THE EFFECT OF LAND TENURE ON COMMERCIAL LIVESTOCK PRODUCTION IN THE PEDDIE COASTAL AREA OF THE CISKEI

FDK Anim
Department of Agricultural Economics, University of Natal, Pietermaritzburg

MC Lyne
Department of Agricultural Economics, University of Natal, Pietermaritzburg

Uittreksel
Die effek van grondbesitregte op kommersiele lewendehaweproduksie in die Peddie kusstreek van die Ciskei

Ekonomiese teorie suggereer dat die privatisering van weidinggrond met vrye toegang veebelading sal verlaag en belegging in die gehalte van weiding sal bevorder. In hierdie studie word monsterdata ontleed wat verkry is van veeboere in die Peddie kusstreek van die Ciskei, ten einde die verhouding tussen grondbesitregte, beesverkope en veldgehalte te toets. Die bevindinge ondersteun die standpunt dat private toegang tot weidinggrond tot beter veldgehalte, hoer verkope, en kommersiele lewendehaweproduksie lei. Die gevolgtrekking is dat private toegang tot weiding 'n beduidende positiewe uitwerking op kommersiele lewendehaweproduksie het.

Abstract

Economic theory suggests that privatization of open access grazing land will reduce stocking rates and promote investment in pasture quality. In this study, sample data drawn from livestock farmers in the Peddie coastal area of the Ciskei are analysed to test the relationship between land tenure arrangements, cattle sales and veld quality. The findings support the contention that private access to grazing land results in better veld quality, increased sales, and commercial livestock production. It is concluded that private access to grazing has a significant positive effect on commercial livestock production.

1. Introduction

This study investigates the effects of private and open access to grazing land on commercial livestock production in the Peddie coastal area of the Ciskei. The study is important because most of the Ciskei receives less than 760 mm of rainfall per annum and 81 per cent of the area is suitable only for extensive livestock production (Trollope, 1974). In general, the veld has excellent grazing potential.

Almost 97 per cent of the Ciskei's land is vested in the South African Bantu Trust (Ciskeian Department of Agriculture and Forestry, 1973) and the vast majority of grazing is a common property resource characterized by low levels of investment in pasture improvement and commercial livestock production (Trollope, 1974). The paper begins with an overview of the common property problem, with particular emphasis on the economic implications of open and restricted access to grazing. This is followed by a brief description of the techniques used to collect data and to analyse them. Firstly, a probit model is used to isolate important characteristics of tribal stockowners operating under open and private access to grazing; secondly, a linear discriminant model is used to identify production variables associated with these tenure arrangements; and thirdly, the impact of open and private access on commercial livestock production is assessed using ordinary least squares (OLS) regression. The results and their implications for policy reform are discussed in the final sections (4 and 5) of the paper.

2. An overview of the common property problem

If an asset is open to all users, it tends to be overutilized, unlike assets subject to more restrictive property rights (Konczacki,1978). Gordon (1954), compared two extreme cases of property rights, namely:

- common property characterised by open access and
- private tenure.

Under open access, resources are overutilized in the economic sense and investment is low (Lyne and Nieuwoudt, 1990). On the other hand, with private tenure, the incentive to invest is higher and rates of utilization are lower because the cost of resource degradation is internalized (Baber,1991:27). Between these two extremes, there exists a range of outcomes associated with observed common property situations.

This study compares outcomes under private and open access to tribal grazing land in the Peddie coastal area. Here, private access refers to grazing land that is used exclusively by a stockowner for an undefined period but which cannot be sold, rented out or inherited. Open access refers to land used by a defined but large group of stockowners without restrictions on the number of cattle stocked by members of the group. It is assumed that stockowners operating under private access will face incentives closer to those generated by private ownership, while unrestricted access within a large group is expected to result in outcomes very similar to those predicted by Gordon for unlimited entry to a common property resource. Popkin, (1979) has suggested that restricted access can be compared with open access when the group is larger than a family.

Lyne and Nieuwoudt (1990) present estimates showing that in KwaZulu, where access to grazing land is unrestricted, stocking rates and mortality rates are higher, but calving and commercial sales rates are lower than in neighbouring Natal where land is privately owned. Lenta

(1978), reports cattle mortality rates of seven per cent for Kwazulu and four per cent for Natal, and Colvin (1983) reports a calving rate of 32 per cent for KwaZulu and 80 per cent for Natal.

