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Competitiveness of Beef Processing in Borno State of Nigeria: *A Policy Analysis Matrix Approach*

A. O. Mamza, K. K. Salman and I. B. Adeoye

Department of Agricultural Economics, University of Ibadan, Oyo State, Nigeria

Corresponding author: A. O. Mamza, Email: asinamaimamza@gmail.com

Abstract. Beef processing improves food safety, extend shelf-life, better nutrition as well as increased household income. It is vital to examine the Competitiveness and impact of government policies on beef processing to evaluate the contribution of the sub sector to food security and economic empowerment. The study therefore investigated the Competitiveness, Comparative Advantages and effect of government policy on beef processing in Borno State. Multistage sampling technique was used in selecting 86 processors within the study area. The study utilized both primary and secondary data and was analyzed using Policy Analysis Matrix (PAM).The study identified three main beef products namely Kilishi, Tsire and Balangu. PAM result revealed that Kilishi, Tsire and Balangu processing were privately and socially profitable. Private profit of ₦1,087,278.41, ₦839,576.95, ₦439,857.69 and Social Profit of ₦5,810,065.52, ₦3,347,518.07 and ₦1,398,042.95 were estimated for Kilishi, Tsire and Balangu processing respectively. Private Cost Ratio (PCR) of 0.27, 0.28 and 0.35 were obtained for Kilishi, Tsire and Balangu indicating competitiveness of the enterprises. The Nominal protection coefficient on output (<1) and input (>1) indicated that the processors are taxed. The Effective Protection Coefficient (EPC) of Kilishi, Tsire and Balangu processing were 0.24, 0.32 and 0.43 indicating low value added at domestic price. The study recommends provision of incentives to processors to increase competitiveness and secured environment for private sector participation.

Keywords: Beef processing, beef products, competitiveness, policy analysis matrix.

Introduction

Beef is the meat obtained from matured cattle and it is a good source of animal protein which is needed for proper and balanced diet (Ekine *et al.* 2012). Beef is known universally as a very important food item because of its high nutritional quality and significance in improving human health (Ugwumba and Effiong, 2013), as an important source of animal protein it has played important role in the pattern of food consumption in Nigeria (Ugwumba and Effiong, 2013). It is anticipated that demand for food of animal origin in developing countries will double by the year 2020, thereby creating markets for these animal products (Juma *et al.,* 2005). Borno state is said to have the highest population of cattle in Nigeria thus making beef to be the most preferred meat in the area (Gambo, *et al.,* 2010). The numbers of producers as well as consumers of processed beef have, therefore, increased tremendously irrespective of ethnicity, religion, social status or sex (Igene, 1982). In accordance with consumer preferences, beef is processed into a variety of products (dried and sliced); in northern Nigeria, Tsire, Balangu and Kilishi are the most commonly consumed beef products (Bube, 2003).

To be competitive, the beef industry must be able to sustain itself against the demand by expanding and imploring new ideas and technology, it must also maintain its market share at private and social market amidst changes in both domestic and international policies. The concept of competitiveness encompasses a variety of factors including changes in nominal exchange rates, relative prices, and production costs (Dohlman *et al.*, 2003). These factors will determine profitability in beef processing. Information on these factors will also inform policy makers on the necessary actions required to streamline the entire processing system and it will inform investors on appropriate areas of intervention for maximum impact. Illiyasu *et al.*, (2008) determined the profitability of three methods of suya production and marketing in Maiduguri Metropolitan Council of Bornu State using gross margin, ginni coefficient, marketing margin and average cost function. This paper therefore examines the competitiveness, comparative advantage and the effect of government

policy on kilishi, tsire and balangu processing using the Policy Analysis Matrix model approach.

Methodology

Study Area

The study was carried out in Borno State, North eastern part of Nigeria. It has 27 local government areas. The study area has an approximated land area of about 69,436km^2 and lies between latitude 10^{0}N and 14^{0}N longitude 11^{0}30'E and 14^0 45'E. It shares border with the Republic of Niger to the north, Chad to the northeast and Cameroon to the east. Within the country, its neighbours are Adamawa to the south, Yobe to the west and Gombe to the south west (NPC, 2006). It has two major vegetation zones viz: Sahel in the North with severe desert encroachment covering most of the Chad Basin areas and Sudan Savannah in the South which consist of scrubby vegetation interspersed with tall tree woodlands.

