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THE EFFECT OF PHYSICAL AND ECONOMIC VARIABLES ON THE FINANCIAL RESULTS OF FARMS IN THE NORTHERN CAPE*

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ABSTRACT

A typical farm was specified for the Bechuanaland subregion in terms of the physical, financial and operating features of farming in the area. The best method of acquiring the information to specify a typical farming unit is probably to use a combination of the group discussion technique and a postal survey. The typical value of every feature is best described by the median value of the distribution of the data for that feature. The simulation technique was used to determine the effect of inflation, interest rates, debt burden ratio and farm size on the financial results of the typical farm. The analyses indicate that every variable singly, and inflation, interest rates and debt burden ratios in combination, have a significant effect on the cash flow situation of farming in the Bechuanaland subregion. This micro-oriented information can be used beneficially in the policy-making and decision-making process in respect of this region.

INTRODUCTION

The effect of risk and its correct handling is one of the most dominant problems in South African agriculture. In order to restrict the detrimental consequences of risk to a minimum, it is important to determine, among other things, the effect of macro-economic variables and agricultural policy on the micro-level in as much detail as possible. One should first determine what the nature and extent of the farming is at micro-level before it is possible to measure the potential effect of physical and economic variables at this level. The acquisition of this information can, among other things, lead to the better execution of certain production objectives from the White Paper on Agricultural Policy (1984).

This study determines the effect of physical and economic variables on the financial results and success of a typical farming unit in the Bechuanaland subregion. In order to do this, the most effective survey method of collecting the data for the study was determined. A typical farm for the area was then specified in terms of physical, financial and operating features. This typical farm was then used as a basis

for determining the effect of macro-variables such as varying farm sizes, inflation rates, interest rates and debt burden ratios.

METHOD OF SURVEY

A pilot investigation was done to obtain a complete picture of the area and to determine in broad outline what the nature and extent of the farming activities in the area are.

The four most common methods of collecting data included personal surveys, telephone interviews, postal questionnaires and questionnaires that were filled in in groups (Warwick 1975, p. 128). Owing to the extent and the inaccessibility of the area, the detailed nature of the required information and the cost and the time aspect, the postal questionnaire and group discussion methods remained the only two options. In order to determine the most effective survey method for the specification of a typical farm, these two methods were evaluated in respect of the cost, the time aspect and the accuracy of the data collected by each one.

The questionnaires were sent by post to 400 farmers in the area; of these, 274 were returned and 252 were used for further processing. Owing to the homogeneity of the farming in the region, only two group discussions were held, at Vorstershoop and Kuruman. The following became evident when comparing the two survey methods:

Postal questionnaire

- The reliability of the results is higher since a more representative reply is obtained from the survey.
- Better information is obtained concerning the characteristics of the farmer himself and his debt burden position.
- This method is relatively cheaper to execute (according to direct costs).
- This method takes longer to complete.
- One can obtain only a limited amount of information by postal questionnaire since, if it is too long, the response diminishes.

Group discussion

- This method takes less time.
- The data concerning the operating features of the farm are easier to collect using this method.
- The composition of the group plays a large role in the usefulness of the results.

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- Direct costs are higher.
- The representativeness of the data is not always high and can be tested only if the information is already available.

The most effective survey method to specify a typical farm therefore appears to be first to carry out a postal survey, according to which the physical features of the typical farm are specified, and then to hold group discussions in the area in order to determine the operating features of the typical farming unit, as specified by the postal survey. This gives a balance between the reliability of the information, the cost of the investigation and the time involved.

TYPICAL FARM

According to *The Census Typical Farm Program*, the development of typical farms in the USA arose in order to make data available at local level for research projects and for the policy-maker (Hatch 1982, p. 2). The specification of a typical farm is not always so simple and is associated with concepts such as accounting average, modus and median (Odell & Mapp 1986, p. 19). A typical farm should be specified in such a way that it includes the greatest number of real farms. The features according to which a typical farming unit is identified include aspects such as farm size, land use, crop diversification, stock diversification, the value of fixed and operating assets, debt burden ratio and operating features.

