

Some aspects of an asset replacement/protection model under conditions of inflation

The area of corporate financial planning has been well explored and a number of useful corporate models have been produced. Models have been developed for profit planning, cash budgeting, etc. However, many of the models have not taken sufficient account of the effects of inflation on corporate performance.

The effects of inflation are numerous and usually increase operational pressure and undermine financial performance. Some of the effects of inflation are quite subtle, and only become visible after some considerable lapse of time when it is often too late to take adequate corrective action. One of the areas which is affected in this way is the provision required for asset replacement.

In a traditional set of accounts the firm provides for the replacement of its assets through the process of depreciation: at least this is one of the interpretations of depreciation. However, such an approach can be regarded as an over-simplification. In the first place assets are replaced by the use of cash, whereas at best, depreciation is an appropriation of profit – an appropriation of profit which is protected against claims from the Receiver of Revenue and the shareholders. However, depreciation is not cash. It is certainly true to say that the existence of depreciation improves the cash flow of the firm. Nevertheless, a depreciation account does nothing to ensure that cash is available as the actual extra cash flow resulting from depreciation practices may be consumed in a number of other areas, including that of working capital, operating expenses, etc., thus leaving no cash for asset replacement. Also in terms of current depreciation policies in South Africa, which only allow depreciation to be calculated in terms of original cost price and not replacement cost price, there is simply not sufficient funds available in times of inflation to replace the asset.

The result of the above two practices is that many firms are faced with a demand for large sums of cash which they cannot easily generate. This usually results in a firm having to go to the capital market. Depending on the timing of this, the firm may have to pay dearly, or may simply not be able to raise sufficient cash.

One of the ways in which the firm may avoid this is through incorporating an asset replacement/protection model into its cash planning. This procedure has the effect of both ensuring that the correct quantity of cash is available and that its availability is properly timed. In effect one is building a cash element for asset replacement/protection into one's cash budgets. Like other items in the cash budget, this asset replacement/protection cash is expended from the operating cash cycle and placed in a sinking fund which is specifically earmarked for asset replacement. This is in direct contrast to depreciation which is specifically excluded from the cash budget because it does not represent any movement in the cash account. Although this approach to the cash budget is technically correct, in effect it side-

steps the important issue of planning the firm's cash requirements for asset replacement.

Consider a situation where a fixed asset costs 40 000 (A_0) and is expected to last 8 years (n). The cost of this asset has been increasing in recent years at the rate of, say, 10% p.a. (r). When this asset has to be replaced it will cost 85 700* (A_r). This is determined by the compound interest formula

$$A_r = A_0 (1+r)^n \dots\dots\dots (1)$$

Now assume that this firm has been using a sinking fund in order to provide cash for the replacement of the asset. The amount of cash being lodged in the sinking fund per annum is equivalent to the annual depreciation

figure $5\,000 \left[\frac{A_0}{n} \right]$. The asset is depreciated on a

straightline basis. Assume the rate which the firm obtains on the sinking fund is the same as the rate of inflation of the fixed asset and no tax is payable on the interest earned in the sinking fund. (Both these assumptions are removed later in this paper.) The amount of cash which will be available in the sinking fund after eight years at a rate of interest of 10% will be 57 200 (A_f). The accumulated amount in the sinking fund may be calculated by the formula

$$A_f = \frac{A_0}{n} \left[\frac{(1+r)^n - 1}{r} \right] \dots\dots\dots (2)$$

From this one may see that one has a cash shortfall of 28 500 (A_s). It is possible to calculate directly the shortfall by use of the formula

$$A_s = A_0 \left[\frac{(1+r)^n (n-1) + 1}{rn} \right] \dots\dots\dots (3)$$

Once the shortfall is known it is possible to establish an annuity which, if added to the cash equivalent of the straightline depreciation, will allow the sinking fund to accumulate sufficient cash to meet the anticipated requirements in 8 years (n) at 10% (r). This marginal amount which is over and above the cash equivalent of depreciation is in the above example 2 500, and is described as ΔA_r and may be formulated as

$$\Delta A_r = A_0 \left[\frac{(1+r)^{nr} - 1}{(1+r)^{n-1} n} \right] \dots\dots\dots (4)$$

It is of course possible to establish immediately the exact

amount $\left[\frac{A_0}{n} + A_r \right]$ which has to be placed in the sinking fund $\left[A_r^1 \right]$, i.e. in the above example 7 500 to

*All figures in this paper are rounded to the nearest hundred.

meet the cash objectives, by the use of the formula

$$A_r^1 = A_o \left[\frac{(1+r)^n r}{(1+r)^{n-1}} \right] \dots \dots \dots (5)$$

However, the use of the marginal formula (4) highlights the inadequacy of depreciation even in the form of its cash equivalent under conditions of inflation and therefore gives greater insight into the problem.

Up to this point the effect of taxation on the interest earned in the sinking fund has been ignored. It is now necessary to remove this assumption. Assume the rate of tax is 50% (t) and that the tax is paid at the end of the period in which the interest is earned. Then the amount of cash which accumulates in the sinking fund,

in terms of the original assumptions is 47 700 $[A_f^t]$.

This may be calculated directly by the use of the formula

$$A_f^t = \frac{A_o}{m} \left[\frac{(1+r(1-t))^n - 1}{r(1-t)} \right] \dots \dots \dots (6)$$

The shortfall which the firm experiences when it attempts to replace the asset is now 38 000 $[A_s^t]$.

This amount may also be calculated directly by the formula

$$A_s^t = A_o \left[(1+r)^n - \frac{(1+r(1-t))^n - 1}{nr(1-t)} \right] \dots \dots \dots (7)$$

By extending these formulae the additional cash per annum to ensure no shortfall 4 000 $[\Delta A_r^t]$ may be calculated.

$$\Delta A_r^t = A_o \left[\frac{(1+r)^n r(1-t)}{(1+r(1-t))^{n-1}} - \frac{1}{n} \right] \dots \dots \dots (8)$$

The mathematics of this analysis may be extended considerably further. However, for the purpose of the paper two more formulae are important.

In the first instance when it is assumed that the rate of inflation is different to the rate of interest obtainable from the sinking fund (r_o) the formula for calculating the marginal cash required each year (ΔA_r) becomes

$$\Delta A_r = A_o \left[\frac{(1+r)^n r_o}{(1+r_o)^{n-1}} - \frac{1}{n} \right] \dots \dots \dots (9)$$

The above model does not accommodate a tax rate.

When tax is taken into account $[\Delta A_r^t]$ the formula becomes

$$\Delta A_r^t = A_o \left[\frac{(1+r)^n r_o (1-t)}{(1+r_o (1-t))^{n-1}} - \frac{1}{n} \right] \dots \dots \dots (10)$$

The above asset protection approach offers the firm an approach with which it may plan its cash availability in order to coincide with its asset replacement schedule. Once the amounts of cash are calculated they should be included in the cash budget. By using this approach one is effectively bringing depreciation or asset replacement into account in the cash budget.

In summary, the current approach to asset replacement/protection through traditional depreciation is quite inadequate to enable the firm to replace its fixed assets without the risk of considerable financial strain. This problem has become exaggerated due to the effect of sustained inflation on asset replacement costs. In order for the firm to be able to replace its assets without extra funding, it is necessary for it to plan its anticipated cash requirements from as early a date as possible. The above formulae accommodate the calculation of annuities which, if invested at appropriate rates, will accumulate sufficient cash for asset replacement funding from operating cash flows and thus reduce the firm's reliance on the uncertainties of the capital market. This approach will be of considerable assistance to the firm in maintaining its financial position, particularly under conditions of inflation.