Data Collection

Primary and secondary data were used for this study. The primary data were obtained from different processors through observation and interview using a structured questionnaire. Data collected included inputs requirements, market prices for inputs and outputs, transportation cost and returns. The secondary data were sourced from Central Bank of Nigeria and National Bureau of statistics, the data included production subsidy, import and export tariff and the exchange rate.

Sampling Procedure

Multi-stage sampling procedure was employed for selecting respondents. The first stage involved the purposive selection of two local government areas that made up Maiduguri metropolis; these are Jere Local Government Area and Maiduguri Metropolitan Council. The selection of the Metropolis is because of the processing activities in the area. The second stage is the selection of two wards in each of the selected local government areas and the third stage is the random selection of 10 Balangu producers, 10 Tsire producers in each of the four selected wards making it a total of 40 Balangu producers and 40 Tsire producers. The available 6 Kilishi

producers were obtained from Maisandari (2), Bulaburin (2) in Maiduguri Metropolitan Council and Ngomari (2) in Jere Local Government Area.

Tsire is roasted, boneless mutton, beef or goat meat that is cooked around a glowing fire in which the meat pieces are staked on wooden sticks (Alonge and Hiko, 1987). Kilishi is obtained from sliced lean muscles of beef, goat meat or lamb. It is a tropical intermediate moisture meat product that is prepared essentially from beef slices, infused in slurry of defatted groundnut paste and spices and then sun-dried as described by Ogunsola and Omojola (2008). Balangu is boneless meat of a sizeable cut which is roasted by placing it on a wet brown paper on a wire mesh. Groundnut oil, spices and salt are added during roasting and the meat is continuously turned until it is well roasted (Farouk, 1985).

Analytical Method

Policy Analysis Matrix (PAM) was used to analyse the competitiveness and comparative advantage and the effect of government policies on the beef processing. The PAM is a Matrix of two accounting identities; one set defining profitability and the other defining the difference between private and social values of a commodity system. The framework of the PAM is shown in Table 1.

Table 1: Policy Analysis Matrix (PAM).

ITEMS	REVENUE	PRODUCTION COST		PROFIT
		Tradable inputs	Domestic factor	
Private price	A	B	C	D
Social price	E	F	G	H
Policy transfer	I	J	K	L

Source: Monke and Pearson, 1989.

Private profitability (D) = A-(B+C)

Social profitability (H) = E-(F+G)

Output transfer (I) = A-E

Input transfer (J) = B-F

Factor transfer (K) = C-G

Net policy transfer (L) = D-H

The following are calculated from the Policy Analysis Matrix:

Private Profitability

The private profitability demonstrates the competitiveness of the agricultural system given current technology, prices of inputs and outputs, and policy. It is the difference between observed revenue and costs value at the market prices (private values) received or paid by farmers, marketers or processors in the agricultural system. The private profitability calculations show the competitiveness of the agricultural system, given current technologies, output values, input costs, and policy transfers. The private values implicitly included the effects of all policy interventions in both direct and indirect subsidies, taxes, and all market distortions and failures (Pearson and Monke, 1987).

Private profit (D) = A-B-C……1

When D>0 it means processors are earning supernormal returns and this should lead to expansion of the system.

If D<0 it means processors are earning subnormal rate of returns and this should lead to exit from the system.

Private Cost Ratio (PCR).

The private cost ratio (PCR) is used in measuring competitiveness. It shows the private efficiency of the processors and is an indication of how much one can afford to pay domestic factors (including a normal return to capital) and still remain competitive.

$$\mathbf{PCR} = \frac{\mathbf{C}}{\mathbf{A} - \mathbf{B}} \quad \text{.....2}$$

When PCR>1 indicates that the resource cost is greater than the value added and thus, it is not profitable to process the commodity.

If PCR<1 indicates that the value added is greater than the resource cost thus, it is profitable.

If PCR=1 indicates the breakeven point.

Social Profitability

The social profitability is a measure of comparative advantage and efficiency because inputs and outputs are valued in prices that reflect scarcity values. It is the difference between revenue and costs of domestic factors and tradable inputs prices at social opportunity cost (social values). Social values provide a benchmark policy environment for comparison as these were considered those that would hypothetically occur in free market without policy intervention (Pearson and Monke, 1987).

Social profit (H) = E-F-G……3

When (H>0) indicates that the system uses scarce resource efficiently and the commodity has a static comparative advantage.

If (H<0) indicates that the sector cannot sustain its current output without assistance from the government, with a resulting waste.

