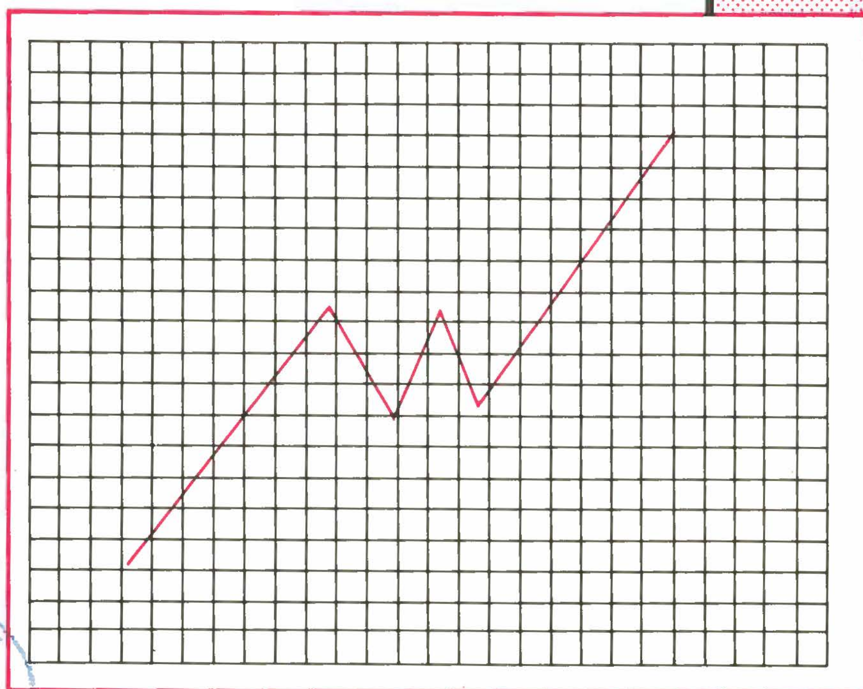

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ANNOUNCEMENTS, COMMENTS AND NOTES

ANNOUNCEMENT

S.J.J. DE SWARDT AGREKON PRIZE

The S.J.J. de Swardt Agrekon Prize for 1987 has been awarded jointly to Prof W.L. Nieuwoudt for his article "Taxing agricultural land" which appeared in the June 1987 edition of *Agrekon* and Prof J. van Zyl, Mr A. van der Vyver and Prof J.A. Groenewald for their article "The influence of drought and general economic effects on agriculture: A macro-analysis" which appeared in the February 1987 edition.

Mr S.J.J. de Swardt, former Secretary of Agricultural Economics and Marketing was responsible for the foundation of the S.J.J. de Swardt Agrekon Prize in 1962. He made a bequest to the Department for the award of prizes for meritorious contributions in the field of agricultural economics published in *Agrekon*.

The Editorial Committee of *Agrekon*, in 1984, in consultation with Mr De Swardt also instituted the S.J.J. de Swardt Agrekon Debutant Prize for the best debutant article with a view to encouraging younger and less experienced agricultural economists in particular, to write for the journal. During 1987 no articles qualified for the Debutant Prize.

RESEARCH NOTE

ON TESTING FOR STOCHASTIC DOMINANCE

Research note by C. Koen and M. Daniel,
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INTRODUCTION

Van Zyl and Groenewald (1986) studied maize cultivar selection under uncertainty using a variety of decision rules. One of these rules was stochastic dominance (SD) testing. This will be re-examined here to illustrate the pitfalls of using unwarranted approximations of the cumulative density functions (CDFs) required in SD tests.

The SD computer program used by Van Zyl and Groenewald is to be found in Anderson *et al.* (1977). Its key feature is the representation of the CDF by straight-line segments representing equal intervals in probability (see also Anderson 1974). In fact, Van Zyl and Groenewald write: "An element of judgement and approximation is required to compare the derived functions irrespective of whether the method of integration is numerical or analytical in nature." This statement ignores the fact that one is dealing with statistical data sets; arbitrary approximations are *not* allowed if the data are to be acceptable representations of the underlying populations.

In what follows, the accepted estimation of the population CDF will be given. Van Zyl and Groenewald's calculation is then repeated using these CDFs and discrepancies pointed out. Some graphical illustrations of the errors incurred by using the Anderson *et al.* (1977) computer program are also presented.

The appendix[1] contains an alternative computer program which tests for first, second and third degree stochastic dominance (FSD, SSD and TSD) with CDFs calculated in the statistically acceptable fashion. The program is in BASIC, intended for execution on microcomputers.

THE CDF

This is

$$F(x) = \frac{N(x)}{n} \tag{1}$$

where N(x) is the number of observations x_i with $x_i \leq x$; n is the sample size (e.g. Conover 1980). According to Yamoto (1972), F is the unbiased estimator for the population CDF with the smallest variance.

The function F is a step function as can be seen by examining figures 1 and 2.

Note also that in the theory of SD sampling errors, the form of F given above has been used (Pope and Ziemer 1984, Stein *et al.* 1987).

