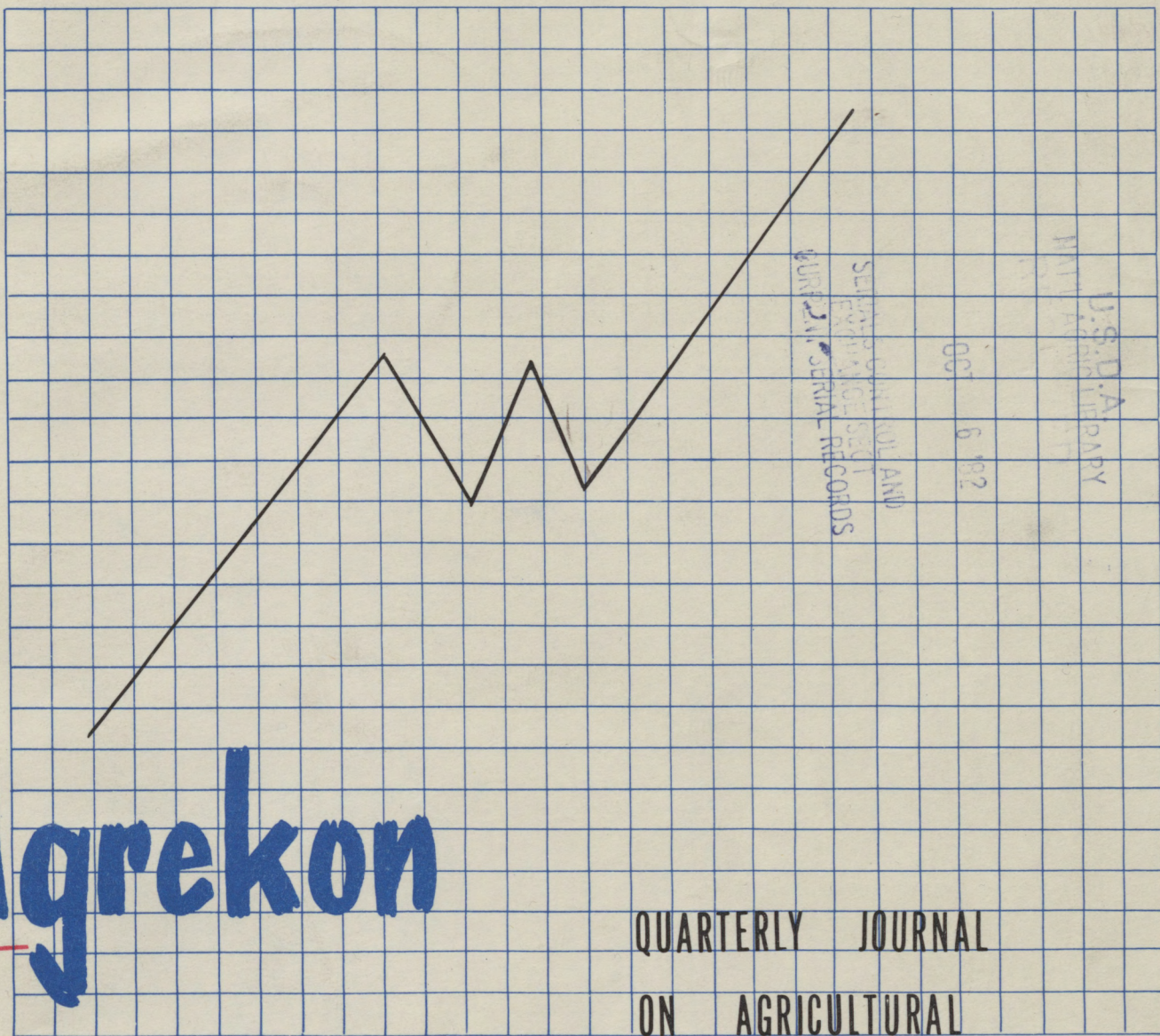IND/DcB.

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THE ECONOMICS OF ESTABLISHING AN INTENSIVE PIG UNIT, I: THE USE OF STATIC BUDGETING TECHNIQUES

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Introduction

Great interest in livestock production has arisen of late following the sharp increase in meat prices towards the end of 1980. This series of two articles is aimed at providing deeper insight into the economics of pig production and the necessary steps to follow when planning a new investment project. This article deals with the use of partial, break-even and parametric budgeting in evaluating the economics of a pig enterprise. In the second article the use of cash flow budgets and discounted cash flow techniques will be evaluated.

