APPRAISAL VALUES FOR PROPERTY AND CASUALTY INSURANCE COMPANIES
FOR MERGER OR ACQUISITION
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BIOGRAPHY

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ABSTRACT

The proposed CAS "Statement of Valuation Principles" indicates
that the valuation of a property and casualty insurer should be
based on the present value of a projected cash flow to be
generated by that insurer.

The detail of the specific cash flow to be valued is not defined
in the Principles - this paper proposes that for merger and
acquisition purposes, the appropriate cash flow is the maximum
distributable earnings of the insurer. These earnings can be
regarded as either the maximum stockholder dividend, or as
modified statutory earnings where the modification is so as to
ensure that policyholder surplus is maintained at the required
level.

The valuation process is prospective. Merger, acquisition and
divestiture are all events which can signal substantial changes
in the future direction and performance potential of an
insurer. A key element in determining the appraisal value of a
property and casualty insurer under such conditions is the
identification and assessment of the likely changes in the
future operations and results of the insurer.

The paper proposes that the macro model of the insurer's
operations be produced by aggregating micro models which are
based at the individual policy level. The micro models are
similar to profit tests which are used to design, develop and
evaluate life insurance products.

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1. WHY VALUE?

In recent years, the number of appraisals of property and casualty insurers has increased as both the reasons for undertaking appraisals and frequency of use has increased. The following indicate some of the reasons for which an appraisal value may be required:-

1.1 Acquisition, Merger or Divestiture: merger and acquisition activity has been increased greatly in recent years in the property and casualty insurance industry - especially through the late seventies and the eighties - as various players in the financial services industry vied for position in a dynamic market place.

1.2 Management Information and Control: for both mutual and stockholder insurance operations, one of the basic objectives of management must be the maintenance or augmentation of the value of the operation over time. Often a more directly measurable variable is used as a surrogate for the value of the operation - for example, premium volume, operating profits or asset value. Each of these items has the virtue of being easily and readily evaluated, but each also is lacking as a true measure of the achievement of management in developing the operation.

Premium volume/market share is often obtained by writing business at inadequate rates - with potential long term detrimental effects on the value of the operation. The emergence of operating profits can be manipulated to some extent by management - what appears to be a healthy growth in profits may merely the capitalization of future profits in the current income statement. Amassing assets may be pursued through cash flow underwriting - I hope we all know the potential pitfalls of such a strategy! The use of appraisal values determined on a consistent basis over time can provide a comprehensive measurement tool by which the performance of management can be truly assessed.

1.3 Share Option/Incentive Schemes: this is an extension of the use noted above - many share incentive schemes provide for the shares to be issued to management at a discount to their true value. For companies the shares of which are not quoted, an appraisal value may provide a suitable basis on which to determine such share values.

1.4 Consolidation/ Accounting Values: under circumstances in which the value of an insurance operation is to be consolidated into a parent company's balance sheet, an appraisal value provides a basis for determining such a value on an arms length basis which is consistent over

time.   Such a basis has much to commend it over the use of such alternatives as net asset value or a multiple of net earnings.

2. AN APPRAISAL VALUE: What is it? - Price versus Value

Value is intangible.   Value depends on the item being valued, the valuer and the circumstances under which the valuation is being carried out.

The value of a property and casualty insurer is no exception.

As noted by Sturgis (2), there are several alternative bases for valuing a property and casualty insurance company - for example, market value and book value.

An appraisal value must be determined by a knowledgable valuer who is aware of the circumstances and purpose of the valuation. The appraisal value will be determined in respect of that specific purpose - this can be contrasted with the book value or market value which are determined independent of the valuer.

There is a unique price for a given transaction which can only be established with certainty in retrospect.

The buyer and the seller each enters into negotiations with his own perspective of the value of the item for sale.

As for any transaction, the price paid for a property and casualty insurer is a function of the supply of and demand for such companies.

3. DEFINITION

The actuarial appraisal value of a property and casualty insurance company is the economic value of that company.

The Economic Value of a company is the best estimate of the present value of future earnings of that company which will be available to the (prospective) owner(s).

The following characteristics of the economic value of an insurer should be noted:

    3.1 It is specific to the valuer. This can be seen directly, for example, from the impact which a change of ownership may have on the tax liabilities of the insurer. If a potential owner has tax credits which can be used to reduce a tax liability which would otherwise accrue to the company, the distributable profit flow of the insurer will

be higher for the potential owner than for the existing one. Less concrete factors are the plans and future expectations of the valuer. If, for example, a potential new owner plans to broaden the company's marketing focus, his expectations of future premium volume and profitability may be considerably different from those of the existing owner and management.

3.2 Economic value embodies only the prospective results of the company. The results of the (recent) past and capital contributions which have already been committed to the company are not relevant to the current value of the company. True, recent performance MAY be indicative of future performance. However, the past performance is being used as a surrogate for estimated future performance and not in its own right. Similarly, the price recently paid to acquire a company or capital contributed to establish it are not necessarily particularly relevant to the value of that company - although either may constitute a lower bound to the PRICE for which it would be (re)sold.

3.3 It is available earnings (i.e. those which could be distributed net of tax on a statutory accounting basis) rather than projected taxable earnings, GAAP earnings, etc. which must be valued. Note that it is not statutory profits

per se that is being valued. It is the marginal amount of statutory earnings, determined after taking into account the amount of policyholder surplus <u>required</u> at year end, which is being valued. For example, if the company is growing so quickly that emerging statutory profits are not adequate to fund the required increase in policyholder surplus together with the increase in DAE etc., then the available earnings for the year will be negative to the extent that capital contributions (in addition to the increase in retained earnings) are needed to achieve the required policyholder surplus level. Refer to Section 4 on profit testing and to Appendix A for further details.

There are differing opinions as to what is the appropriate income stream to be valued - Sturgis in his paper (2), in keeping with the literature relating to life insurance companies, considers the statutory profit stream to be the best choice. This view was contested by Rothman and Duetsch in their discussion of Sturgis' paper (4). They considered the "cash flow" to be a more appropriate income stream to value. Sturgis in his author's reply (5) identifies the difference between these two approaches as being the interest penalty which his approach imposes during the delay between the generation of cash and its release as statutory earnings. This interest penalty is based on the excess of the risk rate of return over the assumed investment yield.

The model approach described later in this paper appears to have the best of both worlds - we will return to this discussion in Section 6.

3.4 The estimation of available earnings must take into account the tax implications of the future development of the company and its portfolios of both liabilities and assets.

3.5 Economic value recognizes the present value of future earnings. That is, the timing of the release of future available earnings must be assessed and a risk rate of return be selected in order to determine the present value of those earnings.

For the purposes of this paper, the economic value of a property and casualty company will be calculated as the sum of:

1. the net worth of the company, reduced by the policyholder surplus required to support the existing business in run-off (see 2. below), and

2. the present value of the available earnings from both existing business and from future new business, discounted at the appropriate risk rate of return.

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Available earnings are taken to be the maximum amount
of earnings which could be distributed on a statutory
basis after tax. Such distribution must consider the
need to maintain the minimum amount of policyholder
surplus. If the model used allocates some policyholder
surplus to support the existing business as at the
valuation date, such amount of policyholder surplus
will be deducted from the net worth of the company to
be used in 1. above. This net worth plus accrued
investment earnings will be released to earnings as the
existing business is run-off.

Refer to the example in Appendix B for further details.

4. "AVAILABLE EARNINGS"

There been several references already to the need to project
"available earnings" in order to determine the value of a
property and casualty company.

For the purposes of this paper in general, and for the valuation
methodology described below in Sections 6 and 7 in particular,
available earnings will be taken to mean that part of after tax
earnings determined on a statutory basis which is available for
distribution. Hence, this is effectively the maximum dividend

which could be declared each year while maintaining the minimum
policyholder surplus.