Domestic Resource Cost (DRC).

The domestic resource cost (DRC) is a measure of relative efficiency of domestic processing by comparing the opportunity cost of domestic processing to the value generated by the product. The ratio can be used to compare different economic activities in terms of social cost of domestic resource employed in earning or saving a unit of foreign exchange. The relationship between DRC and comparative advantage is straight forward;

$$\mathbf{DRC} = \frac{\mathbf{G}}{\mathbf{E} - \mathbf{F}} \quad \ldots\ldots 4$$

If DRC<1 the processing of the commodity in the country is competitive and enjoys protection.

If DRC>1 it signifies that the country has a disadvantage in production of analysing goods.

When DRC = 1 the economy neither gains, nor saves foreign exchange through domestic processing.

Social Cost Benefit Ratio (SCBR)

A good alternative for the DRC is the social cost-benefit ratio (SCB), which accounts for all cost and avoids classification errors in the calculation of DRC (Masters and Winter-Nelson, 1995).

$$SCBR = \frac{F + G}{E} \quad \ldots\ldots 5$$

When DRC>1 will necessarily have a SCBR>1 (Frederic, 2005).

Divergence/Policy Transfer

The measurement of divergence and transfer effect of policies is carried out in the third (bottom) row of the Policy Analysis Matrix. Divergence between the observed private (actual market) price and the estimated social (efficiency) price must be explained by the effects of policy or by the existence of market failures. Distorting policies that lead to an inefficient use of resources enhance the stated divergence.

Nominal Protection Coefficient (NPC)

This is used to determine the relationship between the market price and the shadow price of the beef products (Fabian, 2005). This can be calculated for the output and input.

Nominal Protection Coefficient on Output (NPCO)

The NPCO shows how much domestic prices differ from social prices and it is calculated by dividing the revenue in private prices (A) by the revenue in social prices (E).

$$\mathbf{NPCO} = \frac{\mathbf{A}}{\mathbf{E}} \quad \ldots\ldots 6$$

If NPCO>1 the domestic price is higher than the import (or export) price and thus, system is receiving protection (subsidies).

If NPCO<1 the domestic price is lower than the comparable world price and the system is not protected by policy.

If NPCO =1 reveals the absence of market failures or the absence of intervention in beef processing.

Nominal Protection Coefficient on Input (NPCI)

The NPCI shows how much domestic prices of tradable inputs differ from their social prices. This ratio indicates the impact of policy transfers that cause a divergence between the two prices. The NPCI on tradable inputs in beef processing is therefore defined as private price of input (B) divided by social price of input (F).

$$\mathbf{NPCI} = \frac{\boldsymbol{B}}{\mathbf{F}} \quad \text{.....7}$$

If NPCI>1 the domestic inputs cost is higher than the input cost at world prices and thus the processors are taxed by policy.

If NPCI<1 the domestic price is lower than the comparable world price and it indicates a negative incentive (or disincentive) to the processors.

Effective Protection Coefficient (EPC)

The effective protection coefficient (EPC), another indicator of incentives, is used to measure the degree of policy transfer from product market-output and tradable-input-policies. EPC nets out the impact of protection on inputs and outputs, and reveals the degree of protection accorded to the value added process in the processing activity of the relevant commodity (Samarendu *et al.*, 2003).

$$\mathbf{EPC} = \frac{\mathbf{A} - \mathbf{B}}{\mathbf{E} - \mathbf{F}} \quad \text{.....8}$$

EPC > 1 means that the selected system is protected.

EPC < 1 means that the system generates fewer added values at market price than it would be at social price, and does not enjoy protection.

Subsidy Ratio to Producers (SRP)

Subsidy ratio to producers (SRP) is the net policy transfer as a proportion of total social revenues. The SRP shows the proportion of revenues in world prices that would be required if a single subsidy or tax were substituted for the entire set of commodity and macroeconomic policies (Christo, 2010).

$$\mathbf{SRP} = \frac{\boldsymbol{L}}{\mathbf{E}} \quad \text{.....9}$$

Sensitivity Analysis

Due to the static nature of the policy analysis matrix, sensitivity analysis was carried out to determine earning capacity of the investment with changes in factors such as output, the prices of inputs and outputs, exchange rate among others. Sensitivity analysis provides a way of assessing the impact of changes in the main parameters on both private and social profitability (Monke and Pearson, 1989). Indicators that were varied included revenue (increase and decrease by 10%) and exchange rate (increase and decrease by 10%). This was based on the work of Ude *et al.*, (2013) that used 10% increase and decrease in revenue and exchange rate for sensitivity analysis of rice processing and marketing in Ebonyi State. The effects on private and social profitability and policy indicators were evaluated.

