# THE CONTROL CYCLE: FINANCIAL
# CONTROL OF A LIFE ASSURANCE COMPANY

## By Jeremy Goford

### 1. INTRODUCTION

1.1. THE intention of this paper is to describe, by way of example, how profit testing is carried on in practice and how by making it central to the company's operation the company may be controlled. The mechanism of control is to test the company's results against the results of profit tests built into a model of the company. We shall also describe how the results of these tests of the company's results are fed back into the profit tests to establish the basis for future tests of the company's results.

1.2. The motivation for this paper arose from the need to communicate to shareholders the links between profit testing and the company's actual results. It is all very well to say to shareholders that the products satisfy a certain profitability standard but how does that show itself and how real is that profitability paticularly for a new or expanding company which displays nothing but statutory losses or, at best, break even? This communication also led to the need to explain variations from the original projections and finally to answer the question: what happens to profitability if these variances continue?

1.3. Figure 1 illustrates the sequence of this control cycle. The *profit test* provides cash flows to build up a *model* of the company. The actual results of the company are compared with the model and the differences analysed: *the analysis of surplus*. These differences are *monitored* leading to the possible refinement of *assumptions* used in the *profit test*. The central feature of this control mechanism is the analysis of surplus, i.e. the comparison of *actual* experience with that *projected* by the model and the following up of substantial differences.

1.4. A paper by Jim Anderson (1959) to the Society of Actuaries, which was chiefly concerned with the remuneration structure of sales forces, initiated profit testing as an actuarial art form. This paper established the principle that salesmen or brokers should receive remuneration for each product in proportion to the expected profit generated for the company from the sale of that product. The important corollary of this principle is that the company does not mind, as far as profitability is concerned, which products the salesmen sell because, for each £100 of commission paid, the profit that accrues to the company is the same irrespective of which products are sold. This removes any bias which could otherwise lead the company to pressurize salesmen to sell a more profitable contract to the detriment of the policyholders.

1.5. Some qualification is needed here because mix of business may well be important for other reasons. In particular it is important, in order to be able to
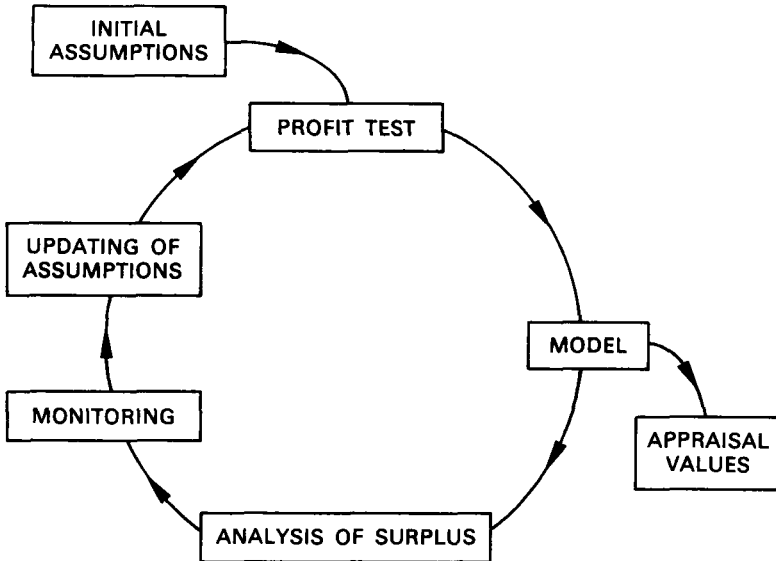
Figure 1. The Control Cycle

provide competitive regular premium life products, to ensure that initial expenses can be relieved for tax purposes as soon as possible. This requires generation of investment income from life products under which the tax on investment income is charged to policyholders. Mix may also be important for marketing reasons.

1.6. Anderson's paper has been followed by papers from Chris Smart (1977) and Robert Lee (1984). Smart's paper concentrated on the philosophy and mechanics of profit testing and Lee on some of its applications.

1.7. We first need to describe what is meant by the profits to the company on the sale of a life assurance policy. An examination of the *profit criterion* used in a company's profit test (and agreed with the directors and shareholders) provides the answer. As an example a company might use the following profit criterion or target against which to test the profitability of a product:

(i) Invested capital earns 15% after tax.
(ii) There are additional profits which, when discounted at 15%, have a present value at outset of 40% of initial commission.

