INTERNATIONAL CONFERENCE OF AGRICULTURAL ECONOMISTS

ICAE
29th | Milan Italy 2015
UNIVERSITÀ DEGLI STUDI DI MILANO AUGUST 8 - 14
AGRICULTURE IN AN INTERCONNECTED WORLD

523

Efficiency differentials and technology gaps in beef cattle production systems in Nigeria

Cecilia Nwigwe, Victor Okoruwa and Oghenerueme Obi-Egbedi
Department of Agricultural Economics, University of Ibadan, Nigeria akuchius@yahoo.com

Introduction

Declining productivity, partly due to high unit cost of production and inability of farmers to afford high-yielding farm technologies characterize beef cattle production in Nigeria.

Consequently, there is deficiency in the intake of beef, which is an important source of nutrients, such as proteins in human diet. For instance, in Nigeria, the intake of animal protein is 4.82g/caput (Tewe, 2010), as against a minimum requirement of 35g recommended by FAO (2009a).

With a population of over 160 million people, it is obvious that Nigeria requires several heads of cattle to satisfy its demand for cattle and cattle products. Again, with a population growth rate nearing 2.8% per year, the country's own domestic production is by far from being able to meet demand (Grain de sel, 2010).

Considering the size of the human population that depends on beef cattle production in Nigeria, the development of domestic and export markets is critical to ensure food security, alleviating poverty, raising revenue and continuing the trend towards more market orientation.

Improving production efficiency could reduce the economic costs of production and enhance supply for beef cattle domestic and export markets in Nigeria.

The present study therefore investigated technical efficiency (TE) and technology gaps in Nigeria's main beef cattle production systems, namely, nomadic pastoralism, agro-pastoralism and ranching.

Investigating the TE provided insights on how to better integrate livestock development into the national and economic agenda, as well as guidance to farmers on resource allocation.

Materials and Methods

The study used survey data from six states in Nigeria that are representative of the three beef cattle production systems in Nigeria.

A multi-stage sampling approach was employed to collect data from 339 cattle farmers including 39 ranchers, 92 nomads and 208 agro-pastoralists, using a well-structured questionnaire.

Data was collected on cattle inventory in the past twelve months; production inputs such as feeds, labour, veterinary supplies and advisory services, fixed inputs; cattle breeding methods; access to extension and market services; and beef cattle producers' socio-demographic characteristics.

The present study applied the stochastic metafrontier model, to investigate TEs and technology gaps in the three major beef cattle production systems in Nigeria.

The stochastic metafrontier equation can be expressed as:

$$Q_n^* = f(X_n, \beta^*) \mathrm{n} = 1,2 \ldots \ldots \mathrm{N} \ldots \ldots \ldots \ldots \ldots (1)$$

Where $f(.)$ is a specified functinal form; Q_n^* is the metafrontier output; and β^* denotes the vector of metafrontier parameters that satisfy the constraints.

Technologies in this study comprise of type of cattle breeds, breeding methods and feeding methods.

Acknowledgements

We acknowledge the Agricultural Research Council of Nigeria (ARCN) for providing research grant for the study.

We also thank the Dept. of Agric. Economics, University of Ibadan, for assisting in data collection for the study.

Literature cited:

1. Battese, G.E, Rao, D.S.P (2002) Technology gaps, efficiency and a stochastic metafrontier function; International Journal of Business and Economics 1 (2): 87-93.
2. O'Donnell, C.J, Rao,D.S.P, Battese, G.E (2008) Metafrontier frameworks for the study of firm level efficiencies and technology ratios; Empirical Economics 34 (2): 231-255.