The Biomedical Computer Program (BMDP) was used for processing the data from the survey. The BMDP software package is able to carry out a wide range of analytical possibilities that vary from a simple description of data to advanced statistical techniques (Dixon 1981, p. viii). The 4F and 2D subprograms of the BMDP were used for specifying a typical farm. The 4F subprogram gives a clear picture of all the data combined and the 2D subprogram specifies every feature in greater detail. According to analyses, the distribution of the data of every feature of the typical farm was skew and the *median value* was used throughout as the most typical value. According to Snedecor & Cochran (1967, p. 124), the median is a more representative locality parameter than the accounting average or the modus if the data have a skew distribution, as was found in this case. The features of the typical farm, as specified from a combination of the postal questionnaire and the group discussions, are given in Table 1.

TESTING THE EFFECT OF MACRO-VARIABLES

Assumptions and model

Production processes in agriculture are dynamic by nature, are affected by various factors and are based on biological principles (Rae 1977, p. 460). This

interaction and relationship of various factors and elements can be described as a system. According to Csaki (1985, p. 9), simulation gives the best analysis of the interaction of elements within a system and of the effect of external factors that influence this system. Louw (1979, p. 61) confirms that in situations where changes in input, probability distributions, changes in time, risk and uncertainty occur, pure scientific models are not the most suitable method of determining the effect.

This study uses certain parts of the simulation model originally developed by Eisgrüber (1965, according to Louw 1979) and adapted by Van Zyl, Van der Vyver & Mostert, (1987). According to this, an amendment that was made to the original model was the inclusion of an equal numbers generator for price and yield distributions for the operating branches. The effect of risk and uncertainty on prices and yield can thus be included. The simulation model is discussed fully by Louw (1979, Chap. 5 and 6) and Van Zyl (1985).

Three different inflation situations were used in the simulation model. An inflation rate of 10 per cent on fixed assets and 15 per cent on the value of stock and the income from the farm was used in all three of the situations. Movable assets and the expenditure of the farm were increased by a rate of 15, 16 and 17 per cent, respectively, in inflation situations 1, 2 and 3.

With regard to interest rates, seven different interest rate ratios were tested. A difference of 4 per cent throughout between a credit and an overdrawn balance was used and the interest rates on the credit balances varied from 10 to 22 per cent and those on the overdrawn balances from 14 to 26 per cent. Seven different debt burden ratios (debt as a percentage of total assets) which varied from 5 to 35 per cent were also tested in the model. With regard to farm sizes, nine farm sizes were tested in the model, varying between 2 000 ha and 6 000 ha. These different situations were all chosen arbitrarily in order to represent a series of values surrounding those for a typical farm (Table 1).

The typical farm specified in Table 1 was used as the starting point and was then adjusted in the programme itself as various combinations of inflation rates, interest rates, debt burden ratios and farm sizes were simulated in the model. The probability of the specified changes in the financial results of the farming were determined for every combination of factors by 50 repetitions for every situation within one year. These repetitions vary equally by a 10 per cent variation in gross income for the farm. Every combination of factors was simulated over a planning period of 10 years and the present value of the farm was determined for every period by discounting the calculated value throughout at a rate of 15 per cent.

Results

Figure 1 shows the course of net farming profit and net expendable income for various farm sizes in Years 1, 3 and 5 in Inflation Situation 3 (fixed costs

TABLE 1. Final description of a typical farm in the extensive stock-farming area in the Bechuanaland subregion, 1988

Description	Size
1. Farm size	3 433 ha
2. Land use	Natural grazing
3. Grazing capacity:	
Normal years	9 - 10 ha/LSU
Present	10 - 12 ha/LSU
4. Land value	R140/ha
5. Composition of stock	Beef cattle
6. Production system	Weaner
7. Marketing pattern	
- Local auctions	65 %
- Controlled markets	35 %
8. Gross income per LSU	R310,71
9. Variable costs per LSU	R59,78
10. Gross margin per LSU	R250,93
11. Value of fixed improvements (excluding residence)	R126 704,00
12. Value of movable assets	R34 950,00
13. Value of stock	R254 419,00
14. Debt	
- Land Bank and Agricultural Credit Board	R71 285,00
- Other	R40 000,00
15. Value of investments and assets outside the farm	R68 500,00
16. Other non-directly allocable expenditure	R4 711,00
17. Number of regular labourers per farming unit	3
18. Expenditure per labourer per annum	R1 710,00
19. Domestic expenditure per month	R1 750,00
20. Number per farming unit	
- LDVs	1
- Tractors	1
- Lorries	-
21. Kilometres covered per annum by LDV	16 000 km - 21 000 km
22. Tractor-hours worked per week by tractor	4 - 6 hours/week
23. Price of leased land	R10 - R12/ha/year
<i>Personal details of farmer</i>	
24. Age	56 - 60 years
25. Number of dependants (wife included)	2
26. Training (ordinary school)	No tertiary education
27. Ownership	One-man business
28. Time spent on manual labour	7 - 8 hours/day
29. Time spent on operating aspects	1 - 2 hours/day
30. Use of external sources of information such as extension officers, consultants, etc.	1 - 2 x/year
31. Involvement of spouse (percentage of total)	
- Financial decision-making	56 %
- Practical problems on the farm	40 %
- Keeping records and correspondence	39 %
- Physical tasks such as handing out rations, etc.	40 %
- Domestic alone	42 %