This criterion may be expressed in another way, namely that the present value of the statutory profits less an initial statutory loss, all discounted at 15%, should be around about 40% of initial commission. One very important point to note here is that it is the projected *statutory* profits which we are discounting as these are the only real profits. By real we mean profits which are actually distributable to shareholders.

## 2. THE PROFIT TEST

2.1. The mechanism of the profit test and the control cycle will be illustrated by the example of a simple 10-year annual premium non-profit endowment assurance with a sum assured of £10,000 and commission of 25% in the first year and $2\frac{1}{2}$% on renewal. Surrender values are determined using a basis of gross premiums, 8% interest and no Zillmerization. The reserve basis uses net premiums, $4\frac{1}{2}$% interest and 3% Zillmerization. This is intended to be the reserve basis which the actuary would use in determining his statutory liabilities so that the profits calculated will emerge after establishing these statutory reserves. In the United Kingdom the actuary had considerable discretion as to the reserve bases he uses. It is only recently that a minimum reserve basis has been introduced, but the actuary need only test that the calculated reserves exceed the minimum. In many cases additional reserves will be held.

2.2. The first part of a profit test is the calculation of the expected *cash flow* each year. The constituent parts will be some or all of the following items:

- (i) Premiums received.
- (ii) Investment Income received and Capital Gains realized.
- (iii) Death Claims paid.
- (iv) Surrender Values paid.
- (v) Amounts paid on Maturity.
- (vi) Waiver of Premium/Disability Benefits.
- (vii) Commissions paid.
- (viii) Expenses incurred.
- (ix) Tax Liabilities.

Notice that the increase in statutory reserves is omitted from this list. It does not constitute a cash flow but is that part of the cash flow which is transferred to the reserves before the profit is determined.

2.3. Revenue items (deaths, surrenders and maturities) and reserves would include allowance for bonuses on with-profit policies if appropriate and varying the bonus rate assumed can assist bonus policy but for this to be effective considerable additional sophistication is required on the asset part of the model in projecting future investment income and gains.

2.4. The profit-test mechanism can also be used to calculate the statutory reserves. The methodology to do this deserves a paper to itself. However, in this example, we will use reserves predetermined on the basis described above. The results of the profit test will be demonstrated on the following set of 'realistic' assumptions:

- (i) Rate of return on investments 7%.
- (ii) Mortality rate 1%.
- (iii) Lapse rate—first year 10%
                —thereafter 5%.

   (iv) Expenses—first year 25% of Annual Premium
                    —annual maintenance £12.50 per policy initially, but subject to
                     inflation.
    (v) Inflation rate 5%.
   (vi) Taxation rate on investment income Nil.
  (vii) Risk Discount rate (required yield on Shareholders funds and additional
        profit discount rate) 15%.
 (viii) Deaths and lapses are assumed to occur at the end of the year.

Table 1 shows the expected cash flows from this profit test.

At this stage the premium of £851 has been estimated. For the purpose of keeping the example simple the interest on the initial cash flow and profit has been calculated at the year-end. The figures for deaths, commission and expenses are self-explanatory and the reserve is that required just for those policies left in force at the end of the year. The loss shown is a year-end figure but will emerge when the premium is paid and hence it has been discounted back to the beginning of the year at the investment rate of return.

2.5. Table 2 repeats the profit test for the second year. The premium is reduced because there are fewer policies now in force and again the interest is calculated on the opening reserve and the cash flows at the beginning of the year. There is now a surrender value payable at discontinuance and the figure shown is 5% of the surrender value for one policy issued. Again, commission and expenses are self-explanatory and the reserves are precalculated. The profit shown for this year is a year-end profit and it has been discounted at the investment rate, of return (7%) to the beginning of year 2 and then at the risk discount rate (15%) from there to the outset of the policy. This is consistent with the assumption that

Table 1. *Expected cash flows in year 1 per policy issued*

| | | | |
|---|---|---:|---:|
| Premium | | | 851·00 |
| Interest | $(851 - 2 \times 212 \cdot 7 - 12 \cdot 50) \times \cdot 07$ | | 28·90 |
| | | | 879·90 |
| Deaths | $10,000 \times \cdot 01$ | 100·00 | |
| Surrenders | $SV \times \cdot 1$ | — | |
| Commission | $851 \times \cdot 25$ | 212·70 | |
| Expenses— | Initial $851 \times \cdot 25$ | 212·70 | |
| | Maintenance | 12·50 | |
| | | | 537·90 |
| | | | 342·00 |
| Transfered to reserves at end year 1 | | | 828·10 |
| Loss for year 1 | | | (486·10) |
| Present value of year 1 loss at outset | | | (454·30) |