Results

Table 1: Technical efficiency and meta-technology ratios

Model		Nomads	Agro-pastoralists	Ranchers	Total
TE w.r.t.the pooled frontier*					
	Mean	0.576985[b]	0.660557[a]	0.694128[a]	0.660053
	Min	0.08544	0.12729	0.15164	0.08544
	Max	0.81593	0.69021	0.88722	0.59020
	SD	0.244114	0.172218	0.137709	0.176296
TE w.r.t. production system frontiers*					
	Mean	0.599802[b]	0.678541[a]	0.707986[a]	0.6600
	Min	0.05626	0.17265	0.27741	0.0854
	Max	0.89576	0.90726	0.87586	0.9020
	SD	0.215038	0.158922	0.127269	0.1763
TE w.r.t. the metafrontier*	Mean	0.4200[c]	0.5059[b]	0.6445[a]	0.5647
	Min	0.0432	0.1629	0.1683	0.0636
	Max	0.8574	0.7715	0.8687	0.9502
	SD	0.1660	0.1534	0.1129	0.1801
Meta-technology ratio w.r.t the metafrontier*	Mean	0.7125[b]	0.7021[b]	0.9501[a]	0.8573
	Min	0.5049	0.7490	0.5704	0.5338
	Max	1.000	1.000	1.000	1.000
	SD	0.1005	0.0393	0.0861	0.1470

Notes:* These TE scores are only reported for the completeness of analysis. The caveat is that they are estimated relative to different technologies; hence non-comparable across the groups. Comparisons are based on the metafrontier and meta-technology estimates because these used a common industry-wide technology as the reference point a, b, c: Letters denote significant differences (at 10 percent level or better) in variables across the production systems in a descending order of magnitude.

A summary of farmers' characteristics indicates that three types of beef cattle production systems were prominent in Nigeria (Nomadic, agro-pastoralist and ranching). Generally, the systems were male-dominated. The nomads kept few cattle and cultivated smaller land compared to the other two systems. Ranchers had more access to veterinary services and credit facility and were more educated than the nomads and agro-pastoralists while the nomads' herds were mostly indigenous breeds.

Preliminary empirical results indicate that there are significant differeces in the input parameters; TE scores and random variations across the three production systems; thus suggesting that differences exist in the production technology and environment, which justifies estimation of a metafrontier.

In the metafrontier model, beef output was considered as the dependent variable, while inputs such as herd size, feeds, veterinary cost, fixed costs etc were included as regressors. The significance of σ^2 and the gamma (γ) parameter indicated, respectively, that the models were stochastic and exhibited technical inefficiency.

With respect to the estimated pooled frontier (Table 1), nomads had the lowest mean TE (0.57) while ranchers had the highest mean TE (0.69). The mean TE across all production systems was estimated to be 0.66. The scores were similar to that of the pooled frontier (0.66). For all systems the mean TE estimates relative to the metafrontier are consistently lower than production system frontier estimates. This confirms that generally there is potential to improve production efficienty, given the existing technologies.

Metatechnology ratio with respect to the metafrontier (i.e, use of technology), showed that the average MTR was highest in ranches (0.95) and lowest in agro-pastoralists (0.70); nomads had a mean MTR of 0.71; the MTR estimates were below 1, indicating that they used the available technology sub-optimally. The maximum estimated MTR was 1 or unity in all the three production systems, which means that the group frontiers were tangent to the metafrontier (Battese *et al*., 2004).

Conclusion

Our research contributes to empirical literature on the stochastic metafrontier method in general, and in the assessment of an important agricultural policy issues in a developing country in particular.

Results show that, on average, significant differences exists in technical efficiency between the three production systems, however the ranching system is more efficient, in that it has higher MTR.

The average pooled TE with respect to the metafrontier was estimated to be 0.56. This suggests that there is scope to improve beef output in Nigeria by up to 44% of the total potential, given existing technologies and inputs.

Consequent upon efficient use of resources in the three production systems, improved technologies for beef cattle production should be made available to cattle producers.

In line with the Agricultural Transformation Agenda (ATA) of the Federal Republic of Nigeria, there is need for the government to use its policy of Growth Enhancement Scheme (GES), to provide guaranteed minimum price support for beef cattle producers.