are kept constant). Accordingly, it may be seen that the farm is profitable throughout, but that cash flow problems arise in the smaller farming units. Table 2 gives the financial results of the various interest rates for Years 1, 3 and 5. It can again be seen that the farm is profitable, but that cash flow is a problem in Year 1. Depending on the inflation situation, an interest rate of 16 per cent and higher will give rise to a negative net expendable income. The situation improves in time, however, since the debt burden becomes smaller owing to the annual payment. Figure 2 indicates the course of the net expendable income for various debt burden ratios in Years 1, 3, 5 and 7 in Inflation Situation 3. According to Figure 2 it can be seen that a debt burden ratio larger than 15 per cent will realise a negative cash flow in Year 1. This debt burden ratio increases over time owing to the annual payment of the existing debt and this

therefore gives a greater profitability in the farming.

The model also calculates the course of net values over time. The present value of net values is calculated in order to compare values directly with one another under various inflation conditions. A discounting rate of 15 per cent is used throughout in the model. Table 3 shows the present value of the net value for a five-year period in the various inflation situations. From Table 3 it appears that the present value decreases over time. This may largely be ascribed to the growth in income and value of the assets structure on the farm not relating to the "consuming" effect of inflation. Negative real growth therefore takes place when discounted at a rate of 15 per cent, in spite of the fact that the farm is indeed profitable (in the initial situation).

Financial ratios serve as an important aid in evaluating the financial position of a farming

TABLE 2. Average value of net farming income (NFI), net farming profit (NFP) and net expendable income (N. Expend. I) for various interest rates in years 1, 3 and 5

Year	Interest rate		Inflation 1			Inflation 2			Inflation 3		
	Credit	Overdrawn	NFI	NFP	N.EXPEND I.	NFI	NFP	N.EXPEND I.	NFI	NFP	N.EXPEND I.
	%	%		R			R			R	
1	10	14	49 500	33 900	867	46 400	30 900	-488	50 100	34 500	1 450
1	12	16	49 500	31 600	-71	46 400	28 600	-1 666	50 100	32 300	451
1	14	18	49 500	29 400	-1 181	46 400	26 400	-2 965	50 100	30 000	-709
1	16	20	49 500	27 200	-2 436	46 400	24 200	-4 360	50 100	27 800	-1 983
1	18	22	49 500	25 000	-3 814	46 400	22 000	-5 896	50 100	25 600	-3 407
1	20	24	49 500	22 700	-5 300	46 400	19 700	-7 586	50 100	23 400	-4 925
1	22	26	49 500	20 500	-6 920	46 400	17 500	-9 376	50 100	21 100	-6 585
3	10	14	65 500	52 900	4 912	61 300	48 600	3 540	63 700	51 100	3 428
3	12	16	65 500	51 200	4 550	61 300	46 980	2 990	63 700	49 400	2 905
3	14	18	65 500	49 500	4 166	61 300	45 280	2 400	63 700	47 760	2 341
3	16	20	65 500	47 600	3 680	61 300	43 400	1 667	63 700	45 800	1 674
3	18	22	65 500	45 900	3 150	61 300	41 700	957	63 700	44 100	1 024
3	20	24	65 500	44 060	2 459	61 300	39 800	100	63 700	42 300	261
3	22	26	65 500	42 300	1 781	61 300	38 100	-736	63 700	40 590	-466
5	10	14	85 400	75 700	6 927	87 800	78 000	7 217	77 400	67 800	4 219
5	12	16	85 400	74 500	6 731	87 800	76 900	7 008	77 400	66 600	3 861
5	14	18	85 400	73 300	6 520	87 800	75 800	6 796	77 400	65 400	3 497
5	16	20	85 400	71 800	6 229	87 800	74 200	6 511	77 400	63 900	3 013
5	18	22	85 400	70 600	5 984	87 800	73 090	6 279	77 400	62 700	2 633
5	20	24	85 400	69 100	5 648	87 800	71 500	5 968	77 400	61 200	2 125
5	22	26	85 400	67 900	5 368	87 800	70 300	5 721	77 400	60 000	1 712

