

WHAT ACTUARIES MIGHT LEARN ABOUT LIFE

By A Asher

ABSTRACT

This paper presents the author's view that the professional life assurance courses for subjects 302 and 402 fail to consider a number of important technical and ethical elements of management and economic theory. These include the marketing concept, the financial life cycle, macro-pricing and public relations, which are important in the management of a life office. They also fail to engage the debates that surround questions of profit, market prices and modelling, especially that between actuarial practice and financial economics. Their failure leads to some incoherence in the courses, and could mean that students are inadequately prepared for professional practice.

KEYWORDS

Education; life assurance; marketing; profit; modelling; financial economics

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1. INTRODUCTION

1.1 The formal actuarial education offered by the British professional bodies, and used in South Africa, has two main elements. The professional bodies themselves produce 'syllabuses' that briefly set out the objectives, and the core reading that indicates the depth of knowledge required. The Actuarial Education Company and various universities provide educational material, the former providing distance education.

1.2 Subjects 302 and 402 are intended to provide the skills required by an actuary in the life assurance industry. This paper suggests that these courses, as described by the 302 and 402 core reading (Institute and Faculty, 2001), are too narrow. Students are not given all the theory they will need, nor required to develop a considered opinion on some important technical and ethical debates.

1.3 In the first instance, the courses fail to take account of a number of insights from management theory that are of particular importance to the actuarial management of life offices. The second and third sections of this paper discuss these insights. Their usefulness in practice has been tested by surveying graduates of the honours course, Product Development, which has been taught for the last eight years at the University of the Witwatersrand, and covers these topics. Pre-1998 graduates, who could be expected to have garnered some practical experience, were asked whether they were finding the

ideas useful. The appendix reports the results, which suggest that these insights can be essential even at an early stage of the actuary's professional life, and that there is value in greater exposure to a wider academic literature.

1.4 In the author's experience, the actuarial courses have been frequently criticised for failing to reconcile actuarial practice with modern financial economics. The fourth section considers the 302 and 402 core reading's failures in this area, making suggestions as to what changes could be made.

1.5 Professional actuarial judgement requires advanced understanding and appreciation of models and their applications. The fifth section discusses how the core reading might treat mathematical modelling in a more sophisticated manner.

1.6 Earlier versions of this paper were given at the Actuarial Teachers' Conference at the London School of Economics in July 2001, and the Annual Convention of the Actuarial Society of South Africa (ASSA) in October 2001.

2. MARKETING THEORY

2.1 THE MARKETING CONCEPT

2.1.1 The 'marketing concept' is the view that the business of a firm is to provide for the needs of its clients at a profit to itself. Firms that adopt it have a marketing orientation in that their primary focus is to satisfy their customers' needs. This can be contrasted with a product orientation, and with a sales orientation, which confuse means (being the product or sales process) with ends (the needs of the customer). In the classic and popular exposition of the marketing concept, Levitt (1975) shows the dangers of failing to appreciate this contrast. He suggests that the American railroads lost their dominant position in the transport industry by failing to see that their business was transport, and not the running of railways. Adopting the marketing concept makes it more likely that existing product and sales methods will be abandoned, and innovations introduced, as customer needs change.

2.1.2 Similar questions arise in life assurance. The business of life assurance is not the selling of policies. It might be the provision of financial security or peace of mind or some other human need.

2.2 WHAT IS OUR BUSINESS?

2.2.1 The firm has to translate its orientation into actions. Drucker (1977) calls this the discovering of one's business, and emphasises that it requires protracted intellectual effort. It is not only true of firms, but of professions and their representative organisations, and also of individuals. For the last, he suggests (Drucker, 1990) that asking the analogous question: 'What do I want to be remembered for?' is the beginning of adulthood.

2.2.2 Actuaries need some knowledge of management for their role in life

assurance companies, their professional organisations and in their own lives. The process of management includes, at least, the three functions of planning, organising and controlling. Planning requires the setting of objectives. The marketing concept translated into Drucker's question: 'What is our business?' is an essential part of doing so in a rational manner.

2.2.3 The marketing concept therefore requires three fundamental questions to be continually asked continually:

- What is the business of a company in the life assurance industry?
- What is the business of the actuarial profession?
- What is my business, or for what do I want to be remembered?