Table 2. *Expected cash flows in year 2 per policy issued*

| | | | |
|---|---|---|---|
| Premium | $851 \times \cdot99 \times \cdot90$ | | 758·20 |
| Interest | $(828\cdot10 + 758\cdot20 - 19\cdot00 - 11\cdot70) \times \cdot07$ | | 108·90 |
| | | | 867·10 |
| Deaths | $10{,}000 \times \cdot9 \times \cdot99 \times \cdot01$ | 89·10 | |
| Surrenders | $SV \times \cdot9 \times \cdot99 \times \cdot05$ | 18·80 | |
| Commission | $758\cdot20 \times \cdot025$ | 19·00 | |
| Expenses | $12\cdot50 \times \cdot9 \times \cdot99 \times 1\cdot05$ | 11·70 | |
| | | | 138·60 |
| | | | 728·50 |
| Reserves—End of year 2 | | 1452·50 | |
| Beginning of year 2 | | 828·10 | |
| Transferred to reserves at end of year 2 | | | 624·40 |
| Profit for year 2 | | | 104·10 |
| Present value of year 2 profits at outset | | | 84·60 |

surplus (or strain) occurs when the premium is paid. There is considerable debate about the timing of statutory surplus—does it occur when the premium is paid or only when the 4th Schedule is completed, say half way through the policy year? There is no debate about the timing of strain: it occurs only on the sale of the policy, i.e. when the first premium is paid. I have taken surplus release consistent with this, i.e., when the premium is paid. It is certainly available to meet strain on other products then without waiting for a full Schedule 4 Valuation Return. Only excess surplus needs to wait for that. Table 3 shows the results of this exercise for each of the 10 policy years. The total present value of profits is £85.20. This is the figure to be compared with the criterion we have established for the profitability of the product. The commission payable on the product is 25% of the premium and our criterion of profit is that the present value of profits should be equal to 40% of commission. The choice of an annual premium of £851 means that the present value of profit of £85.20 is very close to the criterion we are trying to satisfy, namely £851 × ·25 × ·40 = £85.10.

2.6. By putting such profit tests on a micro-computer it is possible not only to arrive at the premium which satisfies the criterion very quickly, but also to obtain valuable information on the shape and incidence of profit and the major constituents of the profit.

2.7. A most important spin-off from the profit test is the determination of the sensitivity of the premium level to changes in the assumptions made in the profit-test basis. Table 4 gives some examples of a sensitivity analysis. If we think it is reasonable that investment income will be 8% rather than 7% then we could satisfy our profit criterion and afford to market this product at a premium rate of

Table 3. *Summary of present value at outset of profits arising in each policy year*

| Policy year | Present value |
|:---:|:---:|
| 1 | (454·30) |
| 2 | 84·60 |
| 3 | 79·90 |
| 4 | 73·90 |
| 5 | 67·20 |
| 6 | 60·10 |
| 7 | 53·10 |
| 8 | 46·40 |
| 9 | 40·10 |
| 10 | 34·20 |
| | 85·20 |

£826.40. Similarly, a reduction of 1% would require us to sell the product at a premium rate of £874.50. Other crucial assumptions are mortality, lapse rates and expenses. If we think mortality rates will be doubled then we must charge a premium of £903.10. If we think they will halve we need only charge £825.40. If we intend to market this policy in such a way that we think the lapse rate might be twice the standard then because the surrender values are penal we could sell at a premium of £834.30. If, however, we expect the lapse rate to be very good then we shall forgo surrender profits so that the premium needs to be increased to £859.90. If we increase commission and initial expenses by, say, 40% so that the initial commission rate is 35% of premium then we would have to charge a premium of £886.90 to satisfy the criterion which in this case will also increase because it is related to the initial commission. If maintenance expenses were double the standard we would have to charge a premium of £862.20. If it were thought that inflation might be twice the standard then the required premium would be £852.90. Policies of twice the size could be sold at a reduction in rate of ·7%. Policies of half the size require their premium rate to be increased by 1·3%.