For the purpose of this exercise a 100-sow unit was chosen. This is considered to be a useful standard in pig farming, although under half of the pig herds in South Africa have fewer than 100 breeding sows (5). The evaluation procedure that is followed here can, of course, be applied to any farming project.

Partial budget of a 100-sow unit

A partial budget is a device used to estimate the financial implications of adjustments to a farm business. It deals with costs and returns that change as a result of the marginal adjustment. The additional returns plus reduced costs (credits) are compared with the additional costs plus reduced returns (debits). The proposed change is considered acceptable if the credits are greater than the debits.

Of major importance in any budgeting procedure are the basic assumptions on which the analysis will be based. The final result can only be as reliable as the quality of the data used. In this exercise it is assumed than an established farmer wants to expand his farming activities and establish a 100-sow unit. No additional manager will be required. Additional capital investments in fixed and movable assets amount to R134 200. All depreciable assets will be written off over 12 years because of the risk involved and since a great proportion of the investment in such an intensive

unit, particularly the buildings, has no alternative uses.

Sow productivity is taken as 18 pigs reared per year with 2,1 litters. The sow replacement rate per year is 30 % of the sow herd and two boars are culled. Of the total number of pigs reared, 15 % are sold as porkers and the rest, after selecting for replacement gilts, as baconers. The feed conversion ratio (FCR) from weaning to 50 kg livemass is taken as 2,8 and from 50 kg to 85 kg livemass as 3,5. Feed is mixed on the farm. Prices are as at the end of January 1981.

A partial budget analysis of the proposed pig unit is shown below. No reduced costs or reduced returns are involved.

TABLE 1 - Partial budget of a 100-sow pig unit, 1981

			R
(a)	*Additional income*		
	Gross income (sale of pigs)		142 442
	less marketing costs		5 789
	Gross income, net of marketing costs		136 653
(b)	*Additional costs*		
	Feed		91 139
	Veterinary @ R2/pig reared		3 600
	Transport:	Railage R1 486	
	Contract	R1 300	2 786
	Labour: 5 men @ average R80 per month		4 800
	Depreciation (fixed and movable assets (over 12 years))		10 050
	Repairs and maintenance		1 970
	Fuel		950
	Electricity		2 000
	Miscellaneous		2 000
	Boars:	2 @ R350	700
	Total costs, excluding interest and management		119 995
	kg feed/kg deadweight		4,8

The additional return to capital and management (net farm income) amounts to R16658, or 12,4 % on the initial capital and 22,5 % on the average capital used during the period. The latter return should be compared to the cost of capital to determine the economic viability of the project. Based only on the cost of borrowed money (debt capital) of say 16 %, the project appears to the profitable. However, the cost of using one's own capital should also be considered. It is

generally considered to be higher than that of debt capital because of the higher opportunity return. Assuming an average interest on capital of R12 000 per annum, the return to management and land (from now on called profit) is R4 658.

The above type analysis is often used to calculate the profitability of an enterprise during a certain period of time. However, for investment appraisal the average or most likely situation should be evaluated since relative prices may change from one period to the next. This is particularly relevant to the pig industry with its characteristic 4-year cycle. A representative meat to feed price ratio over the whole cycle should be used.

Luening (4), in his article on partial budgeting, extended the basic profitability analysis with a "replacement capacity" analysis which deals only with the effect of a change on the cash situation. However, since this analysis does not consider cash flows over time it is not considered worthwhile.

Break-even budgeting

It is obvious from the above analysis that the reliability of the budget result depends on the reliability of the data used. The data should be based on the most likely estimate of the parameters concerned. However, there may be considerable undertainty about one or more of the major vaiables used. The decision-maker would like to have some idea of the degree of safety of his estimates. Although break-even and parametric budgeting do not solve the problem of uncertain data they can provide an indication of what will happen should certain variables change (3).

With break-even budgeting one important variable is usually considered. The decision-maker would want to know at which level of this variable the proposed change would show no profit. For example, how many pigs should be reared per year in order to break even? Or, at what level of baconer prices would gross income just offset total costs? To illustrate this technique the number of pigs reared per 100 sows per year is taken as the uncertain parameter. Let it be represented by the symbol n.

