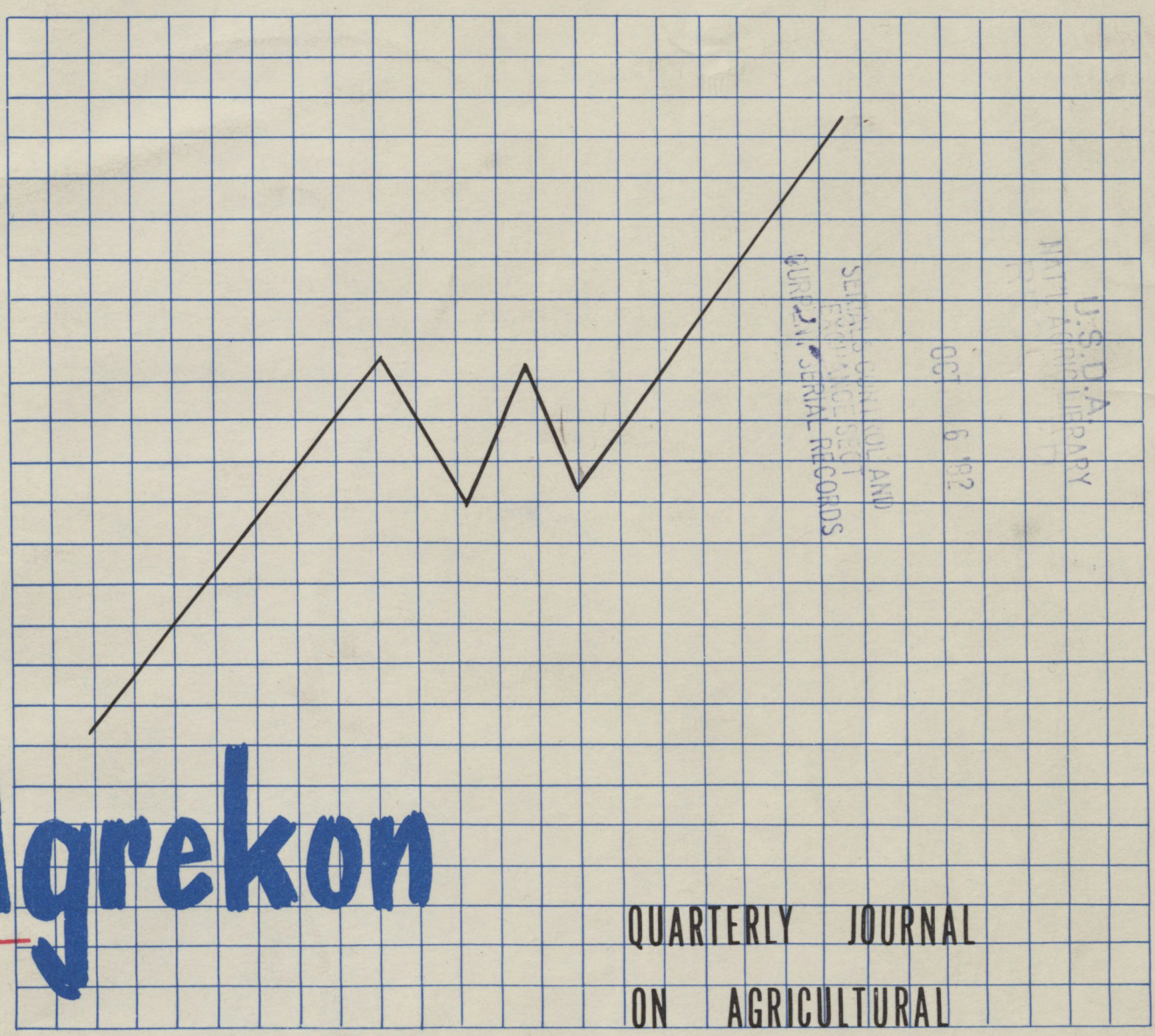
Vol. 20 No. 3
OCTOBER 1981

Price 50c
(48c + 2c GST)