2.2.4 The marketing concept requires that the answers include the ways in which we meet the needs of others. It requires that we work at developing an understanding of the real and perceived needs of our 'customers', and at examining our own capacity to meet them. It is suggested that the professional education system—as outlined by the core reading—should provide a framework for this lifelong work.

2.3 THE FINANCIAL LIFE CYCLE

2.3.1 The core reading includes some consideration of the needs of policyholders by reference to utility theory in subjects 107 and 109, and to particular needs (in the second unit of both subjects 302 and 402). It is suggested that the treatment is inadequate.

2.3.2 The financial life cycle provides a coherent structure for the consideration of the needs of the buyers of life assurance (and pension fund members). The basic idea of the financial life cycle is spelt out in Modigliani's (1986) Nobel lecture. The elements of the cycle have been intensively investigated in the economics literature. Polachek & Siebert (1993) give an excellent coverage of factors affecting income, and Hadjimatheou (1987) provides a useful treatment of some consumption and savings questions. Some relevant items are discussed in the following paragraphs.

2.3.3 The financial life cycle differs between cultures and socio-economic classes, but can be said to start when the individual begins to accept financial responsibilities.

2.3.4 Income levels depend on education levels and age as follows:

- For educated men, income rises with age until the late forties (later in organisations with promotions based on seniority), and then declines until retirement.
- Non-skilled men peak at or about 30.
- Single women's salaries largely follow single men's salary patterns.
- Married women's income drops significantly while their children are young, and they seldom catch up.
- The process has been explained by human capital theory, of which Gary Becker (1983) is the originator—and for which he received a Nobel Prize.

2.3.5 Expenses have a different trajectory, as follows:

- Setting up house—and, for the wealthier, buying cars—is expensive. This is aggravated if children arrive early.
- The cost of children generally rises with age and drops when they leave home.

- Medical costs are currently more or less proportional to the number of people in the household until retirement, after which they rise rapidly.
- Other expenses reduce after retirement, especially as health deteriorates.

2.3.6 Savings—in which life assurers play a key role—depend on the interaction of the two, as follows:

- There is evidence that many people are ‘liquidity constrained’ when they start work. This means that their consumption is constrained by their inability to borrow enough to live at a level that is likely to be justified by their future earning power. Even if they want to borrow, fears of moral hazard and the lack of the ability to insure risks lead to reluctance on the part of lenders.
- Paying off early debt is usually prudent. Saving for retirement can then begin. Modelling of the process can show that it might be reasonable to start this at 40 or even later if a house has been purchased.
- Retirement means living off investment income and capital. The failure of most people to buy voluntary annuities is a puzzle often debated. One possibility is that the bequest motive is widespread.
- The determinants of saving constitute a major debate in economics, which has addressed the effects of increases to income, self-employment, tax incentives, income volatility etc.

2.3.7 Much intriguing data on the volatility of income, expenses and savings have come from the Panel Study on Income Dynamics started in 1970 by the University of Michigan. Duncan (1988) reports on some of the findings in the first 11 years. Changes to family composition (particularly leaving home and divorce) prove to be the major contributors to financial instability. Also of interest is the spread and volatility of income progression in the light of changes to inflation and other economic variables. The author is in the process of attempting to develop a South African equivalent to that study.

2.3.8 Duncan’s findings have a number of implications for actuaries concerned that life offices provide for the real needs of their clients. Not least amongst them is the question whether level premium contracts are appropriate for people with volatile income and expenditure patterns. 30% of the families experienced a drop of 50% or more in their income-to-needs ratio during the 11 years of the study. It would be surprising, in the author’s opinion, if this were not typical of other times and other countries. Duncan also points to the poverty faced by widows whose husbands failed to buy joint annuities.

2.3.9 One of the principal failings of the actuarial education system is that it does not create any awareness of the massive academic literature on subjects closely related to actuarial work. Introducing students to the life cycle and income dynamics literature can assist in filling the gaps. It is surely essential if innovation in product design is to better serve our ‘customers’.