At this stage it is important to distinguish between variable and fixed costs. Variable costs, in this context, are those that change with the number of pigs reared. They include such cost items as feed (except the boar, sow and replacement gilts' maintenance requirements), marketing and veterinary expenses. Contract transport and railage are considered fixed since one load of pigs, irrespective of the number (within limits), is sold every week. Fixed costs are those that do not change with the number of pigs reared.

At the break-even level profits are zero. Thus gross income equals total costs. The following equations have been determined:

Gross income (net of marketing costs) =
$$75,13 \text{ n} + 1\,429,99$$
Total costs $= 44,25 \text{ n} + 52\,358,93$

Profit (P) = gross income *minus* total costs.
At break-even P = 0,
i.e. $75,13 \text{ n} + 1\,429,99 = 44,25 \text{ n} + 52\,358,93$
$$30,88 \text{ n} = 50\,928,94$$
$$\text{n} = 1\,649,25$$

Hence, under the assumptions made, 1650 pigs reared per year would enable the unit to break even. This gives the decision-maker a guide-line as to the safety of his estimate. It also acts as an incentive in that it provides a minimum standard to comply with in practice.

Another advantage of such an analysis is that, once the equation has been established, the algebraic symbol can be replaced with any figure in order to determine the effects on profit. For example, should 2 000 pigs be reared per year, the profit would be R10 831.

From the analysis above it may be seen that the break-even yield (BEY) can be determined with the following formula:

$$\text{BEY} = \frac{\text{fixed costs } \textit{minus} \text{ fixed income}}{\text{variable income/unit } \textit{minus} \text{ variable costs/unit}}$$

where fixed income refers to income that does not vary with the number of pigs sold, for example, income from the sale of culls.

Parametric budgeting

Parametric budgeting is simply an extension of break-even analysis. The effects on profit of changes in two or more parameters and not one parameter only are considered.

To illustrate this technique three parameters are considered (algebraic symbols are given in brackets) : the number of pigs reared per year (n), the weighted average price of baconers (p) and feed conversion in the baconer stage (f).

With the data in the partial budget serving as base, the following equations can be derived in terms of the algebraic symbols used:-

Income (net of marketing costs) =
$4,58 \text{ n} + 53,98 \text{ np} - 1\,905\text{p} + 3\,919,83$
Total costs $= 26,95 \text{ n} + 4,94 \text{ nf} + 52\,358,93$
Profit = income - costs
$= -22,37 \text{ n} + 53,98 \text{ np} - 1\,905 \text{ p} - 4,94 \text{ nf} - 48\,439,10$

The effect of each unknown on profit can be evaluated by considering different levels of one parameter while keeping the others constant at their most likely levels. In effect, the sensitivity of profit to parameter value changes is tested. Hence also the term "sensitivity analysis" for this technique. (1, p 394).

The results can be shown in tabular or graphical form. For simplicity, three tables could be constructed which show the effects on profit of changes in two parameters, with the third one left constant. To illustrate only one table will be presented. (See Table 2)

The effect on profit of improved productivity is obvious. The partial budget was based on 1 800

TABLE 2 - The effects on profit of changes in the number of pigs reared per year (n) and variations in baconer feed conversion (f) for a 100-sow unit (the weighted average price of baconers (p) is kept constant at R1, 307 per kg dressed mass)

| | | Number of pigs reared per year | | |
		1 600	1 800	2 000
Feed conversion	3,3	76	6,451	12 827
in baconer stage	3,5	-1 505	4 673	10 851
(kg feed/kg	3,7	-3 086	2 985	8 875
livemass gain)	3,9	-4 667	1 116	6 899

pigs reared and a feed conversion of 3,5, giving a profit of R4 658. The slight discrepancy of R15 with the above analysis is due to rounding errors in the construction of the equations.

A useful extension of the above analysis is a graphical presentation.

A graphical presentation is useful in that it enables the planner to determine profits at various parameter levels relatively quickly. Break-even levels of the number of pigs reared at various feed conversion levels are also readily discernible.

It is apparent from the above analysis that parametric budgeting provides more useful information than partial budgeting on its own. It "adds to the flexibility of partial budgeting and allows the planner to obtain more insight into the relationship determining the effect on farm profit of a particular proposal". (3, p 114).

Conclusions

Partial budgeting is useful for evaluating in broad terms the financial implications of a proposed change to a farm business. Since it is based on the most likely estimates of variables an element of uncertainty is involved, with some parameters more than with others. The end result of such an exercise is only as reliable as the quantity of the data used.

