

SEMINAR ON VALUATION ISSUES

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WHAT IS VALUATION?

AN INTRODUCTION TO FUNDAMENTALS AND ISSUES

Miller: We've known for quite a while that the "title" of our portion of the program is "What is valuation? - An introduction to the fundamentals and issues." Now we have to figure out what we're going to say. Do you have any ideas?

Miccolis: At least we're going to have to try to answer the question: "What is valuation?". And then we're going to have to identify some fundamentals and discuss them; and identify the important issues and discuss them.

Miller: One of those issues is "Why is valuation important to casualty actuaries?"

Miccolis: I agree. I think the answer to that question lies in the close relationship between valuation on the one hand and ratemaking and reserving on the other. I think we ought to discuss that point in some detail, but before we do that we ought to discuss the definition of valuation in depth and try to describe the fundamental concepts of the valuation process.

I. DEFINITION OF VALUATION

Miller: If we look at the dictionary definition of valuation, some of the phrases used are: "Act of valuing; appraisal; appraised price".

Miccolis: Notice the words "appraisal" and "appraised" in that definition.

Miller: I hear them. But I also notice the word "valuing". Let's see what the dictionary says about that.

Miccolis: "Value" can be used as a verb or as a noun. The definition of the verb is: "To estimate the value or worth of; to appraise."

Miller: That definition brings up a couple of points.

First, our whole discussion deals only with valuations where property/casualty contingencies are involved.

Second, the word "appraise" in the definition reminds me that for the most part, casualty actuaries think of an appraisal as being made in connection with a merger or acquisition. That's a narrow use of the word. In

fact, used in that sense, an appraisal is just one form of what we mean by a valuation.

Miccolis: Your point about property/casualty contingencies should not limit our focus only to dealing with property/casualty losses. In an appraisal situation the valuation could encompass assets, liabilities other than losses, future profitability, and future growth in business.

Miller: That means that casualty actuaries need to learn more about analyzing the investment, operations, and production sides of the insurance business.

Miccolis: Good point. Another point to notice is that the definition of "value" as a verb says: "To estimate the value ... of". The use of the word "estimate" implies there is uncertainty in valuation. Also, the definition of "value" as a verb is based on the definition of "value" as a noun.

Miller: Let's go to the dictionary again. The definition of "value" as a noun includes: "Monetary worth of a thing; marketable price." So I'd like to say that for purposes of this discussion, "value" is something that is measurable in terms of money.

Miccolis: Let's see how all these ideas fit with the definition of valuation that our Committee on Valuation Principles has decided on after taking into account the comments and suggestions we have received about the exposure draft of the Statement of Principles.

The definition in the revised Statement of Principles reads as follows:

Valuation is the process of determining and comparing, for the purpose of assessing a risk bearer's financial condition as of a given date, called the valuation date, the values of part or all of the risk bearer's obligations and the assets and considerations designated as supporting those obligations.

A valuation is carried out in accordance with specified rules and assumptions selected or prescribed in accordance with the purpose of the valuation to produce an assessment of the risk bearer's financial condition.

Miller: That definition is a gold mine of subjects to be discussed. One of those subjects is that the definition doesn't even mention property/casualty contingencies.

Miccolis: That's because the definition is embedded in a Statement that begins by saying that its purpose is to "identify and describe principles applying to property and casualty valuations". So this point doesn't need to be repeated in the definition.

Otherwise the definition in the Statement seems to be generally consistent with the dictionary definitions. Of course, the Statement definition is considerably narrower than the very general definitions given in the dictionary.

Miller: As I said a little while ago, there are a lot of things in the definition that we need to discuss. But I think that before we discuss those points we ought to go over some of the fundamental concepts underlying the valuation process.

PURPOSE OF VALUATION

Miccolis: A little while ago you said that: "An appraisal is just one form of what we mean by a valuation." The purpose of an appraisal is to determine the net worth of the target of a merger or acquisition. Once determined the net worth can be used in agreeing on the financial arrangements for completing the deal.

Other forms of valuation can be made for the purpose of:

- o analyzing an insurer's financial strength, i.e. determining solvency;
- o planning for future growth and profitability;
- o determining how well an insurer is performing; or
- o managing an insurer's risks

Miller: The forms you mentioned all relate to the valuation of an insurance company. Couldn't a self-insurer use a form of valuation to determine the assets it would need to prudently support the retention of its own property/casualty claims.

Miccolis: You're absolutely right. A valuation for a self-insurer could also be used to assess how successful its risk management program had been in the past and to project how successful it might be in the future.

Miller: Notice that all of the "other forms" of valuation that you have listed relate to matters that are - or should be - of great interest to the management of an insurance company or a self-insurer. Relatively few actuaries are engaged in appraisals; but a great many actuaries are involved in work that is at least related to the other forms of valuation. These other forms of valuation are a large part of the reason why the subject of valuation is important to casualty actuaries.

Miccolis: A little later we can talk about how traditional actuarial work like ratemaking and reserving is related to valuation, but for now let's talk about several different forms of valuation and let's start with appraisals for mergers and acquisitions.