3. Methodology

Data were gathered from a sample of 300 stockowners identified from twenty locations in the Peddie coastal area. Out of 184 respondents, 32 stockowners had private access to grazing land while the remaining 152 shared unrestricted access to common grazing. Information was collected with the help of two livestock inspectors resident in the area using a standardized questionnaire. The data were captured on a computerized database and descriptive statistics were computed for the variables measured in the survey.

Zero-order correlation coefficients were estimated for relevant variables. Variables that were strongly intercorrelated were identified and, where necessary, were subject to principal components analysis to reduce multicollinearity amongst sets of explanatory variables. Following Stevens (1986) advice, Bartlett's sphericity test was applied to check the null hypothesis that elements in the population correlation matrix were uncorrelated.

Three multivariate models were estimated. In the first model, probit analysis was used to identify personal attributes distinguishing stockowners with private access to grazing land from those operating under conditions of open access. This technique is suited to regression models where the dependent variable (TENURE) is dichotomous, scoring a value of one (private access) or zero (open access). Probit analysis ensures that the predicted probability of a case belonging to either group (i.e., having private or open access) will always lie between the logical limits of zero and one (Penn,1971; Witherington and Wills,1978).

In the second model, production variables associated with private and open access were isolated using discriminant analysis. This technique weights and combines discriminating variables measuring characteristics on which groups of cases are expected to differ in a linear function that maximizes differences between the groups (private and open access farmers) (Klecka, 1975). Discriminant analysis is widely described in multivariate analysis texts (Lachenbruch, 1975; Morrison, 1978; Stevens, 1986; Tabachnick and Fidell, 1983). In this study the model was not intended to identify causal relationships. Rather it serves to emphasise significant relationships between tenure arrangements and production outcomes.

Finally, OLS regression analysis was used to quantify the contribution of open and private access to the level of commercial livestock production. This approach was used by Melichar (1965) to examine the relationship between farmers use of credit and variables such as age, tenure and size of farm.

4. Empirical results

4.1 Descriptive statistics

Demographic characteristics computed from the survey data are summarized in Table 1. On average, stockowners with private access to grazing were older (AGE) and had larger families (KIDS) than those with open access to grazing.

The incidence of pension earnings (PEN) and the proportions of stockowners that had attended school (EDUC) and who claimed to be farmers (FARM) were also higher in the former group. There were also more males (SEX) but fewer wage employees (WAGE) in this group.

Table 2 shows that the average herd size (HERS) within the open access group (9,87) was smaller than that computed for farmers with private access (11,88). Although the average herd size was larger for stockowners with private access to grazing, the largest herds observed were owned by members of the open access group. Sales frequency (SALES) and the incidence of good veld quality (QUALITY) were lower, but ritual slaughterings (SLTR) higher, in the open access group.

Table 3 presents zero-order correlation coefficients between pairs of relevant variables observed for all 184 respondents. The variable TENURE is positively correlated with KIDS, AGE, PEN and FARM suggesting some support for the probit model described in section 4.2. The high intercorrelations between AGE, KIDS and PEN also support the use of principal components to reduce multicollinearity in this model.

The results of the principal components analysis are shown in Table 4. Bartlett's Sphericity test was highly significant indicating that the elements in the correlation matrix were strongly correlated.

The first principal component (PC_1) explained 69 per cent of the total variation in the three variables. The weighting coefficients carry the same sign and their magnitudes are similar. It can be inferred that a change in one variable will be accompanied by similar changes in the other two. This component was used to compute index scores for a composite variable labelled MATURITY.

The second and third principal components accounted for only 22 and nine per cent of total variation respectively and both had eigen values smaller than unity. Johnston (1980), supported by Stevens (1986), suggests that an appropriate guideline is to interpret only those components with eigen values exceeding 1,0. The rationale for this is that a component with an eigen value of less than 1,0 accounts for less of the total variance than did any one of the original variables. Hence these components were ignored.

4.2 Probit model

The probit model hypothesised that the incidence of private access to grazing land would be higher amongst older stockowners who farm (i.e. have larger herds and are not wage employed), are better educated, earn pensions and who have larger families as these individuals would exercise more influence with the local chief. Owing to high intercorrelations between AGE, KIDS and PEN their contributions were captured by including MATURITY as a proxy variable in the model. The probit model can be expressed as follows:

$$\text{PROBIT (TENURE)} = B_0 + B_1\,\text{FARM} + B_2\,\text{EDUC} + B_3\,\text{HERS} + B_4\,\text{MATURITY} + e \qquad (1)$$

where

TENURE = 1 if the stockowner has private access to grazing, and 0 otherwise,

FARM = 1, if a stockowner claimed to be a farmer, and 0 otherwise,

Table 1: Personal characteristics of 184 stockowners, Peddie coastal area, Ciskei, 1990.