2.8. In summary the profit test provides proof that the profit criterion is satisfied on the assumptions made and information about the shape of the earnings which might be expected from the product. It also identifies the major sources of profit contained in the product and the sensitivity of the overall profit to changes in the assumptions. Additionally, it indicates the level of initial cash strain for each policy sold.

2.9. As we continue around the control cycle we shall see how the basic structure of the profit test is used to build up information against which the profit-test assumptions are measured and finally, how having monitored these assumptions, they are revised for a re-run of the profit test.

Table 4. *Results of some sensitivity tests for the premium rate*

| Assumption in profit test basis | Change in basis | New annual premium (£851 on standard basis) | Premium rate change |
|---|---|---|---|
| Interest | +1% | 826·4 | −2·9% |
| (7%) | −1% | 874·5 | +2·8% |
| Mortality | ×2 | 903·1 | +6·1% |
| (1%) | ÷2 | 825·4 | −3·0% |
| Lapse rates | ×2 | 834·3 | −2·0% |
| (10% year 1, 5% thereafter) | ÷2 | 859·9 | +1·0% |
| Commission (25% Year 1, 2½% thereafter) and initial expenses (25%) | +40% | 886·9 | +4·2% |
| Maintenance expenses (£12·50 annually) | ×2 | 862·2 | +1·3% |
| Inflation (5%) | ×2 | 852·9 | +·2% |
| Policy size | ×2 | 1,690·8 | −·7% |
| (Sum assured £10,000) | ÷2 | 431·1 | +1·3% |

## 3. THE MODEL

3.1. The numbers derived from the profit test will now be used to build up a model of the company. It is most important in building a model that the various elements of the Revenue account are self-consistent in their own right. It is not sufficient to project premiums, death claims, lapses, investment income, etc., independently. The way in which the various elements of the model are kept together is to take all the numbers derived from the profit test and give them equal treatment when they are applied to the production and when they are used to project the in-force business.

3.2. For example, if we assume that we are going to sell 1,000 policies at the beginning of year 1, i.e., now and that there is no in-force business then the resulting predicted cashflows are those in Model 1 of Table 5. It is not surprising that this looks like the first year of the profit test because all that has been done is to multiply the first-year figures of the profit test by 1,000. Similarly, in year 2 of the projection, where just 1,000 policies were sold at the beginning of year 1, the model projection will look just like the second year of the profit test multiplied by 1,000. This is illustrated in Model 2 of Table 5.

3.3. If we assume that, in addition, 1,100 policies are sold at the beginning of year 2 then in order to create year 2 of the model we simply take the first year of the profit test, multiply it by 1,100 and add it to the second year of the projection (Model 2 of Table 5). The result is Model 3 of Table 5. In a similar way future years of the projection can be constructed.

3.4. All that remains to be done is to include the in-force business. It is essential

J. GOFORD

Table 5. *The build-up of the Model Revenue Account (£000)*

| Model No. | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Calendar year of projection | 1 | 2 | 2 | 2 | 2 |
| Number of policies in force | | | | | |
| at the outset | 0 | 0 | 0 | 4,000 | 4,000 |
| —issued 1 year ago | 0 | 0 | 0 | 1,000 | 1,000 |
| —issued 2 years ago | 0 | 0 | 0 | 1,000 | 1,000 |
| —issued 3 years ago | 0 | 0 | 0 | 1,000 | 1,000 |
| —issued 4 years ago | 0 | 0 | 0 | 1,000 | 1,000 |
| Number of policies written at | | | | | |
| outset (start of year 1) | 1,000 | 1,000 | 1,000 | 0 | 1,000 |
| Number of policies written at | | | | | |
| start of year 2 | 0 | 0 | 1,100 | 0 | 1,100 |
| | | | | | |
| *Revenue Account* | | | | | |
| Reserves b/f | 0 | 828 | 828 | 11,490 | 12,318 |
| Premiums received | 851 | 758 | 1,694 | 3,201 | 4,895 |
| Interest and gains received | 29 | 109 | 140 | 1,019 | 1,159 |
| Commissions paid | 213 | 19 | 253 | 80 | 333 |
| Expenses incurred | 225 | 12 | 259 | 56 | 315 |
| Death claims paid | 100 | 89 | 199 | 376 | 575 |
| Surrender values paid | 0 | 19 | 19 | 525 | 544 |
| Amounts paid on maturity | 0 | 0 | 0 | 0 | 0 |
| Reserves c/f | 828 | 1,452 | 2,363 | 14,068 | 16,431 |
| Profit or (Loss) generated | | | | | |
| during year of projection | (486) | 104 | (431) | 605 | 174 |
| | | | | | |
| Number of policies in force | | | | | |
| at end of year of projection | 891 | 838 | 1,818 | 3,538 | 5,356 |