In his paper, Sturgis (2) suggests two alternative bases for
valuing a property and casualty insurer:

1.   The discounted value of maximum stockholder dividends; and
2.   Current net worth plus the discounted value of future
     earnings less cost of capital.

Sturgis argues that under the first basis, "the entire valuation
is based upon projections of future earnings and is wholly
dependent upon the particular selected risk rate of return." By
comparison, the second basis "splits the economic value into
component parts. ... The first component ... is an accounting
value ... This represents a significant portion of economic
value and is not dependent on the selected risk rate of return.
... The cost of capital then is based upon the difference
between the anticipated rate of return that will actually be
realized on invested capital and surplus, and the rate it could
be earning if it were invested elsewhere."

In fact, if the two methods are applied consistently, the basis
of projection is identical and the two methods are equally
dependent on the risk rate of return selected.

Under the first basis, any "surplus surplus" would be released immediately as a dividend. Such a dividend is likely to be significant in relation to the total value of the company and, since it is assumed paid immediately, is independent of the risk discount rate assumed. The rest of the value of the company will be based on the emergence of future dividends.

Under the second basis, the total net worth is assumed released immediately and taken as value. The company then has zero policyholder surplus. A model is used to estimate the emergence of statutory profit from the company assuming that it maintains zero policyholder surplus. That is, statutory earnings are withdrawn to value each year (this seem to me to be the same as saying that a dividend equal to statutory earnings is paid each year!). Since in practice, the company will require policyholder surplus, the cost of holding such surplus is also assessed from the model and is deducted from the combined value of the net worth and projected earnings stream. Sturgis proposed that this cost is a fixed percentage of the required policyholder surplus; the percentage being the loss of yield due to the conservative investment strategy required on the assets corresponding to the policyholder surplus. It would be more consistent with the overall valuation philosophy if the cost of capital were based on the excess of the risk rate of return over the assumed invested asset yield - hence the cost will increase

as the risk rate of return increases (although the deeper discount at the higher risk rate of return will offset this impact to some extent).

Thus, although there appears to be two substantially different bases of calculation (possibly with two very different answers), that is all it is - an appearance. The two methods, given the same underlying assumptions, will necessarily yield the same results.

As was mentioned in Section 3.4 above, Rothman and Deutsch in their discussion of Sturgis' paper (4) suggest that it is more appropriate to value the projected cash flow rather than the projected statutory earnings. They comment that "In general, there is a tendency for statutory valuations to undervalue a company that is experiencing premium growth and to overvalue a company that is experiencing premium deterioration. The reason for this is that statutory accounting principles do not recognize revenues and expenses in the proper periods, i.e., premiums and losses are recognized over the policy period, while actually premiums are received at the beginning of the policy period and losses are paid over several years."

It must be emphasized that in projecting statutory earnings, it is essential that the underlying cash flow (including investment

income) be recognized. Although the statutory accounting basis recognizes incurred losses in the year they occur, the model used to estimate statutory income must reflect the fact that those losses will not be paid until some later date. In the interim, the assets backing the unpaid loss reserves will be generating investment income. In his author's reply, (5), Sturgis correctly identifies the difference between the two approaches as being an interest penalty (the excess of the risk discount rate over the assumed yield on invested assets) on assets backing reserves from the time the reserves are established until they are brought down again. Rothman and Deutsch argue that "... limiting cash flow to statutory earnings is unrealistic. It ignores the value of internally generated cash that can be invested by the owner at his discretion, within certain regulatory constraints. For example, excess cash can be used to finance further acquisitions or a wide variety of other investments." This argument assumes that the investment assumptions used in the appraisal value are based on a traditional, conservative investment policy. However, it is not necessary to move to a totally cash flow based valuation in order to reflect an aggressive investment policy. The asset allocation/ investment return module of the projection model can be set up to model whatever investment policy and investment returns are anticipated by the valuer. Note that if the investment of assets is to be in higher risk/ higher expected

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return types of investments, then it may be necessary to increase the risk rate of return as the riskiness of the whole operation is increased by such an investment strategy.

5. WHAT IS DIFFERENT ABOUT APPRAISALS FOR ACQUISITION/MERGER COMPARED WITH APPRAISALS FOR OTHER PURPOSES?

An appraisal value is based on an assessment of the expected future income-generating capacity of the company.

Acquisition, merger or divestiture are events which often signal a change in direction for the company. A merger may introduce new marketing resources, a new geographical focus or a broader product range. Acquisition will subject the company to the plans of the new owners. Divestiture may release the company from the influence of restrictive or conservative corporate policies which have hampered company development.

As noted above, there is a common thread to all three events — they signal that the future direction of the company may be subject to substantial change.

An appraisal value for merger and acquisition purposes must take account of the plans and expectations of the owners and managers who will be directing the company in future.

This characteristic of an appraisal value which is being determined in the context of merger or acquisition was identified by Lowe in his discussion of Sturgis' paper (4). He differentiates between the value to the seller (the "value in use") and to the buyer (the "value in exchange"). A property and casualty company, considered as a going concern, is not a concrete object. It is a collection of persons (both natural and corporate), relationships, systems, contracts, assets and liabilities. Lowe suggests that value in use is intrinsic to object being valued, whereas value in exchange is not - I have considerable difficulty in conceiving of this "intrinsic" value for a property and casualty company in use. There may be a limited amount of intrinsic value in the run-off of the in-force business. However, I see nothing intrinsic in the assumption that the going concern will keep going and generate profits from future new business.

There is a more detailed discussion of some of the issues relevant to this in Section 8.

6. PROJECTION OF FUTURE EARNINGS - Profit Testing

In order to foster an understanding of the sources of earnings to emerge in future, it is useful to focus on the expected earnings emergence from a single policy over the period from

when it is issued until the last claim from that policy is settled.

A technique widely used in the design and development of life insurance products is profit testing. Smart's paper (6) provides a description of the application of profit testing to life insurance products. (Profit tests are often the heart of the models developed when preparing an appraisal value of a life insurance company - for example, see reference (7).) A profit test is simply a projection of the cash and non-cash accounting flows associated with an "average" policy. These flows are produced in order to assess the emergence of "profits" after taking into account the need to establish reserves and to assign surplus to support the policy. Hence a profit test generates the statutory accounts relating to an individual policy at, say, monthly intervals.

In this context, "profit" is used to denote available earnings (refer to Section 4), that is, the cash flow available to the insurer net of capital contributions required in the form of policyholder surplus and in the form of reserves to the extent that they are not fully financed by premiums (the DAE part of unearned premium reserves based pro-rata on 100% of written premium, etc.)

This "profit" stream is discounted at a risk loaded rate of return to the date of issue of the policy. Since the definition of profit includes the capital investment required by the insurer in order to issue the policy, a present value of zero implies that the issue of the policy earns the insurer the assumed hurdle risk rate of return. This return is earned on the capital invested in the policy by the insurer as surplus and as reserves not financed by premium income.

As has been discussed in Section 4 above, this definition of profit effectively equates to the maximum dividend which could be declared on a statutory accounting basis after tax.

The profit testing approach to product design and development is valuable as it permits the user to evaluate the sensitivity of the product's return to any one or any combination of the underlying parameters.

Appendix A provides a simple example of a profit test and briefly describes method.

It is evident that recent developments in the pricing of property and casualty products have been moving towards a profit testing approach. Such an approach explicitly reflects all the factors affecting a policy by projecting the expected experience

of that policy.   The 1986 Tax Reform Act requiring discounting

of loss reserves for tax purposes, pressure from several sources

requiring an explicit allowance for investment income in pricing

and the severity of the trough during the most recent downturn

in the underwriting cycle have all helped focus attention on the

need for effective and realistic pricing methods.

One of the problems with the underwriting (policy) year based

model proposed by Sturgis (2) is that there is very little

insight gained as to the source and sensitivity of the projected

statutory earnings flow relative to the multitude of underlying

assumptions and input parameters.