Data and Modelling Assumptions

The social prices were computed by adjusting FOB for insurance cost (1%) and transportation cost, then deducting it from free on board (FOB) prices. This was done by summing up the cost of goods, freight and insurance cost to arrive at the CIF price. The CIF Lagos price was converted to Nigerian local currency (naira) at the exchange rate of N155.00 to one US dollar (world reference currency) which was the prevailing exchange rate at the time of the survey. The social price of labour was calculated by dividing labour into peak season and off season components as used by Yao cited in Ogbe *et al.* (2011). The wage rate in the peak season was the opportunity cost of labour for the period being examined. The opportunity cost of labour in the off-season was 50% in the ruling wage rate. The social price of labour was computed by:

$$Pl = \frac{Wp + 0.5Wo}{2}$$

Where:

Pl = Social price of labour;

Wp = prevailing wage rate in peak season;

Wo = prevailing wage rate in off peak season

For Kilishi production 1tonne fresh beef is used to produce 0.66673 tonne of Kilishi, for Tsire production 1tonne of fresh beef is used to produce 0.8tonne of Tsire while 1tonne of fresh beef is used to produce 0.75tonne of Balangu.

Results and Discussions

Level of profitability and divergences in beef processing in Borno State

The Level of profitability and divergences in beef processing in Borno State are shown in Table 2. The results revealed that Kilishi, Tsire and Balangu had positive private profit of ₦ 1,087,278.41, ₦ 839,576.95 and ₦ 439,857.69 respectively per one tonne of beef processed. The positive private profit implies that Kilishi, Tsire and Balangu are competitive given current technologies, prices of inputs and outputs, and policy transfers. However, the result shows that Kilishi was the most profitable with private profit of ₦ 1,087,278.41 followed by Tsire with private profit of ₦ 839,576.95 while Balangu had the lowest private profit of ₦ 439,857.69. The above results agree with Illiyasu *et al.*, 2008, they reported that Kilishi, Tsire and Balangu production are profitable in Maiduguri Metropolitan Council of Borno State. The result of the competitiveness was further confirmed from the PCR values in Table 3 which were less than unity. The PCR values of the processors are 0.27, 0.28 and 0.35 for Kilishi, Tsire and Balangu respectively; this implies that the beef processing is competitive at the current level of technology and policy intervention.

Social profit of ₦ 5,810,065.52 was estimated for Kilishi, ₦ 3,347,518.07 for Tsire and Balangu (₦ 1,398,042.95). The positive social profit for Kilishi, Tsire and Balangu implies that the processors utilize scarce resources efficiently in the beef processing and that the processors can survive without government interventions. Similarly, the DRC coefficients for all processors were also less than unity, thereby indicating that the value of domestic resources used in processing is lower than the value added. This implies an efficient use of domestic resources in processing and that processing in the area was socially profitable. Consequently, the study area has a comparative advantage in processing beef into Kilishi, Tsire and Balangu. Kilishi production was the most profitable in terms of use of domestic factor owing to lower

DRC value of 0.06; this was followed by Tsire production with DRC value of 0.09 and Balangu production with DRC value of 0.11.

The social benefit cost ratio (SCBR) which is another measure for assessing efficiency in the use of fixed factor also confirmed the result of DRC ratio obtained. There was however, a negative divergence between private and social profits in all the processing thus suggesting that the net effect of policy intervention reduced profitability in beef processing in the area.

Ratios of protection coefficient, competitiveness and comparative advantage of beef processing

The summary of ratios of protection coefficient, competitiveness and comparative advantage of beef processing are presented in Table 3. The NPCO values of Kilishi, Tsire and Balangu are 0.33, 0.44 and 0.66 respectively indicating that the processors are not protected by policy and that substantial output tax applies. NPCI values of greater than unity indicate that the input costs in all the processing were higher than the world reference price; thus indicating that government is not providing incentives to the processors. EPC values of 0.24, 0.32 and 0.43 for Kilishi, Tsire and Balangu respectively further indicates the absence of protection and negative incentive to the domestic processors.

