THE SENSITIVITY OF INTERFARM COMPARISONS TO INACCURACIES OF MEASUREMENT AND VALUATION

R. G. Mauldon and Henry P. Schapper*

This paper discusses accuracy of recording, allocating and valuing in the context of comparisons between farms of efficiency ratios and gross margins. Some experiments were conducted to investigate the effects on rank orderings of livestock gross margins of (i) different allocations of failures to reconcile between recorded sources and recorded uses of livestock, and (ii) of random changes in valuations of livestock. The outcome of the experiments suggests that inaccuracies which occur in farm recording, allocating and valuing can lead to wrong classifications of farms into groups for comparative purposes.

Elsewhere and for another audience we have expressed our views on the usefulness of interfarm comparisons of ratios and margins for farm management extension purposes[1]. Briefly, the argument of that paper is that such comparisons are so untimely, so expensive, so inaccurate, so historical and so inherently ambiguous in their economic meaning as to be of slight usefulness for reliable planning, budgeting and diagnosis in farm management.

Many of the arguments of that paper are not new, but have been presented as a challenge to those who recommend that this method of analysis be used in Australia[2]. The purpose of this article is to amplify a point in our other paper which we believe has not been made before in the extensive discussions of this technique, and to document an experiment which illustrates its potential importance. Only the conclusions drawn from this experiment were reported in our other paper.

1 RECONCILIATION, VALUATION AND ALLOCATION

Discussions of comparisons of efficiency ratios and historical gross margins have all been based on the tacit assumption that the source data are of perfect accuracy or of insignificant inaccuracy. Their probable

---

* University of Western Australia.

[1] R. G. Mauldon and H. P. Schapper, "Random Numbers for Farmers", *Journal of the Australian Institute of Agricultural Science* Vol. 36, No. 4 (Dec., 1970), pp. 279-284.

[2] E. O. Burns, "Comparative Analysis of Farm Accounts", *Australian Journal of Agricultural Economics*, Vol. 10, No. 2 (December, 1966), p. 169.

accuracy is worth examining. Correctness implies three assumptions; first, that recording was accurate so that recorded sources and uses reconciled with actual sources and uses for both physical commodities and financial flows; second, that valuations were known objectively and with certainty; and third, when comparing departments or activities of farm businesses, that allocations reflected decision categories and that these were the same for all farmers in the comparison. That these assumptions are not met in practice is reflected by the necessity to make "adjustments" or "corrections" to accounting information before interfarm comparisons can be calculated[3]. Departures from these assumptions could seriously detract from any potential usefulness of interfarm comparisons in practice, and they lead us to suspect that many comparisons are meaningless, being biased by the non-random selection of errors of measurement and valuation.

To impose a common system of allocation is clearly less appropriate for the manager in farming than for the manager in almost any other type of business. Farming is characterized by joint inputs and joint products, with continuous opportunities for substitution between inputs, between products, and for the protraction or contraction of production over time. These all imply that there can be no unique way of defining farm activities, and that farmers rightly will differ in the ways in which they distinguish between them. A pattern of allocation imposed by an outsider must inevitably cut across the farmer's decision categories, increasing rather than minimizing the arbitrariness of allocations.

Values of transactions can be known with objectivity and certainty. Therefore, to the extent that information to be compared is dominated by market transactions, there may be negligible departures from the assumption of objectively certain valuations. But stocks vary widely in the degree of certainty about their values and the objectivity with which this degree of certainty is held. The value of cash balances can be known objectively and with certainty. On the other hand, valuations of inventories of land, livestock, plant and machinery, produce, and other financial assets are inevitably the expected values of subjective probability distributions[4]. Yet values of these different types become mixed in interfarm comparisons. In this context it is meaningless to compare interpersonal subjective probability distributions. Nor is meaning restored by having one "skilled analyst" impose his subjective valuations for all farmers in the comparison. It is entirely appropriate that managers

---

[3] E. J. Waring, "Comparative Analysis of Farm Accounts", *The Chartered Accountant in Australia*, Vol. 36, No. 9 (March, 1966), p. 660 and A. G. Volum and P. A. Rickards, "The Farmer and the Computer", *The Journal of Agriculture (Victoria)*, Vol. 67, Pt 6 (June, 1969), p. 172.