2.4 MARKETING IN SUBJECTS 302 AND 402

2.4.1 Unit 8 of subject 302 discusses the factors that must be considered in product design. ‘Marketability’ is mentioned as one such factor, but in terms that are bound to create cynicism:

The benefits offered need to be attractive to the market in which the contracts will be sold. Innovative design features may make a contract more attractive as may the additions of options and guarantees. The charging structure under a unitized contract needs to be attractive to the potential market and consideration needs to be given to whether the charges should be guaranteed. More generally, it needs to be considered what guarantees should be given with regard to premium rates.

2.4.2 The refrain of ‘need to be attractive’ suggests superficiality. The issue, if one accepts the marketing concept, is whether the policies meet needs, not whether they can appear attractive. Referring to the charging structures on unit-linked contracts suggests looking for ways of confusing policyholders: how else, for instance, does one explain capital units? ‘Innovative design features’ suggest gimmicks. ‘Options and guarantees’ do have a place, but most actuaries and economists would probably regard affordable options as offering limited value to policyholders.

2.4.3 Unit 9 of subject 402 is more balanced, and lists a number of ‘marketing’ objectives that would benefit policyholders. No distinction is made, however, between real benefits to the policyholder, such as simplicity and flexibility, and perceived benefits or gimmicks, such as the absence of an explicit market-value adjustment. The development of professional judgement surely requires practice in discriminating between the real and the superficial.

2.4.4 A caveat should be added here. It would be unwise to presume to know more about the real needs of policyholders than they do themselves, or to refuse to provide benefits because an actuary does not believe they add value. A gap in perceptions of this sort would suggest that the question: ‘What is our business?’ had not been fully answered.

2.4.5 ‘Marketing’ pressures to design contracts that appear deceptively innovative and inexpensive do form part of the day-to-day life of many actuaries. Such temptations contribute to the need for professional ethics and discipline. Actuaries that are committed to serving customers’ real needs because they understand that this is ultimately more remunerative, are in a better position to resist these temptations. It is to be hoped that the professional courses can be changed to encourage this commitment.

2.5 PUBLIC RELATIONS

2.5.1 An explicit aim of subject 201 is to test the student’s ability to communicate with lay people familiar with the financial sections of the press. Implicit, it would appear, is that such a communication could itself be used in the media. It is suggested that relations with the media require further development in the syllabus of 302 or 402. Life assurance has advantages that need to be communicated, as do the reported results of companies, and the responsibility frequently falls to actuaries.

2.5.2 The basics of the theory of communication are that it includes sender, message and recipient, and that there are translation problems at each interface, comprising the following elements:

– the sender:

The sender’s position and interests form part of the message. No one is particularly

persuasive when defending their own interests; they should at least be disclosed.

– the message:

The message depends partly on the medium. It would be helpful to include some information as to how newspapers choose and edit material.

– the recipient:

Some consideration might also be given to the effort required to get the attention of the recipient.

2.5.3 Some discussion of the needs of journalists could be helpful. This would include the nature of deadlines and off-the-record comments.

2.5.4 One might not be able to cover public relations without displaying some cynicism as to the integrity of the process. This can be acknowledged but it should go together with the development of skills in communicating the complexities of life assurance.

3. PRICING FOR PROFIT

3.1 THE NATURE OF PROFIT

3.1.1 Profit is a controversial subject. Asher (1998) suggests that profit can helpfully be divided into four elements:

– an interest portion:

The interest portion allows for the deferment of the use of the money. In the framework of financial economics, this would be the risk-free rate.

– a risk premium:

The risk premium consists of one part to allow for expected losses and another to reimburse providers for uncertainty. Under financial economics theory, the additional amount is expected to be proportional to the correlation of the risk with the market return on all potential investments.

– entrepreneurial activity:

Entrepreneurial activity (in the sense of the creative, and not the risk-taking, elements) will be rewarded if customers are prepared to pay more for quality or innovation.

– a monopoly rent:

A monopoly rent can be extracted from customers if they are somehow prevented from obtaining better value elsewhere.

3.1.2 On the political left, there are those who see each element of profit as morally reprehensible, on the right those that see all profit as acceptable.

3.2 EQUITY OR JUSTICE

3.2.1 Asher (1998) goes on to offer a traditional model of justice that suggests that equitable decisions must attempt to achieve equality, liberty, and efficiency, to provide for people's basic needs, and to recognise their deserts. Compromise is obviously likely to be necessary, but should be accepted reluctantly.