By starting at the level of the individual policy, it is

possible to gain a much better feel for the source of earnings

and for the critical factors within the valuation.   (The profit

testing approach to developing an appraisal value model is

similar to building macroeconomic model by assembling

constituent micro-economic models.)

Of course, there are some items which can only be finally

determined at the macro level.   For example, the complexity of

the federal income tax calculation will require an assessment of

tax payable on the company as a whole.   An adjustment may be

required to reconcile the aggregate of the expected tax payments

from the sum of the profit tests with the total amount of tax payable. Similarly, although the individual profit tests make some allowance for the required level of policyholder surplus on a policy by policy basis, it may be necessary to make a macro adjustment to obtain the desired level of policyholder surplus in total. For example, a profit test could be based on requiring policyholder surplus determined as a function of both unearned premium reserve (which initially equals written premium) and unpaid loss reserves. While this approach is logical at a micro level (i.e., when considering the policy in isolation for pricing purposes), it fails to recognize the need either for a minimum critical mass of policyholder surplus or the impact of certain real world rules of thumb such as needing policyholder surplus of at least one third of written premium. For a new company, or in respect of a new and growing product line, the macro model for the portfolio of policies will require further capital contributions to support the portfolio. This is a real cost which should be associated with the start up of the new company or product line and not with the individual policies issued.

7. THE HURDLE RISK RATE OF RETURN AND PROFIT MARGINS

The risk rate of return to be used to discount the projected future available earnings flow is a hurdle rate of return selected by the valuer.

A hurdle rate of return is the minimum rate of return on equity which an investor/valuer is willing to accept on his investment. For example, in a large company with many operating divisions, investment in the various divisions may be controlled by requiring that the projected return on equity for each new capital expenditure exceed a stated minimum rate. This rate is the hurdle rate of return.

For an insurer, the issue of a policy represents an investment of a limited resource - policyholder surplus. Capital must be supplied to support the policy in the form of policyholder surplus (solvency margin) and to fund reserves to the extent that they are not fully funded by premium income.

The strategy for running an insurance company can be evaluated from the perspective of game theory. The "game" has three players - the insurer, the insured and the intermediary. Game theory indicates that under such circumstances, the best strategy is for two of the players to team up against the third. Typically in the insurance game, the insurer and the intermediary will team up. This does not necessarily mean that they act so as to harm the insured - but they will align their actions and bases of operations so as to complement each others situation.

For example, consider the situation in which the intermediary is remunerated by commission payments (whatever the basis of calculation). We would generally assume the intermediary will act so as to maximize his commission earnings. How should the insurer price his policies? The pricing basis should be such that the intermediary will automatically act so as to maximize the value to the insurer of the policies he sells. What if the insurer priced his products so that the present value of the expected earnings from each policy (discounted at the hurdle rate of return) was a set percentage of the commission payments due to the intermediary under each policy? Then, as the intermediary maximizes his own income, he will automatically maximize the value added to the insurer through his efforts. Such an alignment of purpose need not be detrimental to the insured - indeed, if it provides for more effective and efficient distribution of the product, the insured may benefit from reduced insurance costs.

8. ISSUES

Underlying the profit test is a broad range of assumptions - from the expected ultimate loss amount per unit exposure to the level of expenses involved in setting up and administering the policy and the amount of surplus required to support the policy.

In addition, in aggregating the profit test results for individual policies into a model of the total operation, there are many more assumptions to make - for example, the expected premium volume by line for each future year to be modelled.

There is, however, a primary assumption which underpins the whole model - the assumption that the company, and each of its major operating divisions, will continue to function in an effective and coordinated manner.

Let's consider what this may mean in more detail in the context of merger and acquisition.

8.1 **Management** - What if it leaves? What if it is to be replaced?

In the context of merger and acquisition activities, a vital factor is the extent to which the existing management will either want to stay on and/ or will be permitted to stay on. If there is to be a change in management, then the potential impact on the whole operation and direction of the company needs to be assessed. This starts with the basic direction of the company (personal versus commercial markets; products within markets; methods of marketing; competitive posture in pricing; volume of product to be sold; etc.) and follows through to every aspect of

the company's operations (level of expenses; claims handling and reserving philosophy; underwriting standards; etc.).

This may be a central source of difference in the value placed on a company by the seller/ existing management and that assessed by the buyer/ new management. While beauty may be in the eye of the beholder, value is in the expectations of the valuer!

8.2 Marketing/ "The Production Machine" - What will happen to it? Is it dependent on one or a few key individuals? Can they take it elsewhere?

In addition to the changes which a change in ownership and/or management may impose on the marketing division of the company, it is vital to recognize that this division is capable of effecting changes to the future profitability of the company either in cooperation with the new direction or despite the new direction. For example, consider if the marketing effort is created principally through the actions of one key marketing executive. The continued presence and commitment of that individual is essential to the on-going well being of the marketing process. Should he decide to leave or become disillusioned with the new management, the assumed levels of sales may not materialize.

8.3 Underwriting

As with marketing, the future underwriting performance of the company is a function of the interaction of the new owners/ management and the people who are expected to implement the underwriting policy in the future.

8.4 Claims Reserving and Handling

Since the appraisal value hinges on a projection of the future cash flow of the company, any factor which could have a material impact on that cash flow needs to be considered carefully. The projected level of reserve adequacy and the assumed loss payment patterns are likely to be based, to some extent, on the historical experience of the company. The appropriateness of these assumptions will depend in part on the continuity of loss reserving and claims handling personnel and policy after the change in ownership.

8.5 Investments

Both the percentage of assets available to invest and the investment performance obtained on invested assets are important factors in determining the appraisal value. If the new owners/ management expect to be able to improve either or both of these

factors, then the appraisal value should recognize such improvements.

For statutory accounting purposes, the existing bond portfolio is valued on an amortized basis. This artificial valuation basis is used to avoid changes in the value of bonds when market interest rates change (as would occur is they were valued at market value): given that loss reserves on a statutory basis are held on an undiscounted basis and are not sensitive to interest rates, such a change in bond values would be immediately and fully reflected in a change in policyholder surplus.

(If the balance sheet were considered as a whole rather than being viewed as a collection of independent pieces, it would be more logical to value the major assets (invested assets) and the major liabilities (loss reserves) on a consistent basis. That is, the bonds and the loss reserves would both be valued on a discounted basis using current yields. If the assets were suitably invested by term relative to the liabilities, the change in the market value of the assets due to a change in interest rates would precisely match the change in the discounted value of the loss reserves at the new discount rate. Thus policyholder surplus would be unaffected. Unfortunately, the real world is not as logical as this!)

The yield earned on the bonds held at amortized values is an average of the yields at which those bonds were purchased. Since the difference between market value and amortized value cannot be released on a statutory basis, it is appropriate to value the run-off of the existing policies on the books which are supported by those bonds using an investment rate equal to that to be realized on the bonds at amortized values. This approach effectively releases the premium or discount on the bond portfolio as the business runs off.

However, the interest rate used to value future new business must reflect the investment returns expected to be earned in future and should not take into account the embedded yield on the existing assets.

9. SENSITIVITY ANALYSIS

The model is based on assumptions regarding a wide range of input variables. These assumptions represent the valuer's best estimate for factor concerned. If the projected results from the model are compared retrospectively with the actual performance of the company over time, the difference between the two can be determined. These differences can be considered as the "error" in the model's results. On a prospective basis, there are two sources of such potential error:-

9.1   Random variation or statistical error

Statistical error arises from the fact that the prospective results from business in general, and from insurance business in particular, are due to the outcome of many future contingent events.   Since the precise outcome cannot be determined in advance, any estimate of such future performance must be subject to a range of possible error.   Assuming that the basis of the projection is, in fact, the true expected values of the various input parameters (but see discussion of systematic error below), then it can be argued that any deviation from the expected course will often be countered by an automatic offsetting adjustment in another parameter (for example, a move towards tighter underwriting standards with lower loss ratios may be expected to result in lower premium growth levels).