Break-even and parametric budgeting can serve as useful extensions to the basic analysis. Although these two techniques do not eliminate uncertainty they do provide the planner with more information regarding the sensitivity of profit to changes in some important variables. A greater degree of flexibility is involved.

However, what is apparent from an analysis of these techniques is that they cannot be used in isolation when evaluating new investment projects. A considerable amount of information is not provided, for example, capital requirements over time, the effect of the financing strategy and income tax payments on the cash flows over time. All in all, analysis is more than determining the average change on the trading account.
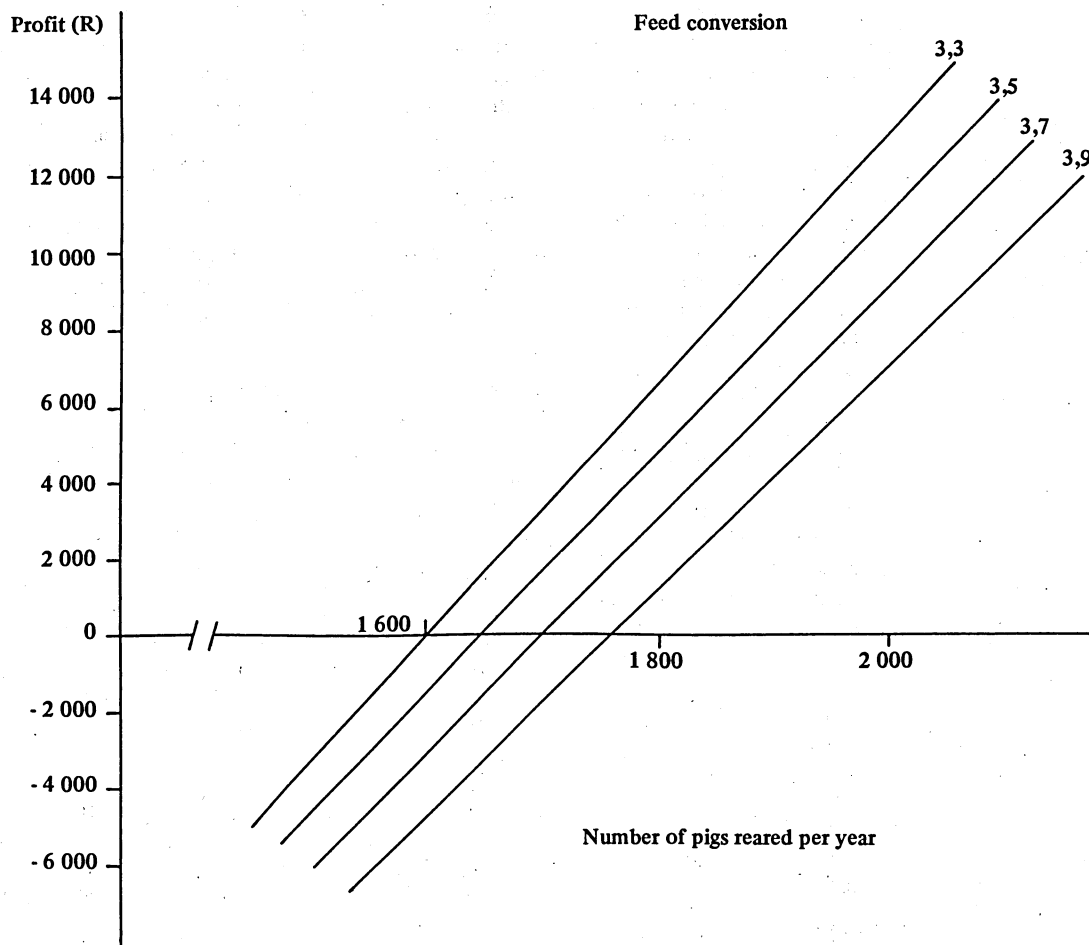

FIG. 1 - The relationship between feed conversion, number of pigs reared per year and profit for a 100-sow unit

3

Consideration of the time patterns of cash flows also becomes important when mutually exclusive projects are to be analysed and ranked according to their rates of return. A project showing quicker returns in earlier years has an advantage over projects in which returns are only received in later years because of the time value of money (i.e. a rand today is worth more than a rand later). Static budgets may give rise to erroneous conclusions when ranking these projects since they do not consider cash flow patterns (2, p 262). For these reasons it is considered necessary to extend the basic analysis to include a discussion on cash flows and discounted cash flow techniques. This will be the subject of the second article.

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