3.2.2 This model is then applied to the allocation of profit to consider whether alternative distributions can be justified. It is argued that the first three elements of profit

outlined in section 3.1, are both ‘natural’ and morally acceptable, and should normally be allocated according to desert. Monopoly rents, however, satisfy none of the criteria in 3.2.1 and are therefore reprehensible, and represent an abuse of power. This argument appears consistent with mainstream views of profit and justice, and provides a justification for free markets and anti-monopolistic legislation present in modern economies.

3.2.3 The model provides a framework for discussing other issues of equity. This can be illustrated by discussing discrimination in underwriting. Discrimination is an offence against equality in that people are treated differently, and against desert if the grounds for discrimination were not self-inflicted. Prohibiting it would be an infringement of liberty. Efficiency is debatable: Polachek & Siebert (*op.cit.*), under the headings of ‘statistical discrimination’ and ‘insurance underwriting’, show that there are arguments on both sides. The second debatable question is whether people’s basic needs are endangered by discrimination. People can, legitimately, take different positions on the debatable questions.

3.3 PROFIT IN 302 AND 402

3.3.1 Those holding this view of justice would accept that firms in competitive markets are morally entitled, and even obliged, to maximise profit. This is achieved by investing in all possible projects where the expected return on capital exceeds the cost of capital.

3.3.2 The courses do not have a coherent view of profit. At times, there appears to be a fear of criticising common practices that might prove embarrassing to the profession. The author’s experience is that this creates both confusion and cynicism in students.

3.3.3 Return on capital is described in the first units of 302 and 402 as depending on ‘other uses of the company’s capital’ rather than on the cost of capital in the market. The company’s other uses for capital are only relevant if the company does not want to raise capital. In practice, the costs (financial or in terms of dilution of control) of raising capital are often too high. Market returns are also important if the company has capital but cannot invest it at the market rate, and so should return it to shareholders. These considerations need to be mentioned if students are to learn to reconcile theory and practice.

3.3.4 While it is conceded, in unit 5 of 302, that a company will want to maximise profits, the position spelt out in units 6 and 9 of 302 is that a company sets a required profit criterion. Again, in practice, using a required return somewhat in excess of the cost of capital can be justified as a rule of thumb, but this needs to be made explicit.

3.3.5 Setting a profit target also places a ceiling on entrepreneurial profits or monopoly rents. This could be an ethical approach if set at the cost of capital, or a rational approach for a monopolist who feared a reaction from regulators if profits were too high. It might be argued that there is significant competition, and that there are therefore no monopoly rents, in the life assurance industry in both the UK and South Africa. The recent Cruikshanks (2000) review of UK banks, however, found significant competition

problems in all the markets investigated. The Myners (2001) report on the institutional investment market in the UK found similar problems. Both are sufficiently close in structure to the insurance markets to suggest the same criticisms might apply. In particular, actuaries clearly have something of a monopoly on pricing.

3.3.6 To be provocative, the current, actuarially recommended, approach to price determination (which suggests that profit targets should significantly exceed the cost of capital) might be found to be an illegal price-fixing cartel. This is not to suggest that this is a conscious decision, but that it is the unintended consequence of a theoretically unsound approach to pricing.

3.3.7 On the other hand, if the market is competitive, then the setting of an excessively high profit target means that profitable business opportunities will be turned away.