[4] For a critical analysis of the distinction between these concepts, see O. Morgenstern, *On the Accuracy of Economic Observations* (Princeton: Princeton University Press, 1963), Ch. 4.

make their own subjective probability estimates of values[5]. Also, the relative contributions of objectively certain and subjectively uncertain components vary from farm to farm[6].

To impose perfect reconciliation in accounting is to "contradict the probabilistic nature of the world"[7]. Particularly in farming, where a minimum of specialized resources is devoted to record keeping, it is ludicrous to assume that recorded sources and recorded uses do or should equal actual sources and actual uses. Differences between recorded sources and recorded uses are important pieces of management information which should be highlighted so that farmers can consider their significance and gauge whether it is worth the trouble and cost of recording for closer reconciliation. It is standard accounting practice to enforce a paper reconciliation. The assumption is that failures to reconcile either do not exist or that they can be traced and allocated at the end of the accounting period. In reality there are traceable and untraceable errors. Inevitably these become distributed among the accounts. Despite the resultant reconciliation, there is no way of knowing the truth of the picture which these accounts depict. Moreover, there is no evidence to assume that errors are distributed in a non-biasing manner, for this would require that failures to reconcile be distributed randomly between the components of sources and/or uses. But even if error allocations were random, their effect would not be neutral in interfarm comparisons, since the errors themselves can dominate the basis for allocating farms into groups.

2 INCREASING IMPORTANCE OF ERRORS UNDER DIFFERENCING

Errors are especially important when differences are compared. The most important difference calculations used in interfarm comparisons are historical gross margins. These are the difference between gross income from an enterprise and the variable expenses incurred in achieving it. In individual cases, errors of recording of gross income and variable

---

[5] For an account of the important role of subjective probability assessments in management see J. P. Makeham, A. N. Halter and J. L. Dillon, *Best-Bet Farm Decisions* (University of New England, Professional Farm Management Guidebook No. 6, 1968).

A different but related point on the significance of subjective assessments in income aggregations (and therefore comparisons) is made by J. R. Hicks, *Value and Capital* (Oxford: Oxford University Press, Second Edition, 1946), pp. 177–179.

[6] Using a rigorous assumption about certainty and an unambiguous definition of profit, Harcourt shows that accounting measures of profit are not independent, *inter-alia*, of rates of growth of capital stocks and holdings of financial assets. No easy rules of thumb could be found for compensation for differences between these characteristics. See G. C. Harcourt, "The Accountant in a Golden Age", *Oxford Economic Papers*, Vol. 17, No. 1 (1965), pp. 68–80.

[7] O. Morgenstern, *op. cit.* p. 71.

costs may cancel out, but there is no way of knowing whether they do. Overall, in gross margins comparisons, differencing increases the relative importance of variations which result from errors of recording.

A simple model demonstrates this. If r is true gross income and c is true variable costs, they could be related in the following simple linear manner

$$c = ar \tag{1}$$

where presumably

$$0 < a < 1. \tag{2}$$

However, gross income and variable costs are recorded with independent additive errors, u and v respectively. The calculated gross margin, g, is then

$$\begin{aligned} g &= (r + u) - (c + v) \\ &= (1 - a)r + (u - v) \end{aligned} \tag{3}$$