Hence, although there is scope for random variation in the actual results of the company over time, sensitivity analysis based on a range of sets of assumptions from optimistic to pessimistic will generally produce values in a relatively narrower range (compared with the range of the individual parameters).

9.2 Systematic variation or parameter error

The discussion in 9.1 above indicates that, given that the base projection is truly based on the expected values of the input parameters, then the range of results due to random variability is relatively narrow.

However, it will usually be impossible to be certain that the model is based on the true expected value of individual assumptions.

When testing the sensitivity of the results due to possible parameter error (that is, incorrect estimation of the expected value of the input parameter), it is no longer valid to assume that an adjustment in one input parameter will usually be offset by its impact on another input parameter.

It is vital to assess the sensitivity of the profitability of the products by varying the key parameters one at a time from the assumed "best estimates".

10. DRAFT STATEMENT OF PRINCIPLES AND COMMENTS THEREON

10.1   Every asset, obligation or consideration is associated with one or more items of cash flow.

10.2   The value of an asset, obligation or consideration is
        equal to the combined values of its constituent set of
        items of cash flow.

10.3   The value of an item of cash flow depends upon the
        values of the following valuation variables, each of
        which is, conceptually, a random variable for which a
        probability distribution may be assumed to exist:

    a.   the occurrence of the item of cash flow

    b.   the amount of the item of cash flow

    c.   the interval of time between the valuation date and the
          time of occurrence of the item of cash flow, and

    d.   a rate of interest related to the interval of time
          between the valuation date and the time of occurrence
          of the cash flow.

10.4   The value of any of the valuation variables with
        respect to an identified set of items of cash flow may
        be determined on the basis of any set of rules or
        assumptions which are appropriate to:

    a.   the nature of the asset, obligation or consideration
          made up of that set of items of cash flow,

    b.   recognize suitably the various environments within

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which the valuation is being performed, and

c.   the purpose of the valuation.

10.5   All identifiable factors that may have a material effect on the values of a set of items of cash flow involved in a valuation must be taken into account in establishing the set of rules or assumptions to be used in determining those values.

COMMENT on principles 1 through 5:   these principles confirm that the value of a property and casualty insurer is to be based on the present value of a projected "cash" flow.   The profit test based methodology presented in this paper provides such a "cash" flow and the means to determine its present value.

10.6   In general, the result of a valuation is a random variable.

COMMENT on principle 6:   until this stage, the presentation has focussed on the expected present value of the projected profit flow.   Since an expected value is involved, it should be understood that this value is being used to represent an underlying distribution of values.   Although the profit test has been applied on a deterministic basis in the example, it could easily be extended to provide an estimate of the distribution of

value through the use of monte carlo simulation. Each of the input assumptions would be replaced by a distribution and sampled randomly. The process would be repeated using independent random selections of the random variables.

Note that some of the distributions may be interdependent - for example, a higher rate of investment return may be associated with increased inflation which would be reflected in higher expenses and loss payments, and higher rates of premium growth.

There may also be some interdependence on the results between products (e.g. commercial and personal auto may both suffer from poor experience due to adverse weather conditions) and between lines (e.g., general liability and auto liability may both benefit from tort reform).

The distributions should be those appropriate for the portfolio as a whole rather than for the individual policy, unless the simulated results of the individual policy are themselves to be used to simulate the portfolio results.

10.7   A valuation may involve only the assets and obligations related to specified events underwritten on or before the valuation date or it may involve both those assets and obligations and the assets and obligations related

to specified events projected to be underwritten after the valuation date.

COMMENT on principle 7:   this principle identifies one of the dimensions of the input assumptions which must be established. Even for appraisal values, it is possible to envisage situations under which a buyer would only value the business underwritten before the effective date of the valuation.

"Asset stripping" gained some notoriety during the seventies and early eighties when conglomerate companies were purchased with the express intent of breaking up the companies and selling off the assets.   Unlike the usual situation, the valuer considered the sum of the value of the parts to be higher than value of the whole.

In insurance, an industry which tends to trade in liabilities rather than assets, an equivalent, namely liability stripping, exists.   This situation anticipates the liabilities of the purchased company being either run-off to extinction or being commuted.   In either case, the buyer of the company believes that he can either run-off the liabilities or buy them back (i.e. commute them) for less than their value in the acquisition price.

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10.8   If a valuation is performed as of a given valuation
        date and involves only a specified set of an
        underwriter's obligations, then the set of assets to be
        associated with that set of obligations for purposes of
        the valuation must be explicitly identified; and none
        of the elements of that set of assets may be associated
        with obligations that are not elements of the specified
        set of obligations for purposes of a valuation that is
        performed as of the same valuation date and applies to
        a different set of obligations.

COMMENT on Principle 8:   This principle appears to be a special
case of the general principle that when a valuation is carried
out, it is essential that the valuation identify precisely what
is being valued, and that any item can only be considered as
contributing to one aspect of the value in a given valuation.
For example, in the paper, the need to take into account the
amortized value of bonds and the unamortized premium or discount
was noted.   A natural consequence of the profit test based
approach described in the paper is that the setting of
assumptions will, inter alia, require that the existing asset
portfolio be allocated if the liabilities are to be valued in
more than one subdivision and different investment assumptions
are to be applied to each subdivision.

10.9   The results of valuations performed as of different
         valuation dates may not be consolidated (unmodified).

COMMENT on Principle 9:   unless a zero rate of discount is being

used to determine the present value of the projected cash flow,

this principle is redundant, since a present value is only valid

at the underlying valuation date!   Even if a zero discount rate

is being used, there is a problem with the cash flow from the

earliest valuation date to the item's own valuation date on

those items with later valuation dates.   This principle

effectively says it is not valid to add the balance of your

checking account at the beginning of the month to the balance of

your deposit account at the end of the month to determine your

total worth at the bank.   From the perspective of both the

present value concept and the need for congruent cash flows,

this appears to be more of a truism than a principle.

11. SOME QUESTIONS

11.1   If company persistently (as a management decision)
         under-reserves, as in fact the whole industry is at the
         moment, should the full reserve deficiency be taken off
         the value, or just the present value as it will
         emerge?   Sturgis in his paper (2) suggests that the
         full value of the deficiency should be recognized.

While this may be a good place to start negotiating as the buyer, a more realistic value would recognize the value of not having to fund the deficiency in reserves until some later date.

11.2   Is it true that "The further into the future the projections, the less reliable they are; but they are also less critical because of the increasing impact of the present value discounts" (Sturgis (2))?   It is certainly true that the reliability of estimates decreases as the time horizon recedes.   This is what the British actuaries refer to as "the expanding funnel of doubt".

However, consider the assumption underlying the expected losses per unit of premium.   If premiums are assumed to increase at 10% per annum, and a risk rate of return of 10% per annum is being used (these assumptions may not be internally consistent), then the impact of the discount factor will be precisely offset by the impact of the assumed increase in premium volume.   Hence, the present value of a one percentage point error in the estimated loss ratio in respect of next year will be precisely equal to the present value of a one percentage point error in the expected loss

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ratio in ten years time. The estimation of the latter
loss ratio is much less certain.

11.3   What will be the impact of a move to allowing
discounted reserves on a statutory basis? Will it be
offset by a requirement to hold other reserves? How
should such a possibility be valued?

11.4   "Most property/casualty companies carry a substantial
portfolio of bonds at book value. This should be
pointed out to the client so that an adjustment to
market value could be made if he deems that
appropriate. However, it should also be pointed out
that such an adjustment should carry with it a
partially offsetting adjustment to the cost of surplus
calculation. That is, our cost of surplus would be
lower if we used a market, rather than a statutory,
valuation of required capital and surplus." (Sturgis
(2)).