Agrekon

QUARTERLY JOURNAL ON AGRICULTURAL ECONOMICS

Issued by the Department of Agriculture and Fisheries, Pretoria

THE ECONOMICS OF ESTABLISHING AN INTENSIVE PIG UNIT, II: THE USE OF DISCOUNTED CASH FLOW TECHNIQUES

by G.F. ORTMANN
University of Natal

Introduction

In the first part of this series of two articles an attempt was made to explain the usefulness and also the disadvantages of using static budgeting techniques in investment appraisal. Partial budgeting is useful in analysing the average impact of a proposed change on the farm trading account. The analysis can be extended by determining break-even levels of important variables and also to ascertain the effects on profit of changing the levels of certain variables. Break-even and parametric budgeting do not eliminate uncertainty but they do provide the decisionmaker with more information and greater flexibility.

However, for all the advantages of these techniques they have a decided disadvantage in that they do not consider the time patterns of cash flows. These will be crucial when attempting to rank mutually exclusive investment projects according to their rates of return. The use of only partial budgeting may give rise to erroneous conclusions (2, p. 262).

In this article the pig project will be analysed using discounted cash flow techniques. The major objective is to provide greater insight into these techniques. As the name implies the use of cash flow budgeting is involved. In addition to serving as a basis for the discounting procedure, cash flow budgets are useful in determining additional capital requirements and are helpful when negotiating for credit.

Since the financing of a project plays a vital role in its success and the loan repayments affect the cash flow situation over time the financing strategy that will be followed in this exercise is discussed in the next section. This will be followed by an evaluation of cash flow budgeting and discounted cash flow techniques.

Financing strategy

It is assumed that the farmer will use only borrowed funds and that he has sufficient collateral for this purpose. Financing will be done through a registered general bank with a R150 000 bond loan to be repaid over 10 years. The interest rate is taken as 16% for the first five years and 18% for the last five years. Repayments will be once a year in arrear. Overdraft interest rates have been taken as 15% for the first three years, 16% for the next three, and 17% for the remaining years. The above interest rates were chosen after consultation with the manager of a registered general bank.

Cash flow budgeting in pig production

A cash flow budget reflects all expected inflows and outflows of cash over a certain period of time, which may be a month, a quarter or a year. Over the short term the projected figures are usually grouped on a monthly basis. However, for enterprises with relatively constant monthly cash flows (for example, dairying or pig farming), quarterly or half-yearly budgets may suffice. These budgets are useful in that they estimate the future capital requirements of the business and enable the manager to plan his financial requirements and income tax commitments. They are useful tools when negotiating for credit.

Of major importance when projecting cash flows are the basic assumptions made. "Mistakes in these basic assumptions will lead to incorrect cash flow forecasts and consequently to bad accept-reject decisions" (with regard to discounted cash flow techniques) (3, p. 257).

Two cash flow budgets were drawn up. The first showed projected monthly cash flows for the period May 1981 to April 1982, the year of development. Bank overdraft requirements were expected to be about R100 000 in April, 1982. The second budget showed annual cash flows over a 12-year period of time and reflected the annual bank balance status. In addition it served as basis for the discounted cash flow analysis. Overdraft requirements were expected to reach a peak of about R164 000 in 1986/87. Inflation was considered in making these projections. The effect of cash flows from other farming activities was ignored.

Since cash flow projections consider the time factor, additional assumptions have to be made over and above those that apply to the partial budget. In this exercise price trends of inputs over the last six years were used as guides in projecting the annual cash flows up to 1992/93. With regard to pigmeat and feed prices a study of past trends has shown that over the 25-year period 1950/55 to 1975/80 (5-year averages were used to eliminate year-to-year variations) the pork price increased by

5,2 % per year, the pigmeal price by 5,1 % and the price of maize grain, the major component of balanced feeds, by 3,9 % (4). The demand for feed is derived from the demand for livestock products (5). The income elasticity of the demand for meat is higher than that of the demand for cereals with the result that demand shifts in meat and cereals will tend to show relatively greater price increases for meat. The extent of the price increases hinges on the elasticities of supply of meat and cereals.