If the errors are independent, the variance of the gross margins is

$$\begin{aligned} \text{Var}\,(g) &= \text{Var}\,\{(1 - a)r\} + \text{Var}\,(u - v) \\ &= (1 - a)^2\,\text{Var}\,(r) + \{\text{Var}\,(u) + \text{Var}\,(v)\} \end{aligned} \tag{4}$$

the first term of the right hand side of (4) is less than Var (r) provided that

$$(1 - a)^2 < 1 \tag{5}$$

and is less than Var (c) provided that

$$(1 - a)^2 < a^2 \tag{6}$$

Condition (5) will apply under condition (2), and condition (6) will apply when

$$a > \cdot 5$$

The second term on the right hand side of (4) is the variance of the *difference* between the errors, and is equal to the *sum* of the variances of the errors. It can be seen from equation (4) that as the gross margin narrows ($a \longrightarrow 1$), the distribution of the error terms comes to completely dominate the distribution of the gross margin. The same argument follows, though less strongly, if assumptions are weakened to make relation (1) stochastic.

3 RECONCILIATION EXPERIMENTS FOR GROSS MARGINS COMPARISONS

To demonstrate the role which errors can play in comparisons of historical gross margins, we have conducted some experiments which use actual recordings of inputs and outputs allocated to sheep enterprises on farms. The experiments were based on records for 1968–69 of clients of the Farm Management Service Laboratory at the University of Western

Australia. The purpose of the experiments was to test the effect on the rank ordering and subsequent grouping of resultant gross margins of alternative distributions of differences between recorded sources and recorded uses of livestock, and with small random changes in livestock valuations.

Gross margins for livestock may be calculated in different ways, but they all have the following basic structure:

Gross Margin Calculation

(a) *Livestock Inventory Change*

(i) Closing Value =
numbers on hand at close .....
× average valuation ..... = + ...

(ii) Opening Value =
numbers on hand at opening .....
× average valuation ..... = − .....

= ± .....

(b) *Livestock Capital Transfers and Transactions*

(i) L/S sales = numbers .....
× average price ..... = + ...

(ii) L/S transfers out (inc. rations) = numbers .....
× average valuation ..... = + ...

(iii) L/S purchases = numbers .....
× average price ..... = − .....

(iv) L/S transfers in = numbers .....
× average valuation ..... = − .....

= ± .....

(c) *Other Income*

(i) Current produce not sold = quantities .....
× average valuations ..... = + ...

(ii) Current produce sold = quantities .....
× average prices ..... = + ...

= ± .....

(d) *Other Outgo*

(i) Current inputs not purchased = quantities .....
× average valuations ..... = − .....

(ii) Current expenditure = quantities .....
× average prices ..... = − .....

= − .....

.....

(e) *Gross Margin* $.....

It can be seen from this schedule that to calculate a gross margin implies not only accurate allocations, but also the aggregation of dollar flows with valuations of stocks, the differencing of revenue and cost aggregates,

and the assumption that recorded sources of livestock equal recorded uses. Where the gross margin is expressed on a per unit basis, as it usually is for comparative purposes, such as per acre, per animal, per man or per dollar, there is implied the additional assumption that the divisor has been accurately measured or valued.

Two sets of experiments were performed. The first set involved comparisons among forty-two individual sheep enterprises from randomly selected farmers having two or more sheep activities on their farms. The second set involved comparisons among forty-two total sheep flocks on randomly selected farms. As we expected, average differences between recorded sources and recorded uses of sheep were larger for individual sheep enterprises than they were for total sheep flocks. In the former case the average difference was 5·5 per cent of recorded sources or uses (whichever was the bigger) and had a standard deviation of 8·2 per cent. In the latter case the average difference was 4·8 per cent with a standard deviation of 5·9 per cent. As was also expected, opening and closing sheep valuations exhibited more variation for individual sheep enterprises than was the case for total sheep flocks. For individual sheep activities the average opening value was $5.72 with standard deviation of $1.92, and the average closing value was $5.92 with standard deviation of $1.80. For total sheep flocks the average values were $6.12 and $5.60, with standard deviations of $1.77 and $1.47.

