



A Comparative Economic Analysis of Smallholder Cattle and Small Ruminant Production Systems in Botswana

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ABSTRACT

Cattle rearing is the single most important activity in the agricultural sector of Botswana, and cattle enjoy a high status among both rural and urban dwellers. In recent years, farmers have begun to intensify the production of small ruminants owing to an increasing recognition by policy makers that they are a potential alternative source of farm income. However, as yet, small ruminants have not approached the social importance of cattle. This may be attributable to several factors, including economic considerations. The present study focused on the economic factor. It comprised a comparative economic assessment of cattle- and goat-rearing enterprises for an average smallholder farm-household to throw light on their relative economic efficiency. It was concluded that rearing either cattle or small ruminants is economically viable in the study area. The net profit measured as the net margin either per enterprise or per animal was far higher for a cattle-rearing enterprise. Nevertheless, when expressed in terms of the return on the capital invested in each enterprise, cattle rearing had only a slight edge (1.93%) over rearing of small ruminants

Keywords: cattle, costs, economics, goats, margin, profitability, returns, sociology

Abbreviations: GDP, gross domestic product; P, Pula

INTRODUCTION

Livestock make an important contribution to the livelihood of smallholder farmers in Botswana. They are a major source of income and employment for most rural dwellers, who form the majority of the country's population (Panin and Mahabile, 1997). Also, livestock, primarily beef cattle, are a major source of the foreign exchange generated by the agricultural sector. They account for 3% of GDP and about 28% of the total agricultural gross product (CSO, 1995).

Although cattle rearing is the single most important activity in the agricultural sector, small ruminants, namely goats and sheep, have become steadily more important in the livestock economy of rural households. The increasing importance of small ruminants is due to growing recognition among farmers and policy makers that they provide an alternative opportunity to augment the incomes of smallholder farmers in the country.

The total estimated population of cattle, goats and sheep in 1993 stood at 1.82 million, 1.84 million and 0.25 million, respectively (CSO, 1995). Small ruminants,

particularly goats, are very common among the rural households in Botswana. Almost every rural household owns at least one small ruminant. In contrast, the distribution of cattle ownership in the country is very skewed, with 30–40% of rural households without any cattle (Ministry of Agriculture, Botswana, 1991). The contribution of small ruminants to the average annual rural household income is estimated at 15% (Panin and Mahabile, 1997). A preliminary analysis of the data set on which this study is based has shown that about 85% of the households in the study area rear goats, 29% sheep and 40% cattle.

The increasing recognition of the role of small ruminants as an alternative source of farm income has encouraged many farm-households in the country to intensify the rearing of small ruminants alongside cattle production. Cattle and small ruminants are usually kept and extensively managed together, and they compete for the same limited resources of the farmers. Despite the trend for farmers to intensify small ruminant production, which has been facilitated by a recent government financial assistance programme, goats and sheep have not approached the social importance occupied by cattle among most households in the country. This may be attributed to several factors, but it is assumed that the economic factor is paramount. The present study, therefore, comprised a comparative economic assessment of cattle and small-ruminant enterprises for an average smallholder farm-household, to shed light on their relative economic efficiency. The analysis used only data on goats to represent small ruminants. This was due to the highly skewed distribution of sheep among the smallholder farm-households in the study area, coupled with the fact that sheep are rarely milked (Panin and Mahabile, 1997).

MATERIALS AND METHODS

Study area and data

The study area comprised four villages selected from Kgatleng agricultural district in Botswana. The choice of the study area was made on the basis of the predominance of small ruminants in the area. As in all rural areas in Botswana, the economy of the area is mainly based on subsistence farming, which is characterized by mixed crop–livestock production systems. The average cultivated area is 6 ha per household, the major crops grown being sorghum, maize, beans and millet.

The data used for assessing the relative economic efficiency of cattle and goat enterprises were collected between January and April 1995, through a survey of 167 smallholder farm-households. A two-stage, clustered, stratified sampling procedure was used to ensure that only households owning a mixed herd of cattle and goats at the same time were represented in sufficiently large numbers to permit estimation of the enterprise budget for each production activity. The first stage of the sampling procedure involved a random selection of 300 smallholder farming households from the study area. Eighty-five per cent of these (255) were found to own at least one species of livestock. The second stage involved the selection of households owning a mixed herd of cattle and goats from these 255 livestock owners, leaving out all those owning

goats or cattle only. In all, 167 households, representing 65% of the total livestock owners, satisfied the condition and were selected and surveyed. Detailed information on various aspects of the crop–livestock farming systems was collected. This included the farm size, crop output, herd size, milk yield, off-take rates of cattle and goats, inputs and output prices, etc.