Variable	Unit	Private access (n=32)	Open access (n=152)	Overall (n=184)
Average age	Years	51,72	42,95	44,49
Average number of children		8,23	4,91	5,48
Pensioners	%	41	9	14
Education	%	87	73	76
Farmers	%	28	5	9
Males	%	84	77	78
Wage employed	%	22	54	49

Table 2: Herd size, sales frequency, slaughter frequency and veld condition for 184 stockowners, Peddie coastal area, Ciskei, 1990.

Variable	Unit	Private access (n=32)	Open access (n=152)	Overall (n=184)
Average herd size	cattle	11,88	9,87	10,22
Distribution of herd sizes:				
2-10	%	50,0	69,7	66,3
11-20	%	48,3	22,4	26,1
21-30	%	3,1	5,3	4,9
31-40	%	3,1	1,3	1,6
41-50	%	--	1,3	1,1
Sales	cattle/year	2,3	1,3	1,5
Ritual slaughtering	cattle/year	1,1	1,7	1,7
Incidence of good veld quality	%	91,0	66,0	71,0

Table 3: Correlation coefficients between variables measured for 184 stock farmers, Peddie coastal area, Ciskei, 1990.

	1	2	3	4	5	6	7	8	9	10	11	12
1 TENU	1,00											
2 AGE	0,23**	1,00										
3 KIDS	0,32**	0,70**	1,00									
4 PEN	0,36**	0,38**	0,50**	1,00								
5 SEX	0,05	0,13	0,08	-0,15	1,00							
6 EDUC	-0,14	0,21**	0,03	-0,04	0,04	1,00						
7 FARM	0,33**	0,13	0,13	-0,14	0,07	0,08	1,00					
8 SLTR	0,05	0,17*	0,30**	0,12	-0,11	0,10	0,03	1,00				
9 SALES	0,29**	0,35**	0,32**	0,13	-0,02	-0,01	0,11	0,51**	1,00			
10 QUALI	0,20*	-0,09	0,16*	0,27**	-0,23**	-0,10	0,07	0,31**	0,16*	1,00		
11 HERS	0,10	0,08	0,03	0,12	0,20*	0,00	0,03	-0,01	0,08	0,10	1,00	
12 WAGE	-0,06	-0,09	-0,19*	-0,18*	0,07*	0,07	-0,14	-0,12	-0,05	-0,06	-0,16*	1,00

* $P < 0,05$; ** $P < 0,01$ (2-tailed)

Table 4: Principal component (PC) analysis.

	Component loadings
	PC_1
KIDS	0,90156
AGE	0,85079
PEN	0,72525
Eigen value	2,06264
Percentage variance accounted for	69

EDUC = 1, if a stockowner attended school, and 0 otherwise,
HERS = herd size,
MATURITY = the first principal component extracted from the variables KIDS, AGE and PEN, and where
KIDS = number of children,
AGE = age of the stockowner in years,
PEN = 1, if a stockowner receives a pension, and 0 otherwise,
B_i = weighting coefficients, and
e = error term.

The explanatory variables FARM and MATURITY are expected to have positive coefficients but the variable EDUC could have a negative coefficient because better educated stockowners tend to engage in wage employment. WAGE was excluded from the model as farming and wage employment cannot be viewed as independent (uncorrelated) activities.

The results of the probit analysis are presented in Table 5. Pearson's Goodness-of-fit statistic (which compares Chi Square and Degrees of freedom) and the low mean deviance indicate that the model is reliable. Herd size was omitted from the estimated function as the asymptotic t-value computed for its weighting coefficient was not statistically significant at the ten per cent level of probability. This result was expected as herd sizes did not differ significantly between the open and private access groups. It is unlikely that the negative coefficient estimated for EDUC reflects the partial effect of education. A more plausible explanation is that the coefficient is biased and reflects the inverse relationship between farming and (the excluded variable) wage employment (Table 3). The function correctly classified 80 per cent of the stockowners in each group (when prior probabilities reflected relative group sizes).