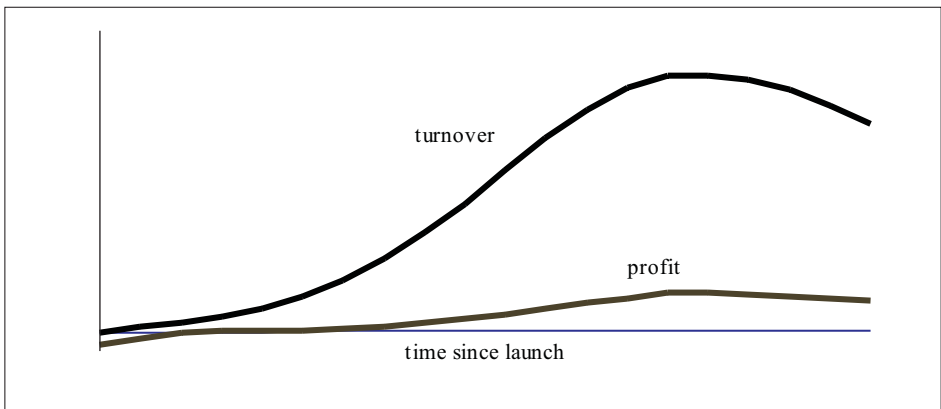
3.3.8 The impression that might be given from the core reading is that profit should not be discussed. This allows important presuppositions (derived from the political right and left) to go unchallenged, and creates confusion about the nature of both profits and ethics. An introduction to the marketing concept and this explicit view of the moral unacceptability of monopoly rents provides the means of integrating the technical, professional and human elements of education. Drucker's (1977) view is that the social function of business is to 'create a customer' (by meeting a need) and that profits are a means to that end. This is an expression of the golden rule: 'Do to others what you would want them to do to you.' In the long run, *ceteris paribus*, ethical business is good business. In the short run, various forms of deceit may be lucrative.

3.4 THE PRODUCT LIFE CYCLE

3.4.1 The product life cycle can give a deeper understanding of the nature of ethically acceptable entrepreneurial profit. The cycle can be shown in two diagrams.

3.4.2 Figure 1 represents a simple model of the market penetration and profitability of a successful product. It is likely to generate initial losses as expenses are

FIGURE 1. The product life cycle

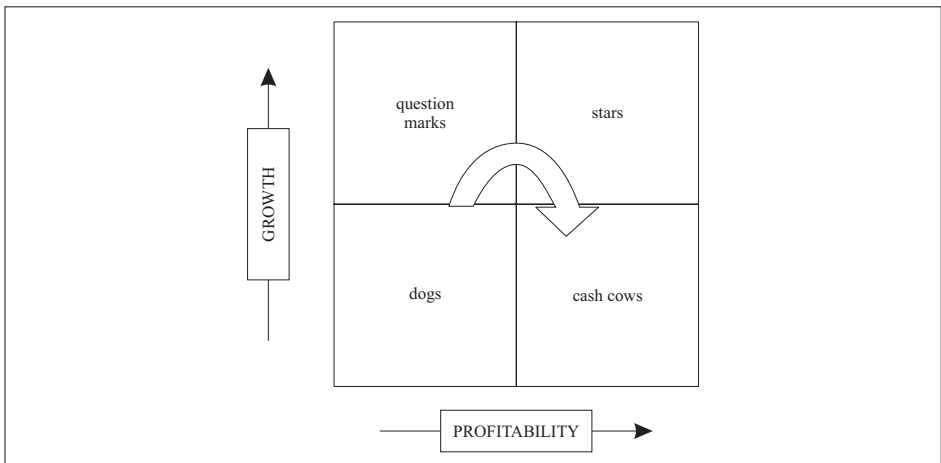


incurred before revenue is generated. Profits then emerge as market penetration increases. Eventually, one gets to the point of market saturation, and turnover may begin a slow decline. Profits, however, can continue at a relatively high level.

3.4.3 Figure 2 is perhaps more colourful and is used to indicate which products are likely to be successful, and which will repay further investment. Crudely put, ‘dogs’, low in both profits and growth, ought to be culled; cash cows can be milked, but are unlikely to repay investment. Stars, on the other hand, require new funds to reach their potential markets. Question marks are just that, and may need to be re-priced or culled.

3.4.4 The two are reconciled in that the product life cycle follows the large arrow from successful question marks through stars to cash cows.

FIGURE 2: Product growth and profitability



3.4.5 The product life cycle illustrates that, in the context of dynamic and competitive markets, legitimate profit rates can vary enormously, and that it is entirely acceptable (and may indeed be incumbent on companies) to maximise their returns by investing in successful products.

4. MARKET VALUES

4.1 THE DEBATE

4.1.1 The debate between using market or alternative values for assets and liabilities has a long history, considerably enlivened recently by debates between supporters of traditional actuarial methodologies and those of financial economics. Exley, Mehta & Smith can be relied on to attack the older ways—as for instance, in their paper on defined-benefit funds (Exley, Mehta & Smith, 1997). Hare *et al* (2000) are the most recent to apply the techniques to life assurance as they show how notional put options can be used to determine a market price of the guarantees in with-profit contracts.