to split the in-force business by year of issue. We know from the profit test that for say, 1,000 policies issued 3 years ago, we could expect 788 policies to be still in force. By ratioing up the number of policies now in force we can derive the pseudo-production which is then included in the model as production 3 years before the beginning of the projection. In this way in-force business can be included in the projection using the same procedures as those illustrated for future business. If for example, there are 1,000 policies in force, which were issued 1 year ago, 1,000 now in force, which were issued 2 years ago, 1,000 now in force which were issued 3 years ago and 1,000 now in force which were issued 4 years ago, then calendar year 2 of our projection represents policy year 3 of the policies written 1 year ago, policy year 4 of the policies written 2 years ago and so on. Adding up these four projections gives the results displayed as model 4 of Table 5. Merging the in-force and the future business gives the results of Model 5 of Table 5.

## 4. THE ANALYSIS OF SURPLUS

4.1. When the periodic valuation of the company's liabilities is made and the

accounts are produced the results may be compared with the model. In so far as the actual profit differs from that shown by the model the difference may be analysed into differences between, for example, premiums, investment income, commission and so on. The differences may also be analysed by product if the breakdown of amounts by product is available. There is an important difference of philosophy between this method of analysing the surplus and the traditional methods. In the past the analysis of surplus was made by comparison with the valuation basis. In other words the results of the company were compared with the results which were required to support the reserves only. A typical result of such an old style analysis is that the company has income and gains from investment in excess of the valuation basis, but on the other hand has incurred expenses and maintenance costs greater than it has allowed for in the valuation basis. It does not need a sophisticated analysis of surplus to show this, and to determine the amount of the excess investment income and the excess expenses. These numbers are largely irrelevant to the company's operation. What is more relevant is to know whether the company has earned more by way of investment than it expected to earn when it designed the product, and whether it is spending more than is allowed to be spent in the design of the product. This will give the first indication of whether the profitability criterion used in designing the policy in the first place is being met in practice.

4.2. If the actual production for the valuation period is included in the model and then it is run from the beginning of the period analysed, the figures for premium income and reserves and commission produced by the model are a reasonable first check on the premiums and commission in the Revenue account and the valuation result. Large deviations in these numbers from those expected by the model may indicate an error in the accounting or the valuation. It is particularly helpful if these figures are broken down by product so that the deviation may be traced to the product line causing the deviation. A comparison of the investment income with that expected under the model is the first indication that the current bonus rate for with-profits policies can be afforded, although of course much more investigation is required before a definite conclusion can be reached. A comparison of expenses will disclose whether a company is spending more or less money than it has allowed for in the product design. Breaking down the model allowances between initial and renewal expenses enables a comparison to be made with a similar breakdown of the actual results. Deviations in the figures for deaths might indicate the need for a mortality investigation.

Similarly, deviations in the level of surrenders, particularly if they are broken down by the year of issue of the policies, gives an initial indication of the problem of excessive lapse rates. A typical analysis of surplus is given in Table 6.

4.3. The structure of the Analysis of Surplus is simply to difference the Revenue Account items of the actual experience and the model projection. Because, in the example, the premiums are annual and all paid at the beginning of the year they show no difference. Nor do reserves brought forward and

