A NOTE ON "A MATHEMATICAL MODEL AND COMPUTER PROGRAM FOR THE ECONOMIC ASSESSMENT OF TRADITIONAL SYSTEMS OF PRODUCTION OF MILK AND WEANED CALVES" [1]

E M Richards[2] & S Berry [2,3]

FMVZ, Universidad de Yucatan, Aptdo 116-D, Merida, Mexico 97100

This note is to bring to the readers attention the unorthodox tech - nique used to compute the return to capital (equation 36) used in the mathematical model (Herrero and Berry 1982), and to point out the limita- tions of the use of the return to capital in a planning/extension situa - ion.

FAO (1980) define *Return to total capital* (TR) in the following manner:

1) TR = (R - value of unpaid family labour) *100/VI

    where R = Net farm income
           VI = Total value of the investment

While *Net farm income* (R) is defined as:

2) R = IT - CT

    where IT = Gross farm income
          CT = Total farm costs (excluding family labour and interest paid on borrowed capital and rent paid)

Thus equation 32, (the calculation of *total costs*, should not include land (TA) as a cost, neither should it include interest paid on borrowed capital and should read:

3) CT=SAL + PAST + FER + SUP + SAN + ELEC + CONST + MAQ + TORO + DEP
    + OTRO
(See original model for definition of terms, Herrera & Berry, 1982)

This method of calculating return to total capital is independant of the level of indebtedness of the farms and also allows comparisons to be made in rural economies where some farms are rented and some are owner occupied. Obviously the level of indebtedness or the fact that capital is borrowed, does not have any relevance to the efficiency of the farm , and will confound inter-farm comparisons of the efficiency of these farm- ers with owner occupiers. Rent is thus regarded as interest paid on land "borrowed".

Thus equations (1) and (3) detailed here, should replace equations (34) and (32) of the model.

Conventionally the total value of the investment (VI) should include

[1] J A Herrero and S Berry, *Tropical Animal Production* 7:144-168

[2] *Technical Cooperation Officer, Overseas Development Administration, London, UK*

[3] *Present address: Centro de Investigaciones Pecuarias (CENIP), Aptd 227-9, Santo Domingo, D.R.*

an allowance for the working capital or money which is "in circulation ".
As a rule of thumb 25% of annual costs actually incurred (i.e.excluding de-
preciation, but including interest and rent actually paid) can be used
although it can be calculated more accurately. For example the quantity of
feed kept in store would affect this calculation. The total value of the
investment (VI) should also include the value of the stock (average number
on the farm at any one time) at an average of beginning and end year prices.

The distinction between fixed and variable costs(p155-156) is adequate
for a specialised dual purpose farm.However,on farms with several activities
buildings, land, machines and labour can have multiple uses. Therefore it
will be necessary to divide the fixed costs of the farm - including regular
labour, maintenance and electricity into the different activities, although
this is sometimes difficult to do, and in fact questions the validity of
enterprise efficiency studies as against farm system efficiency. In a farm
system the only costs that can be really viewed as variable are those spec-
ific to the activity under analysis.

It should be noted that these modifications do not affect the running
of the computer program listed in the original paper as this comprises of
equations (1) to (31). That is, it calculates total farm income (IT) and
changes in total farm income with changes in farm performance. The cal
culation of total farm costs (CT), net farm income (R) and return to total
capital (TR) being calculated subsequently by hand

The rest of this note concerns the use of the rate of return on capi-
tal as a criterion for improvement and measure of farm profitability. In a
situation in which capital is a limiting factor or main constraint on ex -
pansion, as opposed to land and labour, the rate of return on capital will
provide the relevant criteria. However, in a situation in which labour or
land is constraining (e.g.shortage of good quality pasture) it is possible
to raise profit while the rate of return on capital falls. This is because
profit can be increased as long as the *marginal* or additional revenue of
of any improvement exceeds its marginal or additional cost,even though the
average return as measured by the rate of return on capital may fall. There
fore this measure can lead to quite incorrect extension advice. Gross mar-
gin (gross income less variable costs of production) per ha will be the
relevant efficiency criterion when there is a scarcity of land. However it
is intended that the computer program be used to calculate the marginal ben
efit and cost of any improvement i.e. to construct a "partial budget", and
advise on this criterion. See Bernard and Nix (1975) p70-73 and 314-318.

Secondly the rate of return on capital should *not* be used as a measure
of overall farm profitability except in the case when capital is the most
limiting resource. This is because the profitability of the farm depends
on the return of all factors of production (land, labour and capital) over
and above costs. The complexity of calculating this leads the reviewer to
the conclusion that there is really no alternative, in profit optimisation
excersizes, to the use of the established farm\management tool of linear
programming. Finally FAO (1980) argue that the rate of return on capital
may have a limited application in less commercialised agriculture for a num
ber of reasons.

References

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Herrero J A & Berry S 1982 A mathematical model and computer program for the economic assess -
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