4.1.2 Probably the major failure of the core reading as it stands is that it largely fails to acknowledge the debate, let alone accept the insights that financial economics can offer. Hare *et al* are included in the recommended reading for subject 402, but as examinations are based on the core reading, students are not being asked to integrate the insights of financial economics into their thinking about life insurance. It is little wonder that some students who have studied financial economics (which has been in subject 109 for four years) have told the author that they find the later core reading exasperating and irrelevant.

4.2 SURRENDER VALUES

4.2.1 Unit 10 of 402, which deals with policy alterations and surrenders, fails to refer to the market value of a surrendered contract, or to the implicit put options that may be present. Unit 10 of 302 does refer to the auction value of a surrendered policy, but only to assert that the market value it represents may not be reasonable. The environment envisaged for surrenders is apparently a monopolistic one in which profit can be determined by the company.

4.2.2 The theoretical views set out in this paper have two main consequences here. The first, from section 3.2, is that it is immoral for a company to take advantage of its monopoly power in incomplete surrender-value markets to pay less than a fair market value. The second is from financial economics: the fair market value can be determined by a prospective reserve using investment return assumptions derived from a portfolio that more or less replicates the future payout on the policy.

4.3 EMBEDDED VALUES

4.3.1 MODERN FINANCIAL ECONOMICS

4.3.1.1 Modern financial economics is based on the assumptions that there are no arbitrage possibilities in investment markets, and that the markets do not require higher returns for non-systematic risks (those uncorrelated to the market's returns).

4.3.1.2 In particular, one cannot project the returns from an equity-type asset (that offers a higher expected return because of systematic risks) and fixed-interest-type liability (that does not), and then discount the difference. If one were to do so, it would suggest that profits could automatically be created through mismatching, which contradicts the no-arbitrage assumption.

4.3.1.3 Embedded values should therefore be calculated using the risk-neutral model discussed in subject 109: all proceeds should be stochastically projected and discounted at the market's risk-free rate. Alternatively, one could use the deflators described by Jarvis, Southall & Varnell (2001). Appropriate adjustments have to be made for tax.

4.3.2 THE TRADITIONAL ACTUARIAL APPROACH

4.3.2.1 This is the only approach mentioned in unit 12 of 402. It explicitly assumes that shareholders require an additional return for taking on all risks, not only for systematic ones.

4.3.2.2 The traditional approach can be justified in practice. Market participants can be observed to demand a reward for non-systematic risks, albeit one lower than that required for systematic risk. One would expect the additional return to represent the cost of attempting to diversify away these risks.

4.3.2.3 A further assumption of the traditional approach is that investments in equities yield a return, in the long run, that significantly exceeds that available on fixed-interest assets. This is consistent with most historical evidence, and it appears that the excess return exceeds the risk premium that might plausibly have been required for investment in equities (Siegel & Thaler, 1997). Some possible explanations for the historical out-performance are that most investors were not able to buy equities because of regulatory obstacles, institutional difficulties in obtaining appropriate advice, ignorance or even perversity. There is widespread agreement that the prescribed asset requirement in force in South Africa until 1989 led to a much higher return being available on equities. It is vital to note that these restrictions to equity investment in the past may not apply, or may even reverse their effects, in future.

4.3.2.4 The traditional method is to project best estimates of future payments and discount at a rate that equity investors would expect to receive on investments with this particular risk profile. It is a reasonable and practical approach if appropriate allowance is made for contingent payments, but may have to be justified to those with the financial economics paradigm.

4.4 PROFIT REPORTING

4.4.1 Profit reporting is discussed in units 4 and 12 of subject 402. It is also linked to the question of embedded values, and the risk discount rate used in pricing.

4.4.2 There is again no mention in these units of the widespread view that liabilities should be shown at a 'fair' or market value. This view has been incorporated into international accounting standards on pensions (IAS 19), and is currently being discussed for life insurance contracts (see www.iasb.org.uk). Fair value can perhaps be equated with the realistic or 'best' estimates discussed in the core reading, but this would fail to make provision for the value that the market places on risk.