Gross margins were calculated in each case. The individual enterprises or flocks were divided into three groups of equal size, on the basis of the calculated gross margin per sheep, the denominator being the average of sheep on hand at the beginning and end of the year. These gross margins were calculated from allocations and valuations as they were recorded by the farmer. However, recorded sources of sheep did not equal recorded uses of sheep in all cases, nor were valuations per animal the same for all farmers. Gross margins were therefore recalculated under a number of different allocations of failures to reconcile and under random adjustments of livestock valuations. New average gross margins were calculated for the same three groups of farms and differences between these averages were examined in relation to the variation within the groups.

EXAMPLES OF ADJUSTMENTS

The sorts of adjustments made in the experiments are illustrated in the following example. Recorded sources and uses and valuations of livestock of a particular sheep enterprise are as follows:

Recorded Sources

On hand at opening	2,315	valued at $5.70 per head
Purchases	15	bought for $45 per head
Transfers in	0	
Births	999	
Total	3,329	

Recorded Uses

Deaths	176	
Rations	3	valued at $4 per head
Sales	147	sold for $3.90 per head
Transfers out	371	valued at $6 per head
Lost or stolen	68	
On hand at close	2,350	valued at $5.90 per head
Total	3,115	

The difference between total recorded sources and total recorded uses is 214, or 6·4 per cent of recorded sources. To calculate a gross margin, this difference could be handled in many different ways. Four examples of handling this difference are: (i) to ignore it; (ii) to reduce opening numbers by the amount of the surplus of 214; (iii) to increase closing numbers by a random part of the surplus, say 73, and reduce opening numbers by the remainder of 141; and (iv) to make random adjustments to increase components of recorded sources and reduce components of recorded uses, weighted in proportion to the size of the recorded components, so that sources and uses are constrained to reconcile. Particular outcomes of these four treatments are:

Recorded Sources

	(i)	(ii)	(iii)	(iv)
On hand at opening	2,315	2,101	2,174	2,228
Purchases	15	15	15	15
Transfers in	0	0	0	0
Births	999	999	999	955
Total	3,329	3,115	3,188	3,198

Recorded Uses

Deaths	176	176	176	183
Rations	3	3	3	3
Sales	147	147	147	158
Transfers out	371	371	371	382
Lost or stolen	68	68	68	73
On hand at close	2,350	2,350	2,423	2,399
Total	3,115	3,115	3,188	3,198
Difference (Sources-Uses)	214	0	0	0

If the other recorded income for this sheep enterprise (wool, skins, etc.) was $8,602, and the other recorded outgo (shearing, wool packs, and other current inputs) was $3,785, then the gross margin calculations for each of the four treatments becomes as follows:

	(i*A*)	(ii*A*)	(iii*A*)	(iv*A*)
Livestock inventory change..	+ 670	+ 1,889	+ 1,904	+ 1,455
Livestock transfers and transactions	+ 2,136	+ 2,136	+ 2,136	+ 2,245
Other income..	+ 8,602	+ 8,602	+ 8,602	+ 8,602
Other outgo	− 3,785	− 3,785	− 3,785	− 3,785
Gross margin..	7,623	8,843	8,857	8,517
Gross margin per average animal	$3.27	$3.97	$3.85	$3.68

From this example it can be seen that not only do different methods of allocating failures to reconcile have an effect on calculated historical gross margins, but that livestock valuations themselves play an important role. Small random adjustments could be made to each of the valuations involved in the calculations, say increases of 35 cents to sheep on hand at the opening and 11 cents to sheep for rations, and decreases of 30 cents to sheep transferred out and 18 cents to sheep on hand at the close. Gross margin calculations for each of these four treatments are as follows:

	(i*B*)	(ii*B*)	(iii*B*)	(iv*B*)
Livestock inventory change..	− 564	+ 731	+ 707	+ 243
Livestock transfers and transactions	+ 2,025	+ 2,025	+ 2,025	+ 2,131
Other income..	+ 8,602	+ 8,602	+ 8,602	+ 8,602
Other outgo	− 3,785	− 3,785	− 3,785	− 3,785
Gross margin..	6,278	7,573	7,549	7,191
Gross margin per average animal	$2.69	$3.40	$3.28	$3.11