### Table 6. *Analysis of surplus (£000)*

| | Actual experience | Model projection | Difference between projection & experience | Surplus after reserves respread |
|---|---|---|---|---|
| Number of policies in force at outset | 4,000 | 4,000 | | |
| —issued 1 year ago | 1,000 | 1,000 | | |
| —issued 2 years ago | 1,000 | 1,000 | | |
| —issued 3 years ago | 1,000 | 1,000 | | |
| —issued 4 years ago | 1,000 | 1,000 | | |
| Number of policies written at outset | 1,000 | 1,000 | | |
| Year of experience | 1 | 1 | | |
| Reserves b/f | 8,722 | 8,722 | — | — |
| Premiums received | 4,255 | 4,255 | — | — |
| Interest and gains received | 987 | 868 | 119 | 119 |
| Commissions paid | 298 | 298 | — | — |
| Expenses incurred | 351 | 281 | (70) | (70) |
| Death claims paid | 750 | 500 | (250) | (191) |
| Surrender values paid | 720 | 360 | (360) | 337 |
| Amounts paid on maturity | 0 | 0 | — | — |
| Reserve c/f | 11,562 | 12,318 | 756* | — |
| Profit generated during year of experience | 283 | 88 | 195 | 195 |
| Number of policies in force at year end | 4,356 | 4,653 | 297 | |

\* Released on: Deaths 59, surrenders 697.

commission. However, interest and gains, expenses, death claims, surrenders and reserves carried forward show differences.

4.4. Whilst deaths and surrenders show increased claims, the profit or loss from that increase cannot be determined until the apparent surplus contributed by the difference in reserves carried forward (which in the example only arises because the excess policies which become claims need no year-end reserve) is respread and off-set against the increase in claims. The modified analysis is shown in the right-hand column of Table 6.

4.5. This analysis is the major communication of results in the company, to the Board and to Shareholders who are interested in the trends of their company and in how the assumptions on which the products are sold are being borne out in practice.

## 5. MONITORING

5.1. The profit test gives an indication of those characteristics of the policy which should be monitored, particularly as changes in some characteristics affect profitability more than others. In considering the determination of the premium for the policy we demonstrated how changes in the assumptions affect the premium, if the profit criterion is to remain satisfied. We are now concerned about the way in which the profit changes when the premium has been fixed at the outset using the profit criterion and subsequently the assumptions are not borne out in practice. Table 7 gives examples of the effects on profits of various changes in the assumptions.

It is in this way that priorities can be determined for monitoring the critical assumptions. Although in this example the rate of return on investments emerges as a most significant assumption this is not true for unit-linked products where the policyholder's benefits are matched very closely to the performance of the invested assets and hence very little profit or loss arises from deviations of investment income from that expected. In such cases it is more important to concentrate on the monitoring of expenses and lapse rates which are usually by far the most crucial assumptions.

5.2. This can be achieved by maintaining simple records. An example of an Expense Control Sheet is given in Figure 2.

It shows the expenditure by month and for the year to date in each of the main categories. It also shows the budget for the year to date and the variances (in the accounting sense) from the budget. Total expenses are also compared with those

Table 7. *Results of some sensitivity tests for expected profits*

| Assumption in profit test basis | Change in basis | Present value of Profits (£85.20 on standard basis) | Change |
|---|---|---|---|
| Interest | + 1% | 226·2 | +165% |
| (7%) | − 1% | − 58·4 | −169% |
| Lapse rates | ×2 | 173·9 | +104% |
| (10% year 1, 5% thereafter) | ÷2 | 29·6 | − 65% |
| Commission (25% year, 2½% thereafter) and Initial expenses (25%) | +40% | − 85·0 | −171%* |
| Maintenance expenses (£12.50 annually) | ×2 | 19·0 | − 78% |
| Inflation (5%) | ×2 | 73·8 | − 13% |
| Policy size | ×2 | 236·7 | + 39% |
| (Sum assured £10,000) | ÷2 | 9·5 | − 78% |

\* Based on adjusted criterion, i.e., £851 × ·35 × ·40 = £119·14.

Figure 2. *Example of an expense analysis sheet*

| Expenditure head | Actual expenditure | | | | | Expenditure for year to date | Budget for year to date | Variance |
|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | ... | Dec | | | |
| Salaries | | | | | | | | |
| Travel | | | | | | | | |
| Premises | | | | | | | | |
| Communication | | | | | | | | |
| ⋮ | | | | | | | | |
| Depreciation | | | | | | | | |
| Total actual Expenses | | | | | | $A$ | $B$ | $A-B$ |
| Expense Allowances | | | | | | $C$ | $D$ | $C-D$ |
| Overrun | | | | | | $A-C$ | $B-D$ | $X^*$ |