4.5 MISMATCHING

4.5.1 The idea that life offices should mismatch their liabilities in order to increase profits is particularly irritating to those who have adopted the no-arbitrage assumption, or the capital irrelevance proposition from financial economics. The capital irrelevance proposition points out that shareholders are able to adjust their exposure to the market risk by including more, or less, interest-bearing stock in their portfolios—or by borrowing if they want additional gearing. Company managements therefore cannot add value by mismatching and investing more in equities.

4.5.2 The following paragraph from unit 12 of subject 302 is a red rag to the financial economics bull:

The existence of free assets in a life assurance company means that it can depart from the matching strategies outlined above so as to improve the overall return on its assets and

thereby benefit its policyholders, through higher bonuses or lower premium rates, and its shareholders (if any), through higher dividends.

4.5.3 The financial economists may be wrong in practice. Both policyholders and shareholders may want a life company to increase its exposure to the equity market because its cost of administering equities or of borrowing is lower than theirs is, or because they are liquidity constrained. These practical points are however not made, even though mismatching is mentioned in units 1, 4, 11 and 13 of subject 402.

4.6 SMOOTHING

4.6.1 When a company smooths returns, it effectively transfers assets from departing policyholders to new policyholders (or shareholders) at a price that differs from the market value. Smoothing is frequently criticised in that the price determined is arbitrary, and potentially allows arbitrage if single premiums or withdrawals are not adjusted to market value.

4.6.2 Financial economics provides an objective method of determining a fair price in advance, and reconciling current values to the market. This is if smoothing can be regarded as analogous to rolling forward contracts between continuing and maturing policyholders. The smoothed price, where the forward contracts were spread over n periods, could then be defined as:

$$\frac{1}{n} \sum_{t=0}^{n-1} P_{-t} (1 + r_{-t})^t ;$$

where P_{-t} is the market price at time $-t$, and r_{-t} the risk-free rate of interest at time $-t$ on a zero-coupon bond of term t . Some appropriate adjustment would have to be made for dividends. The actual interest rate can differ from the risk-free rate to allow for tax, expenses, and perhaps opportunity costs. It can also be expressed in nominal or real terms.

4.6.3 It is suggested that any smoothing method that cannot be fitted into this framework would be unfair to one or other party. The argument arises from a consideration of the replicating portfolio. A forward contract can be replicated by an immediate sale, the proceeds of which are placed on deposit, and an immediate purchase funded by a loan. The forward price (if no dividends are payable) must thus be at the current price increased by some rate of interest (assumed to be risk free in the naive model). If, for instance, it were known that the notional forward price, at which assets were to be passed on by departing policyholders, was to be significantly less than the theoretically determined price, then it would be better for the departing policyholders if their current share of the assets was realised and placed on deposit. To treat them otherwise would be unfair.

4.6.4 This approach would also allow for the fair pricing of surrender values, and the determination of adjustments that should theoretically be made to new-business premiums if the term to maturity is less than n .

4.6.5 Unit 13 of 402, in dealing with surplus distribution, again fails to mention the market-related approach—although, to be fair, this author has not previously come across the approach mentioned here.

5. MATHEMATICAL MODELLING

5.1 NOT RIGOROUS

5.1.1 A good deal, if not the essence, of actuarial work requires mathematical modelling. A look through a small selection from a university library shows, however, that this can mean different things to statisticians, applied mathematicians, engineers and economists. Pemberton (1999) and discussants show how controversial the philosophical underpinnings can be.

5.1.2 The core reading reflects some of this diversity of opinion, but without much apparent appreciation of the debate. Unit 6 of 302, for instance, discusses models in life assurance but seems to only have a model life office in mind. The readings for subjects 303 and 304 are similarly parochial.

5.1.3 This subject is critically important to life office work, as actuaries have models in mind whether we are pricing, valuing or otherwise investigating the finances of a life company. They cover each of:

- mortality, disability and other risk rates,
- expense allocations,
- lapse and surrender rates, and
- investment returns.

5.1.4 Particularly confusing are statements such as that in course 302, unit 6, which says that models ‘must be valid’. The first unit of subject 103, which provides the fullest and most useful description of modelling, is more circumspect in requiring that a model should be valid ‘for the purpose for which it is put’. ‘Validity’ is seldom appropriate if it means that the model should have passed some statistical goodness-of-fit tests.