Analytical method

The main tool of analysis used in the study was enterprise budgeting. The budgeting analysis was based on the simple theory of cost and returns and involved the estimation of the total expenses and revenue for the enterprise over the same period. The difference between the two estimates gave the profit (loss) associated with the enterprise under study. Enterprise budgeting analysis may therefore be used to calculate the returns by different factors of production as a measure of efficiency, allowing easy comparison between enterprises.

Capital is the major limiting factor in the crop–livestock production systems of smallholder farmers in the country (Panin and Mahabile, 1996). Hence, the efficiency of the two livestock production systems may be compared on the basis of the rate of return on the capital tied up in each of the two enterprises. Capital, in this analysis, is defined as the average value of the household's herd and is calculated using the formula:

$$\begin{aligned} \text{Capital value of stock (cattle or goats)} &= \text{average herd size} \\ &\times (\text{average purchase and sale price per animal}) \end{aligned}$$

Both operating and fixed costs were estimated. The operating cost consisted of variable inputs such as medicines, water, dipping, feeding and replacement of stock. The average fixed costs were obtained by valuing the family labour, the most single important fixed input under smallholder traditional livestock production systems, and estimating the depreciation value of draught animal implements. The annual costs of fencing and housing (kraals) were found to be insignificant and were therefore excluded from the analysis. The value of family labour was determined by its opportunity cost, this being equal to that which the family labour could earn at its next most remunerative employment. In valuing the family labour, the total labour input from adults and children was converted into man-equivalent hours (me-h). The resulting amount was multiplied by the hourly wage rate of P0.50 (1 Pula = US\$ 0.36 in 1995) that prevailed in the area during the survey period to give the opportunity cost.

The conversion of the total labour input into man-equivalent hours was carried out by assuming that children of age 6–9 years would require four times the number of hours that an adult would need to accomplish the same specific activity, while those of 10–15 years of age would need $1\frac{1}{3}$ times the number of hours of an adult. This assumption was derived mainly from discussions held with the farm-household members. Accordingly, the total number of hours worked by children aged 6–9 years and 10–15 years were multiplied by weighting coefficients of 0.25 and 0.75, respectively, and the products were added to the total number of hours worked by adults

(≥ 16 years) to arrive at the total man-equivalent hours. Since most of the people interviewed believed that the time taken by males to accomplish most of the livestock activities would not differ significantly from that of females, the same coefficients were used for hours worked by males and females.

The capital tied up in each of the enterprises was also assigned an opportunity cost, using an average market interest rate of 12%. The returns were obtained by estimating the total value of production. The latter included the values of the animals sold, consumed by the household members or visitors, or given away as gifts during the year of investigation. In the case of cattle rearing enterprises, the income generated by hiring out draught animals was added. The farm gate price for a unit of product was used to compute the total value of home-consumed products. The average farm gate price was set at P0.95/kg for goats' milk and P0.85/kg for cows' milk, P110.00 per goat and P700.00 per cow or ox.

RESULTS

Some major aspects of cattle- and goat-rearing enterprises

Table I presents some of the major aspects of the cattle- and goat-rearing enterprises for an average smallholder household in the study area. The lactation period was 166 days for does and 210 days for cows. The estimated capital invested in cattle per average household was five times that for goats.

Table II presents the frequency distribution of the sizes of the herds of goats and cattle among the households. Most households in the area kept small numbers of animals, ranging between 1 and 20. This was more pronounced within cattle-rearing enterprises, 80% of all cattle herds falling within this range compared with 60% of small ruminant flocks. Within the range of 21–30 animals, the percentage of households keeping goats (20%) was twice that for cattle (10%). For either species, only a few households had herds larger than 31 animals.