TREATMENTS

Outcomes of the experiments are summarized in tables 1 and 2. Treatments correspond to the types of adjustment which have been illustrated. However, treatments other than i*A* or ii*A* involve random adjustments, so the analyses were replicated twenty times to minimize anomalies which might be the result of particular random numbers selected. Results of tables 1 and 2 are the averages of the twenty replications. These tables give average differences between groups, and average numbers of transfers which would have been made between groups if the enterprises or flocks had been reclassified on the basis of the new gross margins.

In treatment i*A* gross margins were calculated with allocations as they were recorded by the farmer, with no allowances made for any failures to reconcile. It was on the basis of these gross margin calculations that enterprises or flocks were classified into low, median and high groupings in tables 1 and 2.

TABLE 1

Average gross margins ($) *per animal for individual enterprises classified by results based on treatment* i*A, and average numbers which would be switched between groups if enterprises were reclassified on results based on other treatments*

Treatment	Average margin per group			Average number of individual enterprises switched if farms were reclassified					
	1	2	3	1 to 2	1 to 3	2 to 1	2 to 3	3 to 1	3 to 2
i*A*	1·868	4·150	6·390						
ii*A*	1·848	4·328	6·730	2·00	1·00	2·00	3·00	1·00	3·00
iii*A*	1·192	3·716	6·182	2·65	1·00	2·70	4·00	0·95	4·05
iv*A*	2·001	4·166	6·456	3·70	1·00	3·05	5·50	1·65	4·85
i*B*	1·422	4·102	6·908	4·30	1·60	3·50	5·55	2·40	4·75
ii*B*	1·376	4·300	7·254	4·40	2·75	3·70	5·15	3·45	4·45
iii*B*	0·658	3·714	6·668	4·20	3·10	4·15	5·10	3·15	5·05
iv*B*	1·430	4·118	6·900	4·40	3·45	4·35	4·80	3·50	4·75

TABLE 2

Average gross margins ($) *per animal for total flocks classified by results based on treatment* i*A, and average numbers which would be switched between groups if flocks were reclassified on results based on other treatments*

Treatment	Average margin per group			Average number of total flocks switched if farms were reclassified					
	1	2	3	1 to 2	1 to 3	2 to 1	2 to 3	3 to 1	3 to 2
i*A*	1·754	3·540	5·648						
ii*A*	2·004	3·950	5·944	3·00	0·00	3·00	2·00	0·00	2·00
iii*A*	1·664	3·332	5·022	3·50	0·50	4·00	3·20	0·00	3·70
iv*A*	2·314	3·786	6·056	5·05	1·70	5·50	2·70	1·25	3·15
i*B*	1·786	3·798	6·362	4·80	2·65	5·80	3·10	1·65	4·10
ii*B*	2·084	4·058	6·672	5·00	3·65	5·60	3·75	3·05	4·35
iii*B*	1·410	3·338	5·980	5·15	3·35	5·25	4·50	3·25	4·60
iv*B*	1·830	3·732	6·364	5·00	3·55	4·60	4·75	3·95	4·35

Treatment ii*A* is an arbitrary though consistent adjustment of data. Opening or closing numbers of livestock were adjusted by the amount of any failure to reconcile. If recorded sources exceeded recorded uses, opening numbers were reduced by the amount of the surplus. If recorded sources were less than recorded uses, opening numbers were reduced by the amount of the surplus. If recorded sources were less than recorded uses, closing numbers were reduced by the amount of the deficit.