Since holding bonds at amortized values is part of the
statutory accounting basis, it appears that there is
really no discretion to recognize immediately the
premium or discount included in the book value of the
bonds, except to the extent that the bonds can be

assigned to "surplus surplus" and hence assumed to be immediately realized to pay the initial dividend. This assumes that a truly statutory accounting basis is to be used in determining expected earnings. In determining the earnings to be discounted from the run-off of the existing business, it is necessary to use the yield on the bonds at their book (i.e., amortized) value when determining investment income. Investment income from assets generated from future business should recognize expected market investment returns.

The "cost of surplus" as defined by Sturgis (2) would only be lower if the bond portfolio is being booked at a premium to market value. Under these circumstances, the yield on the current market value will be greater than the yield on amortized value. The cost of surplus, as defined by Sturgis, is the excess of some fixed yield over the yield being earned on the assets supporting the company's surplus. Since the yield on market value is greater than the yield on amortized value, the excess of the fixed yield over the market yield will be less than the excess over the yield on amortized value.

However, the reverse situation would occur if the bonds were being booked at a discount to market value. As described in Section 8, a more consistent approach is to recognize the premium or discount as it is released under a statutory accounting approach.

BIBLIOGRAPHY:

(1)   James CH Anderson, "Gross Premium Calculations and
        Profit Measurement for Non-Participating Insurance",
        Transactions, Society of Actuaries, Vol XI (1959),
        p 357.

(2)   Robert W Sturgis, "Actuarial Valuation of
        Property-Casualty Insurance Companies", Proceedings of
        the Casualty Actuarial Society, Vol LXVIII (1981),
        p 146.

(3)   Stephen P Lowe, Discussion of (2) above, Proceedings of
        the Casualty Actuarial Society, Vol LXIX (1982), p 120.

(4)   Robert Rothman and Robert V Deutsch, Discussion of (2)
        above, Proceedings of the Casualty Actuarial Society,
        Vol LXIX (1982), p 126.

(5)   Robert W Sturgis, Author's reply to (4) above,
        Proceedings of the Casualty Actuarial Society, Vol LXX
        (1983), p 198.

(6)   I Christopher Smart, "Pricing and Profitability in a
        Life Office", Journal of the Institute of Actuaries
        (London), Vol 104 (1977), p 125.

(7)   Richard P Burrows and Guy H Whitehead, "The
        Determination of Life Office Appraisal Values", Journal
        of the Institute of Actuaries (London), Vol 114 (1987),
        p 411.

APPENDIX A - An Example of Pricing Using Profit Testing

A MUCH SIMPLIFIED EXAMPLE:

Consider the following policy written on January 1, 1989.

(Time, t, is measured in months from the date of issue of the policy.)

	Time t	Amount
Written Premium = Premium Received on 1/1/89	0	$100.00
Commission paid on 1/1/89	0	(20.00)
Expenses paid (policy issue, underwriting, etc.)	0	(10.00)
Net Cash available for investment	0	70.00
A single claim occurs and is reported 7/1/89	6	60.00
The claim is paid in full on 7/1/90	18	60.00
Loss Expense paid on 7/1/90	18	5.00

Assets are invested in a deposit account paying 0.5% per month.

The insurer has a hurdle rate of return of 1.25% per month.

No income tax is payable.

Unearned premium reserve is calculated pro-rata on the full written premium over twelve months.

Policyholder surplus of one third of the written premium is required for 12 months from the date of issue (i.e. it is set up at t=0 and drawn down at t=12).

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Table A.1 shows the situation of the insurer at the beginning of each month from issue of the policy on 1/1/89 (t=0) through the payment of the last claim on 7/1/90 (t=18).

All balance sheet entries (reserves, surplus, invested assets) are as at the first of the month.   Hence t=0 is the day the policy is issued 1/1/89, and t=6 is six months later, 7/1/89.

For income statement items, those which accrue over time (e.g., investment income) are tabulated as of the end of the month. For example, the investment income earned over the first month is show at t=1, 2/1/89.   Payment and receipt of cash is assumed to occur on the first of the month.   For example, written premium is received on 1/1/89 at t=0.   The loss is paid on 7/1/90 at t=18.

It is possible to use other assumptions (for example, that movements occur at mid month) - as long as the assumptions and the formulae applied are internally consistent, no particular approach is the "correct" one.   However, certain bases are more presentable and more easily explained than others!

In Table A.1, Column (15) shows the calculation of the "available earnings" (negative entries represent capital commitments required of the insurer to support the policy - positive entries are return of capital and emergence of income).

Column (16) shows the present value as at 1/1/89 of the available earnings from column (15).

The total of column (16), $6.41, is the present value of the policy to the insurer at the date of issue of the policy.

Column (17) shows the present value of the future earnings to emerge on the policy at each monthly duration of the policy. These values are taken the instant after the movements in accounting entries occur on the first of each month. For example, the value of $69.74 at duration t=0 represents the sum of the present value of the total earnings stream at issue ,$6.41, plus the capital contributed to set the policy up ,$63.33. That is, $69.74 is the present value of the future earnings stream to be generated by the policy on the day it is issued, after the premium has been received; commission and expenses paid; and unearned premium reserves and policyholder surplus set up. These values are shown in Graph A.2.

Graph A.1 shows the incidence of capital contributions and release of earnings over the 18 month term of the policy. The constituents of net earnings (the net earnings are represented by the diamonds) have been grouped into four categories - each represented by a column on the graph. The four categories are written premium (positive); commissions, expenses and losses

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paid (negative); set up (negative) or release (positive) of reserves (both unearned premium and unpaid losses) and policyholder surplus; and investment income (positive).

When the policy is issued (time t=0 from the issue of the policy), a capital contribution of $66.33 is needed because written premium is insufficient to cover the required unearned premium reserve; commission and expenses; and policyholder surplus which must be established.

In the subsequent 5 months, unearned premium reserve is released and augmented by investment income to produce net earnings.

The loss amounting to $60.00 is assumed to occur on July 1 (i.e. at time t=6 months) leading to a capital contribution of approximately $51.19 in order to set up the loss reserve. The balance of the loss reserve is funded by the monthly release of unearned premium reserve ($8.34) and investment income ($0.47).

The next 5 months show net earnings of the release of unearned premiums plus investment income. In the following month, net earnings also include the release of policyholder surplus (at time t=12 months) which was assumed to be required for 12 months from the issue of the policy. At this stage, the unearned premium reserve has also been fully released. Invested assets

for the next 6 months represent the loss reserve of $60.
Investment income on these assets is the only source of income
during these months, except for the release of the loss reserve
in the last month at time t=18 months, when the loss is paid.
There is a small capital contribution required to close the
policy due to the loss adjustment expense which had not been
provided for in the loss reserve.

Note that this simplified example is not realistic in that it
assumes that a single claim occurs on 7/1/89. This leads to the
release of unearned premium reserve to profit over months 1
through 5 and 7 through 12. In month 6 (the loss is assumed to
occur at the end of the 6th month), the release of unearned
premium reserve is overwhelmed by the loss incurred and the need
to establish the unpaid loss reserve. Hence, the jump in value
of future earnings between time t=5 and t=6 is due to the
capital contributed to fund some of the unpaid loss reserve. A
more realistic assumption would be for 1/12th of the annual
losses to be incurred each month, and the requisite loss reserve
established against the release of unearned premium on a monthly
basis. This situation is reflected in the example in Appendix B
and results in a smoother progression of the value of future
earnings over the period of the policy.

Profit Testing of the WC policy from Sturgis'

paper (2)

A profit test based on an individual policy is similar to an accident year projection. The assumptions underlying the model in Sturgis' paper were based on a policy year approach. Those assumptions have been modified to be consistent with an accident year approach in the profit test discussed below and presented in Table B.1 and Graphs B.1 and B.2.

(Time, t, is measured in months from the date of issue of the policy.)