TABLE I

Mean values for some major aspects of cattle- and goat-rearing enterprises, Kgatleng district, Botswana, 1995

Item	Goats (Mean \pm SD; $n = 167$)	Cattle (Mean \pm SD; $n = 167$)
Herd size	20.4 \pm 15.8	15.8 \pm 14.9
Total milk output (kg/herd)	885.8 \pm 221.5	4 387.5 \pm 1 798.9
Total labour input (me-h)	984.1 \pm 374.0	2 668.3 \pm 1 280.8
Number of animals sold	2.6 \pm 3.8	1.8 \pm 2.7
Number of animals consumed	1.2 \pm 1.8	0.3 \pm 1.0
Capital value of herd (P) ^a	1 583.9 \pm 1 221.2	8 292.9 \pm 7 831.0

^aPula (P) is Botswana's currency; P1.00 = US\$0.36 (1995 exchange rate)

TABLE II
The distribution of cattle and goats among owners in Kgatleng district, Botswana, 1995

Numbers of animals	Percentage of owners with specified number of animals	
	Goats (<i>n</i> = 167)	Cattle (<i>n</i> = 167)
1–10	35.9	48.5
11–20	26.4	31.7
21–30	20.3	9.6
31–40	6.6	5.4
41–50	5.4	1.2
> 50	5.4	3.6

Relative economic efficiency

The results of the budgetary analysis for the two alternative livestock enterprises are presented in Table III. The net profit measured either per enterprise or per animal was higher for cattle than for goats. However, the return on the capital invested in the animals was only slightly higher for cattle (30%) than for goats (28%).

DISCUSSION

The economic analysis focused upon a comparison of the efficiency of resource use in cattle- and goat-rearing enterprises of smallholder farmers in Botswana. The main analytical tool used was enterprise budgeting, which is based on the simple theory of cost and returns. Based on the estimates of these two, the profitability (net margin) for each of the enterprises was arrived at by deducting the total cost involved in the enterprise from the total revenue, and was expressed per animal and per enterprise. Although profitability is more frequently expressed as net margin per animal, it is more appropriately assessed according to the use made of the most limiting factor in production (Norman *et al.*, 1985). By maximizing the returns to the most limiting factor, producers will maximize the overall profits (Kee *et al.*, 1995). Since capital has been identified as the most limiting factor in the smallholder farmers' production systems in the study area, the return on capital must be given top priority in assessing and comparing the efficiency of cattle-rearing and goat-rearing enterprises. This single factor involves and is influenced by almost every other possible factor of production.

The results from the analysis show that rearing of cattle and small ruminants is economically viable in the study area. Although profitability expressed as the net margin either per enterprise or per animal was far higher for cattle rearing, the return on the capital invested in the animals was only slightly higher for a cattle-rearing

TABLE III
Budgets for goat- and cattle-rearing enterprises in average households in Kgatleng district, Botswana, 1995

Item	Total value (P) ^a (goat enterprise)	Total value (P) (cattle enterprise)
<i>A:</i> Gross revenue from:		
Sales of animals	282.7	1 225.0
Meat	129.8	210.0
Milk (sales and consumed)	841.5	3 729.4
Draught power	–	139.4
Total gross revenue	1 254.0	5 303.8
<i>B:</i> Operating costs		
Medicines	34.3	57.1
Water	28.4	85.4
Dipping	22.2	56.5
Feed ^b	15.5	36.8
Replacement	26.1	198.5
Subtotal (<i>B</i>)	126.5	434.3
<i>C:</i> Fixed cost		
Value of family labour	492.1	1 334.2
Depreciation on draught implement	–	48.1
Subtotal (<i>C</i>)	492.1	1 382.2
<i>D:</i> Interest on capital	190.1	995.2
Total cost of enterprise (<i>B+C+D</i>)	808.6	2 811.6
Net profit per enterprise (<i>A</i> –(<i>B+C+D</i>))	445.4	2 492.2
Profit per animal	21.8	157.7
Percentage return on capital (Net enterprise profit/value of herd ^c × 100)	28.1	30.1

^aPula (P) is Botswana's currency; P1.00 = US\$0.36 (1995 exchange rate)

^bCovers food items such as pellets and salts

^cFrom Table I

enterprise (30%) than for a goat-rearing enterprise (28%). This implies that both enterprises are almost equally efficient. The returns on both enterprises exceeded the prevailing interest rate of 12% by more than 100%. These results confirm those of Panin and Mahabile (1997).

The major component of the total gross revenue for both cattle- and goat-rearing enterprises was the milk output, accounting for 70% and 67%, respectively. This was because, for many of the households, keeping livestock means having a gradually growing herd of animals that enables one or two animals to be disposed of if there are urgent financial obligations, whereas the animals are milked all the time, either to satisfy the household's demand for milk or to sell.