Subsidy ratio to producer (SRP) is a measure of the level of transfers. SRP shows the extent to which processors revenue have been increased or decreased because of policy. Table 3 indicates a negative SRP values for the three product with -0.69, -0.58 and -0.45 for Kilishi, Tsire and Balangu respectively. This suggests that there is decrease in gross revenue of the processors and this further confirms that the processors were taxed by policy.

Sensitivity analysis for Beef Products

The result of the sensitivity analysis for Kilishi processing (Table 4) showed that 10% increase in output lead to improvement in competitiveness and comparative advantage in kilishi processing. This was indicated by the PCR, DRC and SCBR ratio. Increase in exchange rate by 10% has no effect on PCR but improved the comparative advantage ranking. This was indicated by the DRC, SCBR ratios.

The result of the sensitivity analysis for Tsire processing showed that changes in output and exchange rate affect competitiveness and comparative advantage of Tsire. 10% increase in output improved competitiveness of Tsire products. Increase in exchange rate by 10% had no effect on PCR but improved the comparative advantage of Tsire. 10% reduction in exchange rate has no effect on PCR but lead to increase in comparative advantage of Tsire. Similar trends were also observed for Balangu. Overall result of the sensitivity analysis indicated improvement in output improved the competitiveness of beef product while increase in exchange rate had effect on comparative advantage ranking of the commodity.

Conclusion and Recommendations

Result revealed that beef processing was competitive although processing beef into Kilishi was the most competitive followed by Tsire and Balangu. NPCO and EPC ratios for beef products were less than one indicating that the products were not protected. Based on the findings,

- There is need for government intervention and private sector participation in the sub sector. This can be achieved through the provision of soft loan, training, and subsidies on inputs. These measures will go a long way in improving beef processing not only in Borno State but the country at large.

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Table 2: Policy Analysis Matrix for Beef Processing

Beef product	Private Profitability	Social Profitability	Divergence
Kilishi	1,087,278.4	5,810,065.52	-4,722,787.11
Tsire	839,576.95	3,347,518.07	-2,507,941.12
Balangu	439,857.69	1,398,042.95	-958,185.26

Source: Field survey, 2013

Table 3 Summary of Ratios of Competitiveness, Comparative Advantage and Protection in Beef processing

Ratio indicators	Values		
	Kilishi	Tsire	Balangu
NPCO	0.33	0.44	0.66
NPCI	1.14	1.18	1.30
EPC	0.24	0.32	0.43
SRP	-0.69	-0.58	-0.45
PCR	0.27	0.28	0.35
DRC	0.06	0.09	0.11
SCBR	0.15	0.22	0.34

Source: Field survey, 2013

Table 4: Sensitivity analysis for Kilishi Processing

Indicators	Base Value	10% increase in output	10% decrease in output	10% increase in exchange rate	10% decrease in exchange rate
PCR	0.27	0.24	0.32	0.27	0.27
DRC	0.06	0.05	0.07	0.05	0.06
SCBR	0.15	0.13	0.16	0.14	0.15
NPCO	0.33	0.33	0.33	0.30	0.36
NPCI	1.14	1.14	1.14	1.03	1.28
EPC	0.24	0.25	0.23	0.22	0.27
SRP	-0.69	-0.69	-0.70	-0.71	-0.67

Source: Field survey, 2013

Table 5: Sensitivity analysis of Tsire Processing

Indicators	Base Value	10% increase in output	10% decrease in output	10% increase in exchange rate	10% decrease in exchange rate
PCR	0.28	0.25	0.34	0.28	0.28
DRC	0.09	0.08	0.09	0.08	0.10
SCBR	0.22	0.20	0.22	0.21	0.23
NPCO	0.44	0.44	0.40	0.40	0.49
NPCI	1.18	1.18	1.18	1.06	1.32
EPC	0.32	0.33	0.27	0.29	0.35
SRP	-0.58	-0.58	-0.63	-0.61	-0.56

Source: Field survey, 2013

Table 6: Sensitivity analysis of Balangu Processing

Indicators	Base Value	10% increase in output	10% decrease in output	10% increase in exchange rate	10% decrease in exchange rate
PCR	0.35	0.29	0.44	0.35	0.35
DRC	0.11	0.11	0.13	0.10	0.12
SCBR	0.34	0.31	0.38	0.34	0.35
NPCO	0.66	0.56	0.66	0.60	0.73
NPCI	1.30	1.30	1.30	1.18	1.46
EPC	0.43	0.46	0.40	0.39	0.48
SRP	-0.45	-0.44	-0.46	-0.48	-0.42

Source: Field survey, 2013