	Time t	Amount
Written Premium		$100.00
75% received at 1/1/89	0	
25% received at 7/1/90	18	
Commission paid on 1/1/89	0	(8.00)
Expenses paid (policy issue, underwriting, etc.)	0	(20.00)
Net Cash available for investment	0	22.00

The loss ratio of the policy is 75%. Exposure is earned and losses are incurred evenly over the policy period.

Losses are paid over nine years as follows during each twelve month period from the issue of the policy: 25.0%, 25.0%, 18.5%, 12.5%, 8.0%, 5.0%, 3.0%, 2.0%, 1.0%. Loss payments are assumed to be evenly spread over each twelve month period.

Assets are invested one third in non-taxable bonds at par with coupon of 6% and two thirds in taxable bonds at par with coupon of 10%.

The insurer has a hurdle rate of return of 15% per annum.

Income tax is payable at 46% (pre TRA 86 tax basis used).

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Unearned premium reserve is calculated pro-rata on the amount of premium received in cash at inception over twelve months.

Policyholder surplus of one third of the written premium (based on total written premium, i.e., $100) is required for 12 months from the date of issue (i.e. it is set up at t=0 and drawn down at t=12).

Table B.1 summarizes the cash flow associated with the issue of a policy on the basis of the above assumptions. The projection has actually been carried out at monthly intervals - Table B.1 indicates the balance sheet items (e.g. loss reserves) at six monthly intervals, and shows amounts relating to income statement items (e.g. investment income) which have accrued over the six months to time t.

The total of column (16) indicates that the value of issuing a policy is ($2.61) per $100.00 of written premium. That is, given the assumptions above, at a 15% per annum risk rate of return, the issue of each policy costs the insurer $2.61!

Table B.2 derives the approximate "appraisal value" (including net worth and the run-off of reserves) from Sturgis's paper. Outstanding loss reserves by accident year, from the most recent to the oldest accident year, were given as $10 million, $17

million, $11 million, $6 million, $4 million, $3 million, 2 million. Although the reserves were indicated to be by accident year, the increase from $10 million to $17 million suggests that they may be on a policy year basis, which would be consistent with the rest of the Sturgis model. Table B.2 also identifies the amount of policyholder surplus which is assumed to be tied up by the existing business (this is determined relative to the amount of loss reserves held) and must be deducted from the net worth of the company in determining the total appraisal value. The excess of the net worth over the policyholder surplus is available for immediate distribution.

For ease of presentation, the value of the reserves has been estimated by using the mid-year estimates of the value of future earnings (that is, the values at 6 months, 18 months, 30 months, etc.). In practice, the reserves would be allocated by month since issue of the policy and the value of future earnings determined accordingly.

The present value of a 30 year annuity of 1 per annum increasing at 10% per annum payable in the middle of the year discounted at 15% per annum is 16.56. Hence, is we assume that future business will be written under the same conditions for a period of 30 years with premium volume increasing by 10% per annum, then the value of that 30 years of business will be 16.56 times the value of one year's new business.

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In comparing the appraisal value obtained with that from Sturgis' paper, it is necessary to adjust the latter value for the cost of capital relative to the risk rate of return and not on a flat 5% per annum basis. The invested asset yield assumptions produce an aggregate yield net of tax of approximately 5% per annum. Hence, using a risk discount rate of 15% per annum, the annual cost of capital is approximately 10% per annum. Therefore, it is necessary to double the indicated cost of capital from Sturgis' paper to put it on a comparable basis with that produced from Table B.1.

The differences between the two appraisal values arise due to:-

- the necessary approximation involved in adjusting the policy year payment patterns to accident years patterns.

- the use of mid-year values rather than values at each monthly evaluation. In particular, this may distort the value of the business written 12 to 24 months before the appraisal valuation date. The "18 month" value used assumes that all premium income has been received on this block of business. However, there will be some adjustment premium outstanding on some of these policies which "should" be recognized in the

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value of the existing business. This may be of the order of 50% (half) of 25% (the adjustment premium portion) of $32 million (written premium), that is, $4 million.

- the Sturgis model determines statutory earnings assuming nil policyholder surplus and then separately determines the cost of capital on the required policyholder surplus each year. The two models will only give the same result if cost of capital calculated under the Sturgis model is comparable with that internally determined by the profit test approach.

- the approximate method used in Table B.2 does not test the aggregate tax calculation but assumes that the sum of the tax amounts from the profit tests is appropriate. The tax amounts may be either accelerated or overstated, or both! The difference in the relative levels of tax in the two approaches may also be affected by the item above - the inclusion assets backing policyholder surplus may mean that the tax efficient investment policy used by Sturgis is no longer appropriate.

The value of the profit testing approach is very much in evidence in this example. The separation of the value into that

relating to existing business, that expected from future business and the portion of net worth which is available for immediate distribution provides a valuable insight into the sources of the total appraisal value.

In this case, the value of each new policy issued is, in fact, negative. Hence, unless the new management expects to be able to improve the basis on which policies are issued (reduce expenses, loss ratio, etc.), then the logical approach may be to stop writing new business and portfolio out the existing loss reserves. The results from the aggregate policy year model do not provide the breakdown of the value in this way.

The example given and the application of the profit test results in Table B.2 are very simplified. In practice, the value would be determined by applying the profit test results at monthly intervals and the tax due would be recalculated an an aggregate basis.

Profit Testing – A Much Simplified Example

Time (Months) t	Written Premium	Earned Premium	Unearned Premium Reserve	Incurred Losses	Paid Losses	Loss Reserves	Policy-holder Surplus	Increase In Res. + Polholder Surplus	Comm-ission Paid	Expenses Paid	Invested Assets	Investment Income Earned 0.50% per month	Tax Payable	Available Earnings/ (Capital Contributed)	Present Value at t=0 at 1.25% per month	PV of Future Earnings at time t at 1.25% per month
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
0	100.00	0.00	100.00	0.00	0.00	0.00	33.33	133.33	20.00	10.00	133.33	0.00	0.00	(63.33)	(63.33)	69.38
1	0.00	8.33	91.67	0.00	0.00	0.00	33.33	(8.33)	0.00	0.00	125.00	0.67	0.00	9.00	8.89	61.25
2	0.00	8.33	83.34	0.00	0.00	0.00	33.33	(8.33)	0.00	0.00	116.67	0.63	0.00	8.96	8.74	53.05
3	0.00	8.34	75.00	0.00	0.00	0.00	33.33	(8.34)	0.00	0.00	108.33	0.58	0.00	8.92	8.59	44.80
4	0.00	8.33	66.67	0.00	0.00	0.00	33.33	(8.33)	0.00	0.00	100.00	0.54	0.00	8.87	8.44	36.49
5	0.00	8.33	58.34	0.00	0.00	0.00	33.33	(8.33)	0.00	0.00	91.67	0.50	0.00	8.83	8.30	28.11
6	0.00	8.34	50.00	60.00	0.00	60.00	33.33	51.66	0.00	0.00	143.33	0.46	0.00	(51.20)	(47.52)	79.66
7	0.00	8.33	41.67	0.00	0.00	60.00	33.33	(8.33)	0.00	0.00	135.00	0.72	0.00	9.05	8.30	71.60
8	0.00	8.33	33.34	0.00	0.00	60.00	33.33	(8.33)	0.00	0.00	126.67	0.68	0.00	9.01	8.16	63.49
9	0.00	8.34	25.00	0.00	0.00	60.00	33.33	(8.34)	0.00	0.00	118.33	0.63	0.00	8.97	8.02	55.31
10	0.00	8.33	16.67	0.00	0.00	60.00	33.33	(8.33)	0.00	0.00	110.00	0.59	0.00	8.92	7.88	47.08
11	0.00	8.33	8.34	0.00	0.00	60.00	33.33	(8.33)	0.00	0.00	101.67	0.55	0.00	8.88	7.75	38.78
12	0.00	8.34	0.00	0.00	0.00	60.00	0.00	(41.67)	0.00	0.00	60.00	0.51	0.00	42.18	36.34	(2.91)
13	0.00	0.00	0.00	0.00	0.00	60.00	0.00	0.00	0.00	0.00	60.00	0.30	0.00	0.30	0.26	(3.26)
14	0.00	0.00	0.00	0.00	0.00	60.00	0.00	0.00	0.00	0.00	60.00	0.30	0.00	0.30	0.25	(3.59)
15	0.00	0.00	0.00	0.00	0.00	60.00	0.00	0.00	0.00	0.00	60.00	0.30	0.00	0.30	0.25	(3.94)
16	0.00	0.00	0.00	0.00	0.00	60.00	0.00	0.00	0.00	0.00	60.00	0.30	0.00	0.30	0.25	(4.29)
17	0.00	0.00	0.00	0.00	0.00	60.00	0.00	0.00	0.00	0.00	60.00	0.30	0.00	0.30	0.24	(4.64)
18	0.00	0.00	0.00	0.00	60.00	0.00	0.00	(60.00)	0.00	5.00	0.00	0.30	0.00	(4.70)	(3.76)	0.00
Total	100.00	100.00		60.00	60.00			0.00	20.00	15.00		8.86	0.00	13.86	6.05	