Treatment ii*A* is systematic, but the gross margins estimates which come from it are not unbiased since nothing was left to chance in the way in which failures to reconcile were allocated. Yet in the absence of

information about the nature of any failure to reconcile, a good case could be made for allocating it in some random manner. In treatment iii*A* gross margins were recalculated after failures to reconcile has been allocated at random between opening and closing livestock numbers. If recorded sources exceeded recorded uses, a random part of the surplus was used to augment closing numbers; the remainder was used to decrease opening numbers. If recorded sources were less than recorded uses, random allocations of the deficit were made to augment opening numbers and diminish closing numbers.

Whereas the basis of allocation of treatment ii*A* could be criticized because it does not rely on a random distribution of discrepancies, treatment iii*A* could also be criticized because it ignores information about both the possible components of discrepancies between recorded sources and uses of livestock, and the probable extent of each of these components. In treatment iv*A* adjustments to bring all sources and uses into full reconciliation were made at random, but the extent of each component in the adjustments varied with the size of the recorded component.

Where total recorded sources exceeded total recorded uses, the surplus was allocated in this weighted random manner by reducing opening numbers, increasing closing numbers, decreasing transfers in, increasing transfers out, decreasing purchases, increasing sales, and increasing deaths and rations. Reverse allocations were made where recorded sources were less than recorded uses.

The analyses of treatments i*A* to iv*A* were all made on the assumption that differences between valuations of livestock were accurately recorded with objective certainty. Variation between livestock valuations does, of course, reflect differences in characteristics of animals and the markets on which they could be bought or sold. But superimposed are differences in farmers' knowledge about their livestock characteristics, their uncertainties about markets, and their attitudes toward risks—all of which affect their (or anybody else's) evaluation of worth. In treatments i*B* to iv*B*, failures to reconcile were handled in the same manner as in treatments i*A* to iv*A*, but random variation was allowed to take place around the valuations provided by the farmer. Standard normal variates, truncated to two standard deviations on either side of their means, were added to the unit values of opening numbers, closing numbers, transfers in, transfers out and rations. These variates had means of zero, and standard deviations equal to half the standard deviations of the corresponding unit values for all of the individual enterprises or all of the total flocks.

OUTCOMES

It must be stressed that the replications were of random adjustments, not of samples of individual enterprises or of total flocks. In some individual runs of the experiments some anomalous results were obtained, but

overall the variation of the results between replications was very small. However, since interfarm comparisons themselves are rarely replicated, anomalies are likely to show up in particular cases.

The tables show that various treatments of failures to reconcile and allowances for uncertainties of valuation can lead to considerable differences in the apparent average performance within each group. The biggest changes are in the lowest and highest groups, which contain some of the largest failures to reconcile. Generally, variation between groups is increased slightly by the alternative treatments, but variation within the groups is increased much more.

The increased variation within the groups is reflected by the number of enterprises or flocks which would be switched between groups if observations had been reclassified on the basis of the new calculations. By whatever manner the gross margins were calculated for ordering into groups, alternative treatments of failures to reconcile, or an alternative valuation of livestock inventories and transfers, would have caused considerable switching of farms between groups. Alternative treatments of failures to reconcile would have caused between a quarter and a half of the individual enterprises or total flocks to shift from one group to another. If, in addition to these treatments of failures to reconcile, small random changes were made to valuations in the gross margins calculations, more than one half of the enterprises or flocks would shift into different groups.

Performance in tables 1 and 2 has been classified into three groups, based on calculations of gross margins from unadjusted data. Obviously, the extent of swapping between groups would have increased if enterprises or flocks had been divided into more groups. Also, the particular outcomes would have been different if groupings had been based on any of the other seven treatments.

TABLE 3

Average rank correlations between orderings of gross margins under different treatments (above the main diagonal for individual sheep enterprise and below the main diagonal for total sheep flocks).