A histogram of predicted probabilities (Table 6) is depicted in Figure 1. The distributions show marked separation and the mean probability for private access cases (0,35) is much greater than that estimated for open access cases (0,14).

These results support the notion that private access to grazing land is more common amongst older stockowners who farm, earn pensions and who have larger families.

4.3 Discriminant model

The discriminant model hypothesised that (production-related variables) veld quality and cattle sales would be higher, and ritual slaughterings lower, amongst stockowners with private access to grazing land. The variables MATURITY, FARM, HERS and EDUC were also included as control variables. The discriminant model can be written as follows:

$$\text{TENURE} = B_1\,\text{SALES}^* + B_2\,\text{SLTR}^* + B_3\,\text{QUALITY}^* + B_4\,\text{MATURITY}^* + B_5\,\text{FARM}^* + B_6\,\text{HERS}^* + B_7\,\text{EDUC}^* + u \quad (2)$$

where
SALES = number of cattle sold during the past year,
SLTR = number of cattle slaughtered for ritual purposes,
QUALITY = 1, if livestock could survive without purchased fodder and the veld condition score (VCS) was greater than 70 (Danckwerts, 1978; King *et al*, 1989).
B_i = weighting coefficients,
u = error term, and
* denotes standardized values.

It was anticipated that SALES and QUALITY would have positive coefficients, but SLTR a negative coefficient as slaughterings for non-commercial reasons were expected to be relatively lower in the private access group. The estimated linear discriminant function presented in Table 7 shows that all the independent variables, with the exception of HERS and EDUC are statistically significant. SALES has the heaviest loading in the set of non-control variables. SLTR and QUALITY contribute less to the separation of private and open access groups, and the coefficient estimated for SLTR carries a negative sign.

Wilks' Lambda is an inverse measure of the discriminating power of the variables. The greater the canonical correlation coefficient, the smaller is Wilks' Lambda and the better is the predictive power of the function. The relatively high Wilks' lambda (0,71) and low canonical correlation (0,53) suggest that some discriminating information has not been extracted by the selected variables. Nevertheless, the function classified 83 per cent of the cases correctly.

In summary, the results indicate that, other factors held constant, veld quality and cattle sales are higher, and ritual slaughterings lower, amongst stockowners with private access to grazing land.

4.4 OLS regression model

In the OLS regression model, the dependent variable measured cattle sales as a proxy for commercial livestock production. It was hypothesised that private access to grazing would contribute significantly to commercial livestock production.

Table 5: Parameter estimates of the probit model (n=184)

	Estimated Coefficient	Standard Error	Coeff./S.E.
FARM	1,162	0,351	3,130
EDUC	-0,727	0,389	-1,871
MATURITY	0,322	0,089	3,621
INTERCEPT	3,860	0,153	25,249
Private access cases correctly classified			80%
Open access cases correctly classified			81%
Overall cases correctly classified			81%
Mean deviance			1,33
Chi Square			194
Degrees of freedom			170

Table 6: Distribution of probabilities predicted for open and private access cases (n=184).

Probability	% Frequencies	
	Open access	Private access
0,0000 to 0,0999	48,6	16,7
0,1000 to 0,1999	32,6	3,3
0,2000 to 0,2999	8,3	23,3
0,3000 to 0,3999	5,6	20,0
0,4000 to 0,4999	0,7	16,7
0,5000 to 0,5999	2,1	6,7
0,6000 to 0,6999	1,4	6,7
0,7000 to 0,7999	0,7	6,7

Control variables QUALITY, MATURITY, HERS, FARM and EDUC were also included in the model.

The OLS regression model can be written as follows:

$$SALES = B_0 + B_1 TENURE + B_2 QUALITY + B_3 MATURITY + B_4 HERS + B_5 FARM + B_6 EDUC + v \quad (3)$$

where
B_i = regression coefficients
v = error term.

Although the predictive power of the estimated equation is poor (Table 8), the function is statistically significant and TENURE does contribute positively to the level of cattle sales, *ceteris paribus*. In the set of control variables, only QUALITY and MATURITY had t-values greater than unity and were retained in the function.

5. Conclusion

Results obtained in this study show that the incidence of private access to grazing land in the Peddie coastal area is higher amongst older stockowners that farm, earn pensions and who have larger families. These individuals apparently exercised more influence with the tribal authority responsible for allocating land. Other farmers share open access to common grazing. Veld quality and cattle sales are relatively higher, but ritual slaughterings lower, amongst stockowners with private access to grazing land, and private access has a significant positive effect on commercial livestock production.