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NOTE – Assumptions underlying cash flows:
Balance Sheet items at time [t]
Income Statement items over period [t–1+e] to [t]
Assume all accounting entries occur on first of month
  i.e. at [t]

(4)[t] = (4)[t–1] + (2)[t] – (3)[t]
(7)[t] = (7)[t–1] + (5)[t] – (6)[t]
(9)[t] = (4)[t] – (4)[t–1] + (7)[t] – (7)[t–1] + (8)[t] – (8)[t–1]
(12)[t] = (12)[t–1] + (2)[t] + (13)[t] – (6)[t] – (10)[t] – (11)[t]
     – (11)[t] – (14)[t] – (15)[t]

(13)[t] = (12)[t–1] • 0.005
(15)[t] = (2)[t] + (13)[t] – (6)[t] – (9)[t] – (10)[t]
     – (11)[t] – (14)[t]
(16)[t] = (15)[t] / {(1.0125) ^ t}
(17)[t] = Sum{(16)[i], i=t+1 to i=18} • {(1.0125) ^ t}

Components of Net Earnings

Release of UPR

Draw Down
Policyholder
Surplus

2.21

Set Up Loss Reserve

(51.20)

(63.33)

Set Up UPR
Surplus Against
Written Premium

Paid Loss Offset By
Release of Loss
Reserve. LAE not
Reserved For

(4.70)

E
a
r
n
i
n
g
s

i
n

$

100.00

50.00

0.00

(50.00)

(100.00)

(150.00)

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| --- Months since issue of policy --- >

| ▤ Written Premium | ☐ Commission + Expenses + Losses Paid | ▨ (Set Up)/ Release of Reserves & Surplus | ▥ Investment Income | ◆ Net Earnings = Sum of Values Plotted in Columns |

Present Value of Future Earnings at Duration t

P
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$

Valuation Date: t Months from issue of policy

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APPENDIX B   Profit Testing of the WC policy from Sturgis'
                  paper (2)

A profit test based on an individual policy is similar to an
accident year projection.   The assumptions underlying the model
in Sturgis' paper were based on a policy year approach.   Those
assumptions have been modified to be consistent with an accident
year approach in the profit test discussed below and presented
in Table B.1 and Graphs B.1 and B.2.

(Time, t, is measured in months from the date of issue of the
policy.)

	Time t	Amount
Written Premium		$100.00
75% received at 1/1/89	0	
25% received at 7/1/90	18	
Commission paid on 1/1/89	0	(8.00)
Expenses paid (policy issue, underwriting, etc.)	0	(20.00)
Net Cash available for investment	0	22.00

The loss ratio of the policy is 75%.   Exposure is earned and
losses are incurred evenly over the policy period.

Losses are paid over nine years as follows during each twelve
month period from the issue of the policy: 25.0%, 25.0%, 18.5%,
12.5%, 8.0%, 5.0%, 3.0%, 2.0%, 1.0%.   Loss payments are assumed
to be evenly spread over each twelve month period.

Assets are invested one third in non-taxable bonds at par with
coupon of 6% and two thirds in taxable bonds at par with coupon
of 10%.

The insurer has a hurdle rate of return of 15% per annum.

Income tax is payable at 46% (pre TRA 86 tax basis used).

Unearned premium reserve is calculated pro-rata on the amount of
premium received in cash at inception over twelve months.

Policyholder surplus of one third of the written premium (based
on total written premium, i.e., $100) is required for 12 months
from the date of issue (i.e. it is set up at t=0 and drawn down
at t=12).

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Table B.1 summarizes the cash flow associated with the issue of a policy on the basis of the above assumptions. The projection has actually been carried out at monthly intervals - Table B.1 indicates the balance sheet items (e.g. loss reserves) at six monthly intervals, and shows amounts relating to income statement items (e.g. investment income) which have accrued over the six months to time t.

The total of column (16) indicates that the value of issuing a policy is ($2.61) per $100.00 of written premium. That is, given the assumptions above, at a 15% per annum risk rate of return, the issue of each policy costs the insurer $2.61!

Table B.2 derives the approximate "appraisal value" (including net worth and the run-off of reserves) from Sturgis's paper. Outstanding loss reserves by accident year, from the most recent to the oldest accident year, were given as $10 million, $17 million, $11 million, $6 million, $4 million, $3 million, 2 million. Although the reserves were indicated to be by accident year, the increase from $10 million to $17 million suggests that they may be on a policy year basis, which would be consistent with the rest of the Sturgis model. Table B.2 also identifies the amount of policyholder surplus which is assumed to be tied up by the existing business (this is determined relative to the amount of loss reserves held) and must be deducted from the net worth of the company in determining the total appraisal value. The excess of the net worth over the policyholder surplus is available for immediate distribution.

For ease of presentation, the value of the reserves has been estimated by using the mid-year estimates of the value of future earnings (that is, the values at 6 months, 18 months, 30 months, etc.). In practice, the reserves would be allocated by month since issue of the policy and the value of future earnings determined accordingly.

The present value of a 30 year annuity of 1 per annum increasing at 10% per annum payable in the middle of the year discounted at 15% per annum is 16.56. Hence, is we assume that future business will be written under the same conditions for a period of 30 years with premium volume increasing by 10% per annum, then the value of that 30 years of business will be 16.56 times the value of one year's new business.

In comparing the appraisal value obtained with that from Sturgis' paper, it is necessary to adjust the latter value for the cost of capital relative to the risk rate of return and not on a flat 5% per annum basis. The invested asset yield

assumptions produce an aggregate yield net of tax of approximately 5% per annum. Hence, using a risk discount rate of 15% per annum, the annual cost of capital is approximately 10% per annum. Therefore, it is necessary to double the indicated cost of capital from Sturgis' paper to put it on a comparable basis with that produced from Table B.1.

The differences between the two appraisal values arise due to:-

- the necessary approximation involved in adjusting the policy year payment patterns to accident years patterns.

- the use of mid-year values rather than values at each monthly evaluation. In particular, this may distort the value of the business written 12 to 24 months before the appraisal valuation date. The "18 month" value used assumes that all premium income has been received on this block of business. However, there will be some adjustment premium outstanding on some of these policies which "should" be recognized in the value of the existing business. This may be of the order of 50% (half) of 25% (the adjustment premium portion) of $32 million (written premium), that is, $4 million.

- the Sturgis model determines statutory earnings assuming nil policyholder surplus and then separately determines the cost of capital on the required policyholder surplus each year. The two models will only give the same result if cost of capital calculated under the Sturgis model is comparable with that internally determined by the profit test approach.