In accordance with the long-term tendency for pork and pigmeal prices to increase at similar rates the price of feed in the annual cash flow budget was increased by a constant 14 % per annum while pork prices were varied with the pig cycle but averaged 14 % per year over the 12-year planning period.

The pork to feed price ratio shows a four-year cycle due to variations in the supply of pigs. An attempt was made to simulate this cycle in the annual cash flow budget with the use of historical ratios of various stages in the cycle. The next peaks in the cycle are expected in 1983/84, 1987/88 and 1991/92. It is useful to monitor this ratio on a regular basis for future planning purposes. The net effect of the cycle on the individual producer's situation will depend on such factors as the feed conversion ratio, the net price per kg of meat and feed and ther percentage feed costs constitute of total costs.

With regard to the other cost items in the annual cash flow budget the following annual percentage increases were used: 15 % for labour, repairs and maintenance, electricity (line charges fixed at R100 per month) and miscellaneous; 20 % for hired transport and railage; 25 % for fuel and 13,5 % for veterinary costs. The salvage value of the project after 12 years was taken as R175 000, the value of the herd.

Discounted cash flow techniques

Money has time value. A rand today is worth more than a rand sometime in the future, mainly for three reasons: Alternative uses for today's rand, uncertainty in the future and inflation (1, p.9). Therefore, in order to compare the values of different sums of money, the comparison must be made at the same point of time. This is achieved by either discounting or compounding with an appropriate interest rate.

The discounted cash flow (DCF) techniques of investment appraisal make use of the discounting procedure. Net cash flows over time are considered rather than accounting profits. Additional data needed for the procedure include the initial capital investment, the length of the planning period, the terminal value of the project and an appropriate discount rate, which is usually the cost of capital or the minimum required rate of return.

Two DCF techniques may be used in evaluating investments, namely the net present value (NPV) method and the internal-rate-of-return (IRR) or yield of investment method. For the NPV technique projected net cash flows, which reflect the difference between cash incomes and cash operating expenses, are discounted to their present values with the use of discount factors corresponding to a certain rate of interest. The initial capital investment is subtracted from the sum of the present values to yield the NPV. The model can be shown as follows:

$$NPV = -CAP + NCFi\,(1 + r)^{-1} + \ldots + NCF_n\,(1 + r)^{-n} + SV\,(1 + r)^{-n}$$

where CAP = initial capital investment
NCFi = net cash flow in period i
r = interest rate
SV = salvage value in year n
n = number of years (planning period)

The proposed project is economic if the NPV is positive and will be rejected if it is negative. If mutually exclusive projects are compared the one with the highest NPV will be preferred.

The IRR is that rate of interest which equates the NPV to zero. In the above model, with $NPV = 0$, $CAP = NCFi\,(1 + r)^{-1} + \ldots + NCF_n\,(1 + r)^{-n} + SV\,(1 + r)^{-n}$. This means that the IRR (r in this case) equates the present value of the net cash flows with the initial capital investment. It is the yield of the investment and is determined by trial and error. The IRR can then be compared with the required rate of return (RRR) before a final decision is made. If the IRR>RRR the project is acceptable, and vice versa. Mutually exclusive projects can be ranked according to their respective yields.

The major advantage of the DCF techniques compared with the simple-rate-of-return method as used in partial budgeting is the fact that the time patterns of cash flows and the time value of money are considered. The relative advantages and disadvantages of the NPV and IRR methods are discussed in most books on financial management. Under most circumstances the two methods will give the same results. However, some complex investments may have more than one yield. In general the NPV method is easier to use and is more reliable (1, 2, 3.)