The BASIC computer program tests for FSD, SSD and TSD. Mathematically, the tests are

$$F_1(x) \leq F_2(x) \qquad \text{(FSD)}$$

$$\int_{-\infty}^{x} F_1(u)du \leq \int_{-\infty}^{u} F_2(u)du \qquad \text{(SSD)}$$

$$\int_{-\infty}^{x} \int_{-\infty}^{u} F_1(\nu)d\nu du \leq \int_{-\infty}^{x} \int_{-\infty}^{u} F_2(\nu)d\nu du \qquad \text{(TSD)}$$

where in each case option 1 (with empirical CDF F_1) will dominate option 2 if the above equations are satisfied (with a strict inequality for at least one x) (Anderson *et al.* 1974). Because of definition (1), these equations can be shown to reduce to

$$FS = N_1(x) - N_2(x) \leq O \qquad \text{(FSD)}$$

$$SS = \sum_{i=1}^{N_1} (x - x_i) - \sum_{j=1}^{N_2} (x - x_j) \leq O \qquad \text{(SSD)}$$

$$TS = \sum_{i=1}^{N_1} (x - x_i)^2 - \sum_{j=1}^{N_2} (x - x_j)^2 \leq O \qquad \text{(TSD)}$$

where the observations are considered to have been ranked in ascending order and (x_j) are all the observations of option 1 less than (or equal to) x. The program tests for changes in the sign of FS, SS or TS ("crossing algorithm"); if such occur, then neither option dominates.

RESULTS

The program was applied to the data given by Van Zyl *et al.* (1986). This apparently formed the basis of the "above average management" calculations reported by Van Zyl and Groenewald (1986). The results, in the same format as that used by Van Zyl and Groenewald, are given in Table 1.

TABLE 1 - Stochastic dominance results for maize cultivars: o indicates undominated cultivars according to the program used in this note and x indicates cultivars undominated according to Van Zyl and Groenewald (1986)

Locality	Cultivar	FSD	SSD	TSD
Bethal	SA4	x o	x o	
	SA5	x o	x o	
	SSM48	x	x	
	PNR88	x	x	
	NPP x K64R	x o	x o	x o
	PNR95	x o	x o	x o
	SR52	x o	x o	x
	R200	x o	x	
Potchefstroom	SA4	x	x	
	SA5	x	x	
	SSM48	x	x	
	PNR88	x	x	
	NPP x K64R			
	A471W	x o	x o	x o
	PNR95	x	x	
	SR52	x	x	
	R200	x o	x o	o
Bethlehem	SA4	x o	x o	x
	SA5	x o	x o	x o
	SSM48	x o	x o	x o
	PNR88	x o	x o	x
	NPP x K64R	x	x	
	A471W	x o	x o	x o
	PNR95	x o	x o	x
	SR52	x o	x	
	R200	x o	x o	
Cedara	SA4	x	x	x
	SA5	x	x	x
	SSM48	x	x	
	PNR88	x o	x	x
	NPP x K64R	x o	x o	
	A471W	x	x	x
	PNR95	x o	x o	x
	SR52	x o	x o	x o
	R200	x o	x o	x o

The following observations can be offered:

(i) A large number of Van Zyl and Groenewald's conclusions regarding FSD are incorrect. Figures 1 and 2 illustrate this point.

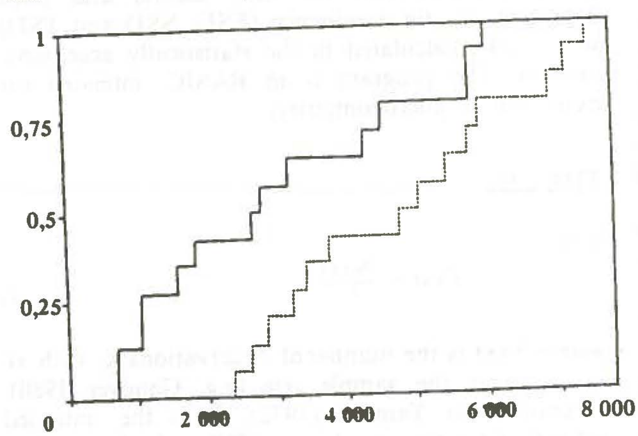

FIG. 1 - A comparison of the CDFs for SR52 (solid line) and A471W (broken line) at Potchefstroom

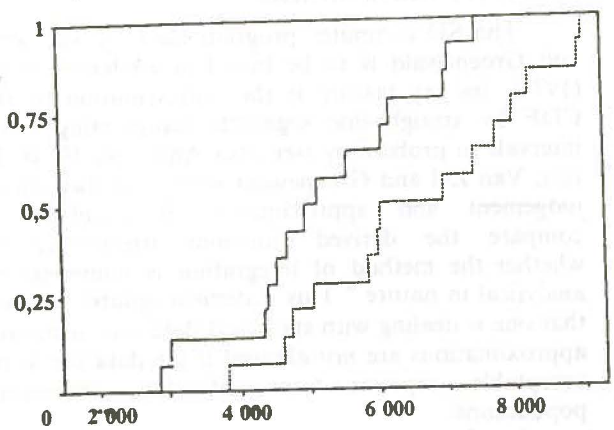

FIG. 2 - A comparison of the CDFs for R200 (solid line) and SA4 (broken line) at Cedara

The misclassification is always in the sense that domination could not be identified.

(ii) The above statement applies to SSD also.

(iii) The same conclusion is true of the TSD case with one exception: Van Zyl and Groenewald found a single dominant cultivar (A471W) for Potchefstroom while the present approach finds R200 also to be undominated.

Inspection of Van Zyl *et al.*'s (1986) data shows that the minimum yield for R200 exceeds the minimum yield of all other cultivars except A471W. The implication, as a study of the dominance equations will show, is that R200 cannot be dominated by any cultivar but A471W. (This is true of FSD, SSD and TSD.)

A careful study of the TS-variable shows that it changes sign twice (i.e. two "crossings" of the twice integrated (DFs)) and hence R200 is undominated.

CONCLUSION

From the above it should be clear that the results of the Anderson *et al.* (1977) computer program are unnecessarily pessimistic; the set of undominated options may be considerably smaller than given by that program. Of course, the question of whether differences between options are statistically *meaningful* still has to be addressed. This question can only be tackled if quantities amenable to statistical analysis are dealt with. It is hoped that the present work is a contribution to the stochastic dominance literature in that respect.

NOTE

[1]Appendix available from authors

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