FIG. 1. The course of net farming profit and net expendable income for various farm sizes in Years 1, 3 and 5 in Inflation Situation 3

enterprise. A problem is, however, to find comparable yardsticks, since various factors may cause the figures of various enterprises in the same field to be incomparable (Reynders, Lambrechts &

FIG. 2. The course of net expendable income for various debt burden ratios in Years 1, 3, 5 and 7 in Inflation Situation 3

Scheurkogel 1985, p. 111). When analysing the liquidity position of the farm, emphasis was also given to the intermediary ratio. This calculates the liquidity of the farm over the medium term. Table 4 gives the intermediary ratio of various farm sizes, interest rates and debt burden ratios in Year 1, as

TABLE 3. Average present value of net value for the typical farm in various inflation situations

Year	Inflation 1	Inflation 2 R	Inflation 3
1	661 900	662 300	662 600
2	661 700	661 100	663 300
3	660 400	658 800	661 920
4	657 500	655 700	658 800
5	653 300	651 600	654 100

TABLE 4. Intermediary ratios for various farm sizes, interest rates and debt burden ratios in Year 1

Description	Proportion	General norm*
Farm size (ha)	2 000 2,82 : 1	4 : 1
	3 000 3,96 : 1	4 : 1
	4 000 5,10 : 1	4 : 1
	5 000 6,24 : 1	4 : 1
	6 000 7,30 : 1	4 : 1
Interest rate (%)	10 : 14 4,62 : 1	4 : 1
	12 : 16 4,45 : 1	4 : 1
	14 : 18 4,31 : 1	4 : 1
	16 : 20 4,17 : 1	4 : 1
	18 : 22 4,04 : 1	4 : 1
	20 : 24 3,92 : 1	4 : 1
	22 : 26 3,80 : 1	4 : 1
Debt burden ratio (%)	5 5,78 : 1	4 : 1
	10 4,82 : 1	4 : 1
	15 4,14 : 1	4 : 1
	20 3,61 : 1	4 : 1
	25 3,21 : 1	4 : 1
	30 2,89 : 1	4 : 1
	35 2,63 : 1	4 : 1

*Source: Van Zyl & The Standard Bank of South Africa, 1988

tested in the model. From Table 4 it appears that for farms larger than 3 000 ha, with a debt burden of less than 20 per cent, the calculated intermediary ratio compares well with the set norm. With an interest rate ratio of less than 20 per cent on a credit balance and 24 per cent on an overdrawn balance, the comparison is also better than the set norm.

The profitability of the farm was also analysed to bring the "profit" realised within a certain financial period into relation with the cost related to it. Tables 5 and 6 show the farming profitability and profitability on own capital for various farm sizes, interest rates and debt burden ratios in Years 1, 3 and 5.

It is clear, according to Table 5, that the yield on the total investment is low. When compared with Table 6, however, it may be seen that the yield on own capital is lower than the yield on total capital, which indicates that the foreign capital is not being used beneficially in the farm.

The variance analysis determines which are the most important sources of variance and what their significance is (Christ 1966, p. 503). The results of the variance analysis with regard to the effect of factors and their interaction on net expendable income in Year 5 are set out in Table 7. The interaction on net expendable income was used for the analysis since it is the most critical financial variable, as becomes clear from the analyses above. Should one look at the two-factor and three-factor interactions, it may be seen that all the interactions are significant, except the combinations in which farm size is included as a factor. The main effects

TABLE 5. Farming profitability (%) for various farm sizes, interest rates and debt burden ratios tested in the model