5.1.5 A more helpful argument might be made on the following lines:

- Mathematical models are attempts to represent reality.
- Actuarial models are constructed to help understand actuarial problems, such as the pricing of life products, or the evaluation of the solvency of a life company.
- Their construction depends on making assumptions about reality. The assumptions should be justified theoretically, and be tested against experience, in order to ensure their reasonability.
- There are seldom enough data to statistically validate actuarial models. Some models are over-parameterised. The ASSA AIDS models provide examples, as they require many more parameters than can be accurately estimated. Other actuarial models have too few parameters, but are acceptable approximations for practical purposes. The use of a single interest rate to model future investment returns provides an example.
- Models represent the past. They must be used tentatively in managing the future. Of particular concern is the possibility that new or previously unimportant factors may become significant.
- Actuaries have, therefore, to exercise judgement in determining the structure of their models and in their utilisation.

5.2 EXPENSES

5.2.1 It is particularly helpful in understanding expense allocations to see them as an actuarial model. Actuaries make assumptions that expense drivers can be distinguished into those that are related to new and renewal business, overheads and marginal costs, premium and sum-assured weightings etc. There will also be a number of significant decisions (such as new computer systems, offices etc.) that affect the outcome. It is not possible to rigorously test the many parameters that would have to be built into a valid expense model. Actuaries have to be satisfied with a model that approximates reality.

5.2.2 Given the uncertainty present, actuaries might be forgiven for pricing products using their best estimates of costs for the future in the profit-testing methodology. It is suggested, however, that the approach of the core reading to these issues is again not sufficiently coherent. As far as the distinction between direct costs and overheads is concerned, unit 16 of 302, reads that: 'In practice, there is not a clear dividing line between the two.' The unit then goes on to treat overheads as if they were irrelevant. Unit 9 of 402, which deals with pricing, does have a paragraph on the question, and it is considered in GN22, but it appears that the student can pass the exams without having considered how real overheads should be treated.

5.2.3 Overheads are explicitly addressed by Chalke (1991), who suggests that we apply the basic economic approach to profit maximisation: that prices should be set at the point where marginal costs equal marginal revenue. All costs are ultimately marginal, but he describes a hierarchy of decisions where costs marginal at one level are overheads at another. For example, changes to the computer system are marginal when deciding to introduce a new policy, but overhead in determining expense loadings. His 'macro pricing' approach requires marginal costs to be distinguished from overheads, and the sales managers to provide the basis for estimating marginal revenue by giving an indication of the likely sales of different expense and remuneration structures.

5.2.4 While it may not be necessary in practice, future actuaries should be aware of his criticism of the new 'tradition' of profit tests. In the discussion of an earlier draft of this paper at the actuarial convention, the point was made that the more successful companies in the South African market had begun to differentiate between overheads and marginal costs. This suggests that the environment may well now require a more sophisticated approach.

6. CONCLUSION

There are a number of insights, from managerial and economic theory particularly, that could be incorporated into the core reading for subjects 302 and 402. They would make the subjects more coherent and useful in practice, and further develop students' professional judgement.

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APPENDIX A

SURVEY OF PRODUCT DEVELOPMENT GRADUATES

A.1 Pre-1998 graduates e-mailed: 33
 Replies: 10 immediately, 7 after a second attempt

A.2 ASKED

Have you found the following sections of the product development course useful in your work? Use the scale:

- essential 1
- very useful 2
- fairly useful 3
- of some interest 4
- do not remember 5

A.3 RESULTS

	Essential	Very useful	Fairly useful	Of some interest	Do not remember
The marketing concept	5	6	3	2	1
What is our business?	6	7	2	1	1
The financial life cycle	3	9	4	1	0
Public relations	1	6	1	4	5
Theory of profit (offered once)	1	3	3	2	8
Product life cycle	3	3	6	4	1
Macro pricing	3	6	2	3	3
Exposure to academic papers	3	6	5	3	0
Lots of written work	6	5	4	1	1

The second set of replies were more likely to score the items as 1 or 2 (essential or very useful), which suggests that those who failed to reply would be at least as enthusiastic about the usefulness of the concepts mentioned. One graduate gave a four ('of some interest') to everything, on the grounds that he had had nothing to do with product development, and so accounts for 9 out of the 21 fours.