$^*X = (A-B)-(C-D)$ or $(A-C)-(B-D)$

allowed for each product, which can be derived from the model or obtained directly from the records of new business and existing business in force. The difference between the actual expenses and those budgeted for in the product design is the overrun or underrun. This is one of the most important control figures for a company. The table is completed by showing the budgeted allowances for the year to date. The excess of the total actual allowances over those budgeted is a measure of the performance of the sales force together with the affect of variation in lapse rates from those assumed. Lapse rates higher than those assumed will reduce the expense allowances available to the company on the inforce business. The figure in the bottom right-hand corner may be looked at in one of two ways. Accountants will tend to look at it as an excess of the actual overrun over that which was anticipated in the budget, i.e., by looking across the bottom and calculating $(A-C)-(B-D)$. Actuaries would interpret it as a comparison between the total allowances earned over budget compared with the additional expenses which it would be reasonable to incur if production is above budget and calculate $(A-B)-(C-D)$. This analysis may be done for each cost centre of the office.

5.3. The lapse experience should be monitored in a similar way. Figure 3 gives an example of the report format. The report shows the breakdown of lapses by duration at lapse and by the month of issue of policies. The report may show the amount lapsing or the lapse rate as a percentage of the amount in force at the beginning of the period before lapse. The amounts used to monitor lapse rates could be number of policies, annualized premiums, sums assured, or initial commissions. Separate reports should be able to be produced for lapses, surrenders and paid-up policies. The analysis should also be able to be produced for each policy type, for each broker or group of brokers, for example those

Figure 3. *Lapse analysis report*

| Month of issue | Total issued | Duration of lapse | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Months | | | | | Years | | | | | |
| | | 0 | 1 | 2 | 3 | 4–6 | 7–12 | 1 | 2 | 3 | 4 | 5 | >5 |
| January | | | | | | | | | | | | | |
| February | | | | | | | | | | | | | |
| March | | | | | | | | | | | | | |
| April | | | | | | | | | | | | | |
| May | | | | | | | | | | | | | |
| June | | | | | | | | | | | | | |
| July | | | | | | | | | | | | | |
| August | | | | | | | | | | | | | |
| September | | | | | | | | | | | | | |
| October | | | | | | | | | | | | | |
| November | | | | | | | | | | | | | |
| December | | | | | | | | | | | | | |

supervized by a particular consultant or branch, for each policy size and for each age band. The analysis by broker provides early warnings on particular problem areas. The remaining analyses provide the basis for the improvement of the assumptions in future profit tests.

5.4. Whilst expenses and lapse rates are the two most important characteristics to monitor it is important to keep an eye on how the policy size is varying from that used in the profit test. A change in the way the product is sold, particularly if a policy designed for up-market selling is being sold down-market, can lead to higher lapse rates and reduced policy size both of which can be detrimental to profitability.

## 6. UPDATING ASSUMPTIONS

6.1. We now come full circle to feed the results of our investigations back into the profit test. In this way we may decide whether, under current conditions, it is reasonable to continue to sell the policies as they are. Whether, if these tests show reduced profitability, the product should be withdrawn or whether the company should live with the reduced profitability for a period. Alternatively, if the product shows excessive profitability but is not selling as a result of increased competition then there is room to improve the product and still satisfy the profit criterion.

6.2. Revised profit tests lead to a revised model—even for existing business. It is important in shareholder communication that the one-off effect of the changed assumptions is isolated. That is to say the model should be re-run from the same start date, with the same in force and production but with revised assumptions about, for example, future lapse rates. Then it becomes apparent what is the effect on the whole company, in terms of statutory profits and the present value of remaining profits in the portfolio, of a change in the rate at which the directors

believe their policies will lapse. Once this change has been made, future analysis of surplus and monitoring will be conducted against the new assumptions.

## 7. APPRAISAL VALUES

7.1. We now consider one of the spin-offs of the model. We have already seen how the profits may be calculated for each year of the policy. So far these profits have only been discounted to the date of issue of the policy. If we want to know the present value of the future profits still to emerge from a policy then, for example, to obtain the value of a policy just about to pay its fourth premium we must discount these profits to the beginning of the fourth year.

Using our example product the value of a policy about to pay its fourth premium is £723.60. By multiplying this figure by the number of policies in force which are about to pay their fourth premium the value of that block of business can be determined. By adding up those figures for policies of all durations and for all products, one may arrive at the present value of future profits to come from an existing portfolio of policies.

7.2. In the case of the policies in force in our example, of which there are 1,000 issued in each of the previous 4 years, Table 9 gives the present values of future profits for each year of issue. The total present value of the in-force business is added to the present value of that written at the beginning in the first year of the projection.