The cost of capital

It was pointed out in the last section that the time value of money is influenced by three factors, namely, alternative uses, uncertainty and inflation. The cost of capital is closely related to the time value of money and is generally considered to include its three components : a risk-free, inflation-free rate for time preference, an allowance for risk and a premium for inclation (1, p. 45; 2, p. 271). The cost of capital is "the cutoff rate or minimum rate of return which must be earned by a capital expenditure project to make it acceptable" (1, p. 45).

Equity capital (i.e. capital from retained earnings) is often considered to be "costless". This is not the case since the use of retained earnings implies opportunity costs of not using these funds

in alternative investments of comparable risk, on the farm or elsewhere. It can also be seen as the required rate of return needed to encourage the manager to increase retained earnings at the expense of consumption (2, p. 293). To measure this cost is difficult and it is largely a matter of judgement (1, p. 52). In general the cost of equity capital is greater than that of borrowed funds since "suppliers of debt capital assume a lot less risk than the suppliers of equity capital" (1, p.52). The cost of equity capital also varies from business to business due mainly to differences in risk and managerial ability (1, p.52).

Increasing the leverage or debt to equity ratio of a business will improve the growth rate of equity if the rate of return on borrowed money is greater than the cost of that money, other factors being constant (2, p. 191). However, at the same time higher leverage reduces liquidity and increases the risk of bankruptcy. Each firm will have its own optimum leverage ratio (where the weighted average cost of capital is the lowest) depending on the relative costs of debt and equity capital.

In this exercise the project is to be financed with debt capital only. Since this project is part of an ongoing farm concern the cost of capital to use in the discounting procedure should also include a component from the cost of retained earnings. The reason for this is that over time a firm will use capital from both sources. Using only debt capital implies that "the firm is also using up some of its potential for obtaining new low-cost debt" (3, p. 400). Should the firm want to expand in the future it will at some time have to use more of its own funds to prevent the leverage ratio becoming too high. The cost of capital to use therefore should be a weighted average of the various types of funds used. The weights will be determined on what management considers to be a balanced capital structure in the long term. As Aplin *et al* (1) point out, the investor should be interested in the future cost of capital rather than the present or past, which can serve as a guide. "The investor then modifies his firm's cost of capital to reflect his judgement of the future" (1, p. 49).

As was pointed out earlier the cost of capital includes an inflation factor. The net cash flows to be discounted should therefore be nominal (money) values and not real values. If the cash flows are in real values then the discount factor should exclude the inflation component; it would only consist of the risk-free, inflation-free component (say 3 or 4 %) and a premium for risk.

For the purpose of this exercise the cost of debt capital is taken as 18 % and that of equity capital, after tax, as 20 %. The weights are taken as 0,5 in each case. The cost of debt capital is not reduced here by the marginal tax rate since advantages of not paying tax due to the accumulated loss are considered in the net cash flows. It is also wise to work with conservative figures. Based on the above assumptions, the weighted average cost of capital is 19 %.

Results

Table 1 below provides a summary of the use of DCF techniques in appraising the proposed pig project. The cash flows were obtained from the annual cash flow budget. The cash outflows do not include the loan repayments (redemption plus interest) nor the interest on overdraft since discounting would imply the double-counting of interest costs. Capital redemption is not a direct cost to the project. Expenditure on capital items is also not included since they are shown as the initial cost of the project and all capital, except livestock, is assumed to be fully depreciated over the period of analysis. With regard to income tax, the first payment is only due in 1991/92 owing to the accumulated loss incurred.