Clearly, both present and future consumers would benefit if cattle sales and veld quality improved. Privatization is therefore recommended where it is acceptable, and should preferably confer rights of transferability through market transactions and inheritance as this would strengthen incentives to conserve resources and to invest in their improvement. A rental market for grazing land would promote efficiency and equity by extending access to new entrants who cannot afford land purchase. Undoubtedly the market approach would be more acceptable to stockowners if the state subsidized the cost of financing land purchase (for some finite period of time) and provided credit for land rental.

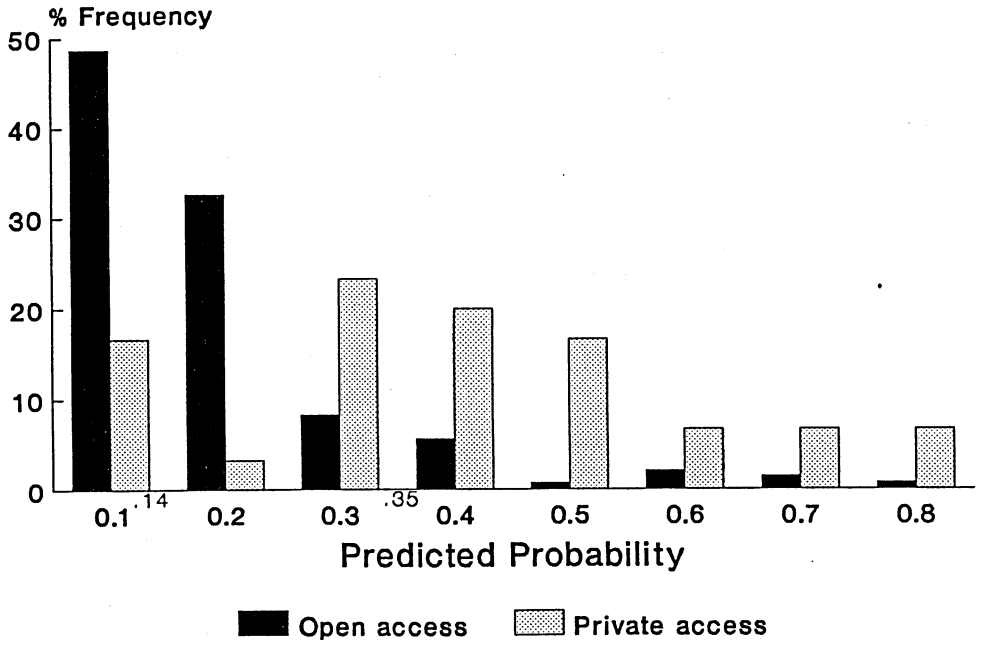

Figure 1: Histogram of probabilities predicted for open and private access cases

Table 7: Estimated discriminant function (n=184)

Discriminating variable	Estimated coefficient	Group means		Univariate F-value
		Private	Open	
MATURITY	0,613**	1,74	-0,23	26,00**
FARM	0,583**	0,30	0,05	19,83**
SALES	0,484**	2,20	1,35	14,7**
SLTR	-0,417*	1,90	1,76	5,43*
QUALITY	0,338*	0,90	0,67	6,56*
Private access cases correctly classified				80%
Open access cases correctly classified				84%
Overall percent of cases correctly classified				83%
Eigen value				0,40
Canonical correlation				0,53
Wilk's Lambda				0,71*

** P < 0,01; * P < 0,05

Table 8: Estimated OLS regression model (n=184)

Variable	Estimated coefficient	t-value
MATURITY	0,142	3,312 ***
QUALITY	0,242	1,308 *
TENURE	0,519	2,220 **
INTERCEPT	1,216	7,884 ***
R^2 = 0,15; DF = 166; F= 9,729 **		

*** P < 0,01; ** P < 0,5; * P < 0,25

Privatization could alleviate liquidity constraints if land is accepted as collateral. However this requires an active land market and the state would have to bear some responsibility for the institutions needed to support contractual arrangements and security of tenure.

Note

1. This work was conducted in the Agricultural Policy Research Unit, University of Natal, Pietermaritzburg, which is supported by the HSRC. The views of the authours do not necessarily reflect those of the HSRC.

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