The value of the total portfolio is nearly £3 million at the date of issue of the new business.

7.3. It is interesting to observe the way in which the appraisal value of a company's business progresses from year to year as the company writes new business. It increases by the value of new business written, which, if the profit criterion is met, would be 40% of commission paid during the year, it increases by the 15% risk discount rate used and it reduces by the value of any profit taken out. Thus the appraisal values of blocks of business may be used to place a value on

Table 8. *Present value of policies by duration per policy in force*

| Duration of policy (years) | Present value of future profits |
|:---:|:---:|
| 0 | 85·2 |
| 1 | 696·4 |
| 2 | 718·0 |
| 3 | 723·6 |
| 4 | 710·4 |
| 5 | 674·9 |
| 6 | 613·1 |
| 7 | 520·7 |
| 8 | 391·9 |
| 9 | 220·7 |

Table 9. *Valuation of a portfolio*

| Duration in force | No. of policies | Present value of portfolio per policy | Total present value (£) |
|---|---|---|---|
| 1 | 1,000 | 696·4 | 696,400 |
| 2 | 1,000 | 718·0 | 718,000 |
| 3 | 1,000 | 723·6 | 723,600 |
| 4 | 1,000 | 710·4 | 710,400 |
| | | | 2,848,400 |
| 0 | 1,000 | 85·2 | 85,200 |
| | | | 2,933,600 |

Table 10. *The progress of the appraisal value (£'000) of a portfolio*

| Year | Present value at start year | Present value of new business* written | Total present value | Profit taken | Add 15% | Present value at end of year |
|---|---|---|---|---|---|---|
| 1 | 2,849 | 85 | 2,934 | (82) | 427 | 3,279 |
| 2 | 3,279 | 94 | 3,373 | (163) | 482 | 3,692 |
| 3 | 3,692 | 103 | 3,795 | (249) | 533 | 4,079 |
| 4 | 4,079 | 113 | 4,192 | (340) | 578 | 4,430 |
| 5 | 4,430 | 124 | 4,554 | (438) | 618 | 4,734 |

*New Business is 1,000 policies in year 1 increasing at 10% p.a. compound.

the company. The value arrived at must be used with extreme caution but if performed on a consistent basis can give an insight into the way in which capital is used and a demonstration of the effect of the cycling of profits from existing business into the financing of new business.

7.4. Of course, the appraisal value of a company does not consist solely of the present value of profits of the existing block of business but also includes share capital, the profit and loss balance, over or under reserving compared with those reserves used in the profit test and over or under valuation of assets. Any adjustments for deferred taxes or tax relief are also included in the appraisal value and a value may be placed on future business.

7.5. As an example of the way in which this latter value may be calculated, if all the policies meet the profit criterion and annual commissions are running at £212,750, as in year 1 of the example, then we may say that the sales force has increased the value of the company by the £85,000 per annum shown. A price earnings ratio which depends upon the quality of the sales force can be applied to this figure to arrive at a value of future sales. We must reiterate that this figure should be taken with extreme caution especially with regard to the value of future business. However, calculated on consistent assumptions it can be a useful tool and is informative to shareholders.

## 8. CONCLUDING REMARKS

8.1. The essence of the Control Cycle is the consistency of the assumption set, upon which the directors approve the terms of policies offered by their company, all the way round the cycle.

8.2. The profit test ensures that, on that set of assumptions, the required profit criterion of the company is met. The model projects the implications of those products on the expected sales volumes and it indicates the expense limits for the company.

8.3. Actual results may be compared with those projected by the model and analysed by source to highlight the significant sources of profit and loss which enhance or reduce the inherent profitability in the product.

8.4. The significant sources of profit and loss may be separately monitored and modified assumptions fed back into the profit test. The acceptance of the resulting profitability or the alteration of products are decisions for the directors of the company and the cycle is complete. Only at this point is the assumption set changed to reflect those decisions.

8.5. Besides increasing the awareness on the part of all concerned with the process of the financial mechanics of their company the spin-offs of the Control Cycle include expense and lapse control, tax planning, surplus control (particularly at the trough of a new company), timing of capital injections, valuation for sale or defence of predatory purchase, solvency margin projection, share-scheme evaluation, etc.

## 9. ACKNOWLEDGEMENTS

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