmers in Nigeria perform efficiently as the numbers of crops/ enterprises on their farms increases. The performance of the farms with higher enterprises is a further confirmation of Schultz's hypothesis that farmers in developing agriculture are poor but efficient in resource use (Schultz, 1964). However, they have a number of policy implications in particular the results of the years of education, extension contacts as well as credit with highest simulated TE across the farms. Policies that will strengthen the present institutional framework on credit delivery and extension systems should be embrace as productivity effects of extension visits and credit are expected to generate a large increase in the overall performance of the agricultural sector of the economy.

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