Treatment	i*A*	ii*A*	iii*A*	iv*A*	i*B*	ii*B*	iii*B*	iv*B*
i*A*		·746	·655	·620	·471	·313	·279	·233
ii*A*	·883		·866	·802	·582	·378	·328	·264
iii*A*	·661	·832		·898	·616	·388	·316	·254
iv*A*	·501	·644	·754		·741	·478	·377	·306
i*B*	·394	·453	·465	·569		·601	·456	·393
ii*B*	·181	·226	·242	·357	·510		·723	·571
iii*B*	·284	·215	·226	·290	·362	·531		·724
iv*B*	·144	·164	·165	·191	·247	·321	·556	

Under the hypothesis of no rank association, the rank correlations are 0·304 at the 5 per cent significance level, and 0·393 at the 1 per cent level.

To discriminate most completely between the variation introduced by allocations of failures to reconcile and random revaluations, we should consider their effects on the rank orderings of gross margins calculations. This has been done in table 3 which shows the average rank correlations between gross margins calculations for all pairs of treatments. Figures above the main diagonal are rank correlations for individual sheep enterprises. Those below the main diagonal are for total flocks.

Apart from the important role which errors of measurement can play in biasing estimates of average performance between groups, it should be borne in mind that the observations are themselves only a sample of performance in a single year, and that it could be confidently expected that in a subsequent year, average performance in these same groupings of farms would "regress" toward the overall mean of all observations[8]. Regression bias is additional to error of measurement bias, and has not been investigated in these experiments.

We have no way of knowing what the "true" gross margins were. But the results of these experiments on some actual recordings by farmers suggest that the groupings under which farms or enterprises might be classified can be very sensitive to both the manner in which deficiencies of information about inventories are distributed, and to uncertainties about valuations.

4 CONCLUDING COMMENTS

In conclusion, three observations need to be made about the nature of the information used in these experiments. First, on the whole the deficiencies of information were not large. We do not know how accurate, or complete, is recording of livestock numbers on farms for which interfarm comparisons are normally made. In the Laboratory's system the farmer is responsible for his own recording, and the monthly frequency of recording for processing minimizes demands on his memory and maximizes opportunities to use primary documents[9]. We suspect that deficiencies of information about sources and uses of livestock are generally greater among the farming community than those on which this study has been based.

---

[8] For a discussion of the possible role of statistical regression in confounding the validity of inferences drawn from groupings made on the basis of least to highest performance, see D. T. Campbell and J. C. Stanley, *Experimental and Quasi-Experimental Designs for Research* (Rand McNally, 1966), pp. 10–12.

[9] For descriptions of the Laboratory's accounting system and the relationship of farmer recording and allocating to accuracy, see articles by R. G. Mauldon, H. P. Schapper and D. W. G. Treloar; "A Managerial Accounting System for Australian Agriculture", *Abacus*, Vol. 4, No. 1 (August, 1968), pp. 39–50, and "Operation Accounting for Farm Management", *Australian Journal of Agricultural Economics*, Vol. 13, No. 1 (June, 1969), pp. 47–57.

Second, in our study the variation between groups is extremely large. We made no effort to select enterprises or flocks from the same district or from farms with the same management characteristics. This is normally done to some extent when interfarm comparisons are made, and the consequence is that relative variation between groups is normally much smaller than the figures in our analyses. But we see no reason for thinking that the variation within groups which would be added as a result of allocations of failures to reconcile or from changes in valuations, would normally be any smaller than in our study. We therefore suspect that within-group variations tend to dominate between-group variations to an even larger extent in the farming community than is suggested by the results of this experiment.

Third, the variations of values which we have introduced into our experiments are not large. In over half of the cases, random adjustments were less than 60 cents per head. In view of the observed differences in livestock values between individual enterprises or total flocks (which could be expected to some extent because enterprises and flocks were not selected for uniform characteristics) and the observed differences between opening and closing valuations within individual enterprises and total flocks, random components of the order introduced do not seem to be at all unreasonable. They also do not seem to be unreasonable in view of the frequency with which livestock valuations are rounded to the nearest 50 cents.