Year	Inflation	Farm sizes			Interest rate ratios			Debt burden proportion		
		2 000 ha	4 000 ha	6 000 ha	10 %:14 %	16 %:20 %	22 %:26 %	5 %	20 %	35 %
1	1	4	7	8	6,4	6,4	6,4	6,4	6,4	6,4
	2	3,5	6,5	8	6	6	6	6	6	6
	3	4	7	8	7	6,5	6,5	7	6,5	6,5
3	1	4	7	8	6	6,5	6	6	6	6
	2	3	6	7	5,6	5,6	5,6	5,6	5,6	5,6
	3	3	6	7	5,8	5,9	5,9	5,7	5,8	5,8
5	1	4	7	8	6,2	6,1	6,1	6,2	6,2	6,1
	2	4	7	8	6,4	6,3	6,3	6,4	6,4	6,3
	3	3	6	7	5,6	5,4	5,6	5,6	5,4	5,6

TABLE 6. Profitability on own capital (%) for various farm sizes, interest rates and debt burden ratios tested in the model

Year	Inflation	Farm sizes			Interest rate ratios			Debt burden proportion		
		2 000 ha	4 000 ha	6 000 ha	10 %:14 %	16 %:20 %	22 %:26 %	5 %	20 %	35 %
1	1	0,1	5	6,3	4,5	3	2,7	5,2	3,4	1
	2	-0,3	5	6	4,1	3,2	2,3	4,8	3	0,5
	3	0,1	5	6,4	4,5	3,6	2,8	5,3	3,5	1
3	1	2	6	7	5,2	4,7	4,2	5,6	4,7	3,7
	2	1	5	6,6	4,8	4,3	3,8	5,3	4,3	3,2
	3	2	6	6,8	5	4,5	4	5,5	4,5	3,4
5	1	3	6	7,4	5,7	5,4	5,2	5,9	5,5	5,2
	2	3	6	7,6	5,9	5,7	5,4	6,1	5,7	5,5
	3	2	5,6	6,9	5,1	4,9	4,6	5,3	4,9	4,5

TABLE 7. Variance analysis of factors and their interactions affecting net expendable income

	Degrees of freedom	F value
Main effects		
Farm size (F)	8	814,5*
Debt burden ratio (D)	6	216,7*
Interest rate (I)	6	69,3*
Inflation rate (R)	2	938,7*
Two-factor interaction		
F x D	14	1,0
F x I	14	0,8
F x R	16	0,6
D x I	12	116,7*
D x R	12	214,9*
I x R	12	56,7*
Three-factor interaction		
F x D x I	20	0,7
F x D x R	28	0,3
F x I x R	28	0,9
D x I x R	24	60,1*
Four-factor interaction		
F x D x I x R	40	1,6
Model	242	216,8*
Fault	1 757	-
Total	1 999	-
Coefficient of determination (R^2)		0,917

*Statistically significant at the 0,01 per cent level of significance
All other F values are statistically insignificant at the 25 per cent level of significance.

have a separate significant effect on the net expendable income. It may therefore be seen that inflation rate, interest rate and debt burden ratio and their effects are mutually dependent. This means that the effects of these three factors cannot be isolated from the other factors or from one another.

CONCLUSION

The specification of a typical farm for the Bechuanaland subregion is a useful aid in determining what the situation is at farm level in terms of physical, financial and operating features. The effect that various variables have on this typical farm may be regarded as representative of the whole subregion.

The detrimental effect of inflation has become apparent in the negative growth that occurred in farming as a result of the decrease in present value over time (Table 3). An increase in offset price inflation also had a negative effect on the stability of income and profits in farming. The profitability of the farms in the area was positive throughout, but farms smaller than 3 400 ha had a negative cash flow situation (Figure 1). When compared with the typical farm size of 3 433 ha, it is clear that cash flow problems may be a reality for the area. With regard

to interest and debt, a rate of above 16 per cent on an overdrawn balance and a debt burden ratio greater than 15 per cent will also cause a negative expendable income for the typical farm in the region (Table 2 and Figure 2). The typical debt burden ratio for the area is 14,5 per cent.

The farms in the area do not have a solvency problem. As far as liquidity is concerned, it is important to note that an excess of liquidity can again cause the profitability to weaken owing to large amounts lying interest-free or too low a yield on liquid assets.

The variance analysis indicates that unless the effects of inflation, interest rates and debt burden ratios are addressed together in a co-ordinated attempt, these will not contribute effectively to farming in the region. The micro-oriented information arising from this study in order to describe the situation at farm level as accurately and representatively as possible can potentially be used in the decision-making process in respect of the Bechuanaland subregion. Policy options in respect of the reconstruction of agriculture in this subregion can in this way be better evaluated by policy-makers.

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