The data in Table III suggest minimal involvement of cash in either of the enterprises. The operating costs were only 10% of the value of the total gross revenue for the goat-rearing enterprise and 8% for the cattle-rearing enterprise. Sales of animals accounted for 23% of the gross value of each enterprise.

On the fixed-cost side, the value of family labour was the only significant item in the two enterprises. Family labour plays a crucial role in the management of the animals in the area. Most of the labour required for herding, grazing and milking is contributed by family members. This implies that lack of adequate available household labour would considerably affect the management of the animals because hiring labour in the study area is relatively unusual. Although both livestock species are kept under an extensive management system, the demand for labour for herding and grazing can be very substantial during the cropping season. During this period, the animals are not allowed to roam freely for fear of destroying other peoples' crops. They are instead herded and grazed around the cultivated fields for about 8–10 h per day under strict supervision by the herdsmen (boys). This practice puts severe pressure on the available household labour, which normally becomes critical during the cultivation period. It was observed that during the cropping season, in households with critical labour shortages, the animals are only taken for browsing and grazing when the children, who often help in herding the animals, return from school. A probable implication of this practice is reduced feed intake by the animals, since they may not have enough time to graze or browse adequately.

The estimated capital invested in cattle per average household was five times that for goats. This confirms the widely held view that cattle rearing is capital intensive, and may explain why considerable numbers of smallholder farmers do not own any cattle.

The results reported here do not provide definitive answers to all the questions surrounding the relatively low social status enjoyed by small ruminants among both rural and urban dwellers in Botswana. Further research is needed to investigate a number of remaining issues and to generate the empirical knowledge needed to develop a sound national policy for small ruminant development in the country. Nevertheless, this study has produced clear evidence that, in terms of efficiency of resource use, cattle- and small-ruminant-rearing enterprises are almost equally efficient. Hence, since capital is the limiting factor for production, it is reasonable to suggest that rearing small ruminants is more practical for many smallholder farmers in Botswana.

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Comparaison de l'analyse économique de la production bovine et pour celle chez les petits ruminants chez des petits fermiers au Botswana

Résumé – L'élevage bovin est l'activité la plus importante pour l'agriculture au Botswana et le bétail a un statut social élevé aussi bien chez les habitants des campagnes que pour ceux des villes. Cependant, récemment les fermiers ont commencé à intensifier la production animale pour les petits ruminants grâce à la reconnaissance croissante des politiciens comme étant potentiellement une nouvelle source de revenus agricoles. Cependant, les petits ruminants n'ont pas le même statut social que les bovins. Ceci peut être dû à plusieurs facteurs, incluant des considérations économiques. Notre étude porte sur ces facteurs économiques. Cela comporte une comparaison des petits fermiers élevant soit des chèvres ou soit des bovins pour éclairer sur leur efficacité économique respective. Il en fut conclut que l'élevage de bovins ou de petits ruminants est une activité économiquement viable dans la région étudiée. Le profit net, en tant que marge nette, soit par entreprise ou par animal, fut plus élevé, pour les entreprises élevant des bovins. Néanmoins si on exprime cela en terme de valeur ajoutée par rapport au capital investi pour chaque entreprise, alors l'élevage bovin a seulement un très faible avantage (1,93%) sur l'élevage des petits ruminants.

Análisis económico comparativo en sistemas de producción a pequeña escala de vacuno y pequeños rumiantes en Botswana

Resumen – La cría de vacuno es la actividad más importante en el sector agrícola de Botswana, y los animales proporcionan un alto estatus social tanto entre los residentes urbanos como rurales. Sin embargo, en los últimos años, los granjeros han empezado a incrementar la producción de pequeños rumiantes debido a un mayor reconocimiento por los políticos de que son una fuente potencial alternativa de ingresos. Sin embargo, hasta ahora, los pequeños rumiantes no han alcanzado la importancia social del vacuno. Esto puede ser atribuido a varios factores, incluyendo las consideraciones económicas. El presente estudio trató el factor económico. Incluyó el reparto económico comparativo de las empresas de cría de vacuno y cabras para un granjero medio con objeto de dilucidar su eficiencia económica relativa. Se concluyó que la crianza tanto de cabras como de pequeños rumiantes es viable económicamente en el área de estudio. El beneficio neto como margen neto tanto para la empresa como por animal fue mucho mayor para la crianza de vacuno. De todas maneras, cuando se expresó en términos de devolución del capital invertido en cada empresa, la cría de vacuno tuvo sólo una ligera ventaja (1,93%) sobre los pequeños rumiantes.