The exclusion of financing transactions means that the yield of the investment can be compared with the weighted average cost of capital to determine its acceptability. Another approach would be to include the loan repayments in the cash outflows and to compare the discounted cash flows with the initial equity in the investment (2, p. 269). This enables the investor to obtain an approximation of the return on his own equity capital and to use the cash flow budget more in its

TABLE 1 - The use of DCF techniques in evaluating the profitability of the proposed pig unit (capital investment (CAP) = R134 200)

Year	Cash inflows	Cash outflows	Net cash flows	Real present values @ 19 %	@ 20 %	@ 21 %
(1)	(2)	(3)	(4)=(2)-(3)	(5)	(6)	(7)
1	10 000	78 625	-68 525	-57 582	-57 102	-56 629
2	159 800	140 480	19 320	13 644	13 416	13 196
3	219 900	161 860	58 040	34 441	33 588	32 764
4	231 300	184 920	46 380	23 130	22 369	21 636
5	232 800	211 390	21 410	8 971	8 605	8 254
6	282 900	241 670	41 230	14 517	13 808	13 136
7	371 500	276 400	95 100	28 140	26 542	25 040
8	390 100	316 210	73 890	18 376	17 187	16 078
9	393 300	361 880	31 420	6 567	6 089	5 652
10	477 700	414 270	63 430	11 138	10 244	9 426
11	628 100	479 534	148 557	21 927	19 996	18 243
12	776 200	585 802	190 398	23 609	21 363	19 325
		Total present values (TPV)		146 878	136 105	126 121
		Net present values (NPV=TPV - CAP)		12 678	1 905	-8 079

original form. However, several disadvantages are attached to this method (1, p. 48).

The analysis shown that with a weighted average cost of capital of 19 % the NPV is positive. The proposed project is therefore profitable since the rate of return is higher than the minimum required rate.

The yield on the investment (IRR) is determined by trial and error. Different discount factors are used in order to find the one at which the NPV is zero. With discount factor of 20 % the NPV is still positive but becomes negative at 21 %. The yield must therefore be between these two values. With the use of interpolation the yield is found to be 20,2 %. At this level the sum of the present values of the net cash flows exactly equals the initial capital investment. Since this rate is higher than the cost of capital (the minimum required rate of return) the project is economic.

The payback period, which indicates the number of years required to recover the initial investment, is 6,2 years.

Conclusions

This article has attempted to illustrate the importance of using DCF techniques instead of static budgeting when appraising investment projects. DCF analysis is more powerful since it considers cash flow patterns over time and also the time value of money. For these reasons, static budgets should never be used in isolation when major projects are to be evaluated, especially in cases where they are to be ranked according to their rates of return.

With regard to the profitability of the pig unit it should be stressed that a piggery averaging 18 pigs reared per sow per year is a relatively efficient one. The national average during the middle of the 1970's was below 14 (6). As productivity decreases, profitability also falls as was shown under parametric budgeting in the first article. However, a figure of 18 pigs reared per sow should be within the reach of an efficient farmer, as some farmers known to the writer are obtaining even greater yields. The yield on investment of 20 % reflects a marginal change to the farm structure. Compared with the high cost of capital the return is not excessive.

The problem of uncertainty, which varies from project to project, was not formally considered under the DCF analysis. Working with conservative figures and including a risk premium in the discount factor would reduce uncertainty to some degree. However, for highly uncertain projects the use of more sophisticated approaches, such as probability analysis, may be beneficial.

References

1. Aplin, R.D., G.L. Casler and C.P. Francis, 1977. *Capital investment analysis. Second ed., Grid Inc., Columbus, Ohio.*
2. Barry, P.J., J.A. Hopkin and C.B. Baker, 1979. *Financial management in agriculture.* Interstate Inc., Danville, Illinois.
3. Brigham, E.F., 1978. *Fundamentals of financial management.* Dryden Press, Hinsdale, Illinois.
4. Division of Agricultural Marketing Research, 1981. *Abstract of Agricultural Statistics.* Pretoria.
5. Nieuwoudt, W.L., 1973. The maize/meat price gap. *Agrekon,* Vol. 12 (4), pp. 37-40.
6. Parsons, S.A. en G.E.T. Taylor, 1975. *An analysis of the South African pig industry.* Div. of Agric. Mkt. Research, Dept. of Agric. Econ. and Mkt., Pretoria.