- the approximate method used in Table B.2 does not test the aggregate tax calculation but assumes that the sum of the tax amounts from the profit tests is appropriate. The tax amounts may be either accelerated or overstated, or both! The difference in the relative levels of tax in the two approaches may also be affected by the item above - the inclusion assets backing policyholder surplus may mean that the tax efficient investment policy used by Sturgis is no longer appropriate.

The value of the profit testing approach is very much in evidence in this example. The separation of the value into that relating to existing business, that expected from future business and the portion of net worth which is available for immediate distribution provides a valuable insight into the sources of the total appraisal value.

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In this case, the value of each new policy issued is, in fact, negative. Hence, unless the new management expects to be able to improve the basis on which policies are issued (reduce expenses, loss ratio, etc.), then the logical approach may be to stop writing new business and portfolio out the existing loss reserves. The results from the aggregate policy year model do not provide the breakdown of the value in this way.

The example given and the application of the profit test results in Table B.2 are very simplified. In practice, the value would be determined by applying the profit test results at monthly intervals and the tax due would be recalculated an an aggregate basis.

Profit Testing – Workers' Compensation

Time (Months) t	Written Premium	Earned Premium	Unearned Premium Reserve	Incurred Losses	Paid Losses	Loss Reserves	Policy-holder Surplus	Increase In Res. + Potholder Surplus	Comm-ission Paid	Expenses Paid	Invested Assets	Investment Income Earned 0.70% per month	Tax Payable	Available Earnings/ (Capital Contributed)	Present Value at t=0 at 1.17% per month	PV of Future Earnings at time t at 1.17% per month
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
0	60.000	0.000	60.000	0.000	0.000	0.000	33.334	93.334	4.800	20.000	93.334	0.000	0.000	(58.134)	(58.134)	55.525
6	0.000	30.000	30.000	37.502	9.375	28.127	33.333	(1.874)	0.000	0.000	91.460	3.870	0.000	(3.631)	(3.490)	63.281
12	0.000	30.000	0.000	37.502	9.375	56.254	0.000	(35.206)	0.000	0.000	56.254	3.800	0.000	29.631	25.661	38.350
18	40.000	40.000	0.000	0.000	9.375	46.879	0.000	(9.375)	3.200	0.000	46.879	2.190	2.035	36.905	29.978	4.162
24	0.000	0.000	0.000	0.000	9.375	37.504	0.000	(9.375)	0.000	0.000	37.504	1.790	0.633	1.157	0.907	3.264
30	0.000	0.000	0.000	0.000	6.938	30.566	0.000	(6.938)	0.000	0.000	30.566	1.450	0.509	0.941	0.682	2.533
36	0.000	0.000	0.000	0.000	6.938	23.628	0.000	(6.938)	0.000	0.000	23.628	1.160	0.407	0.793	0.568	1.944
42	0.000	0.000	0.000	0.000	4.688	18.940	0.000	(4.688)	0.000	0.000	18.940	0.910	0.318	0.592	0.377	1.480
48	0.000	0.000	0.000	0.000	4.688	14.252	0.000	(4.688)	0.000	0.000	14.252	0.720	0.251	0.469	0.271	1.113
54	0.000	0.000	0.000	0.000	3.000	11.252	0.000	(3.000)	0.000	0.000	11.252	0.570	0.201	0.369	0.200	0.819
60	0.000	0.000	0.000	0.000	3.000	8.252	0.000	(3.000)	0.000	0.000	8.252	0.450	0.155	0.295	0.145	0.587
66	0.000	0.000	0.000	0.000	1.875	6.377	0.000	(1.875)	0.000	0.000	6.377	0.320	0.115	0.205	0.101	0.412
72	0.000	0.000	0.000	0.000	1.875	4.502	0.000	(1.875)	0.000	0.000	4.502	0.250	0.087	0.163	0.071	0.277
78	0.000	0.000	0.000	0.000	1.125	3.377	0.000	(1.125)	0.000	0.000	3.377	0.180	0.063	0.117	0.047	0.181
84	0.000	0.000	0.000	0.000	1.125	2.252	0.000	(1.125)	0.000	0.000	2.252	0.130	0.046	0.084	0.033	0.106
90	0.000	0.000	0.000	0.000	0.750	1.502	0.000	(0.750)	0.000	0.000	1.502	0.090	0.031	0.059	0.020	0.057
96	0.000	0.000	0.000	0.000	0.750	0.752	0.000	(0.750)	0.000	0.000	0.752	0.050	0.019	0.031	0.012	0.024
102	0.000	0.000	0.000	0.000	0.375	0.377	0.000	(0.375)	0.000	0.000	0.377	0.030	0.010	0.020	0.006	0.007
108	0.000	0.000	0.000	0.000	0.375	0.002	0.000	(0.375)	0.000	0.000	0.002	0.010	0.004	0.006	0.002	0.000
Total	100.00	100.00		75.00	75.00			0.00	8.00	20.00		17.97	4.93	10.03	(2.61)	

NOTE – Assumptions underlying cash flows:
Balance Sheet items at time [t]
Income Statement items over period [t-6+e] to [t]
Assume all accounting entries occur on the first
day of each month i.e. at [t]

(4)[t] = (4)[t-1] + (2)[t] - (3)[t]
(7)[t] = (7)[t-1] + (5)[t] - (6)[t]
(9)[t] = (4)[t] - (4)[t-1] + (7)[t] - (7)[t-1] + (8)[t] - (8)[t-1]
(12)[t] = (12)[t-1] + (2)[t] + (13)[t] - (6)[t] - (10)[t]
 - (11)[t] - (14)[t] - (15)[t]

(15)[t] = (2)[t] + (13)[t] - (6)[t] - (9)[t] - (10)[t]
 - (11)[t] - (14)[t]
(17)[t] = Sum{(16)[i],[i=t+6 to i=18]} * {(1.0125) ^ t}
Columns (2), (3), (5), (6), (8), (10), (11), (13), (14) and (16)
from underlying monthly projection worksheet.

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Determination of Approximate Appraisal Value

Value of Existing Business

Time (Months)	From Table B.1 Loss Reserves	PV Future Earnings	Actual Loss Reserves	Estimated Value	From Table B.1 Loss Reserves	Policyholder Surplus	Policyholder Surplus Required
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
6	28.13	63.29	$10.000	$22.496	28.13	35.53	$11.849
18	46.89	4.16	$17.000	$1.509	46.89	0.00	$0.000
30	30.57	2.53	$11.000	$0.910	30.57	0.00	$0.000
42	18.94	1.48	$6.000	$0.469	18.94	0.00	$0.000
54	11.25	0.82	$4.000	$0.292	11.25	0.00	$0.000
66	6.38	0.41	$3.000	$0.193	6.38	0.00	$0.000
78	3.38	0.18	$2.000	$0.107	3.38	0.00	$0.000
90	1.50	0.06	$0.000	$0.000	1.50	0.00	$0.000
102	0.38	0.01	$0.000	$0.000	0.38	0.00	$0.000
TOTAL			$53.000	$25.976			$11.849

Total Net Worth:	$15.000			
LESS Allocated to Existing Business:	$11.849	Assumed Growth Rate of Premium	10.00% per annum	
		Risk Rate of Return	15.00% per annum	
Distributable Net Worth:	$3.151	Term of Projection	30 years	
		Present Value of 30 Year's business		
Annual Premium Volume in first year:	$40.000	per unit of Year 1 Value	16.56	
Value of One Year's New Business:	($1.043)			
Value of 30 Year's Future New Business:	($17.272)			
Value of Existing Business:	$25.976	NOTES:	Refer to Appendix B for explanation of calculations	
			$ Values in 000's	
Appraisal Value:	$11.856		Values from Table B.1 per 100 units written premium	

Compared with Value per Sturgis model (using 15% pc risk rate):

Value of Statutory Earnings	$40.870
LESS Cost of Capital of 10%	($19.940)
Adjusted Appraisal Value per Sturgis	$20.930

Components of Net Earnings

Present Value of Future Earnings at Duration t