Miller: Presumably there should be at least two distinct appraisals in connection with each merger or acquisition - one for the buyer and one for the seller. That would imply that there could be at least two distinct results for valuations carried out as of the same date with respect to the target of the merger or acquisition.

Miccolis: I'm not sure that these are necessarily two distinct appraisals. Certainly the buyer and seller would use different assumptions. Of course, the buyer would be interested in paying the lowest possible price and the seller would be interested in getting the highest possible price. But even in the absence of these reasons, there could be real differences in aversion to risk, earnings objectives, synergy of operations, economies of scale, efficiencies of distribution systems, etc.

Miller: Wouldn't these differences produce different valuations by actuaries representing each party. In the end, if the merger or acquisition is to be consummated, both parties will have to agree on a single result which may be different from the results of the valuations.

Miccolis: On the other hand, every valuation involves uncertainty. This implies that actual results are quite likely to differ from those anticipated in

determining the most likely value of the target by either the buyer or the seller.

Miller: An appraisal is one form of valuation in which an actuary must consider the views of the participants in the merger or acquisition as to the reasonableness of the assumptions used to estimate value.

Miccolis: Let's turn from appraisals to balance sheets and income statements produced internally by an insurer to assess its financial strength and earning performance. Here, the rules and assumptions for the valuation will be approved by management, hopefully after considering the recommendations of actuaries, investment managers, tax planners, marketing managers, legal counsel and other professionals.

Miller: Where the actuary will have to consider input from other types of professional, the actuary will still have the ultimate responsibility for the reasonableness of the assumptions and the results of valuation. He is usually going to have to evaluate the reasonableness of the assumptions developed by the other professionals in making recommendations on rules and assumptions.

Miccolis: Let's turn now to the usefulness of valuations in assessing earning performance. We ought to point out that there may be some difficulty in using the results of valuations for this purpose. The definition of valuation in the Statement of Principles focuses on an insurer's financial condition as of a given date. This is the same thing as focusing on the balance sheet. In general, valuation processes that focus on the balance sheet are not ideally suited to developing good information as to the insurer's earning performance. The statutory annual statement is a good illustration of this point.

Miller: But, if it's possible to produce a valuation that gives a reasonably good measure of economic net worth, it should be possible to develop the same kind of measure for the purpose of determining how well an insurer is performing. If a valuation as of a given date provides a good estimate of an insurer's economic net worth as of that date, then the economic earnings for a period would be equal to the difference between the amounts of net worth developed by valuations made at the beginning and end of the period. The rate of return on equity could be obtained by dividing the economic earnings for the period by the economic net worth as of the beginning of the period. An insurer might be

considered to be performing well if it is achieving a satisfactory rate of return on economic net worth with a satisfactory degree of year-to-year stability.

Miccolis: Valuation can also be used as an aid to planning for future growth and profitability. However, to do this, more than one type of valuation must be used.

We've just talked about using valuations for assessing earning performance. Planning would involve projecting valuations of this type into the future. It would also be necessary to project statutory balance sheets to answer questions such as whether rapid growth may bring about some regulatory intervention. In addition, it would be necessary to project taxable earnings so as to take into account the effects of federal income taxes and GAAP earnings for stock companies so as to determine how the company's performance will look to securities analysts and investors.

Miller: The valuations used to assess earnings performance would have to be carried out using the same set of assumptions from period to period so as to assure that the projected results are consistent with each other in that respect. The need for consistency puts a substantial constraint on the assumptions to be used, but the constraint has to be accepted if truly useful results are to be achieved.

Miccolis: This need for consistency carries over into making appraisals because it's important to know such things as how much of a company's net worth will be available for supporting growth and how much of its earnings will be available for distribution to policyholders or shareholders.

Miller: One of the objectives of an insurer's management should be to manage the risks assumed by the insurer. The process of risk management involves identification, control, financing and transfer of risks. It would be an impossible task for management to identify and control every risk faced by an insurer. So it becomes necessary to simplify the task.

Miccolis: In the financial world the value or price of an asset is affected by the perceived uncertainty involved in the income produced by the asset and the future market value of the asset. The degree of that uncertainty is affected by the nature of the asset. For example, the value of a common stock is affected by greater uncertainty than the value of a Treasury bond. The degree of uncertainty is also affected by the

environment; for example, the values of stocks are less stable in an unsettled economy.

The values of debt are affected by the same sources of uncertainty.

Miller: One way of simplifying the job of identifying and controlling an insurer's risks is to sort all assets and liabilities into broad classes, so that all the elements in each class have about the same degree of uncertainty. The next steps would be to determine the degree of uncertainty of each of the classes as a whole and then to determine the degree of uncertainty of the aggregate of all of the classes.

Miccolis: With this information in hand, the management would be able to determine whether the degree of uncertainty of the aggregate of all of the classes was acceptable in the light of its goals in the areas of stability and profitability. The information should also be helpful in identifying ways in which to reduce uncertainty so as to improve stability or to accept somewhat greater uncertainty in such a way as to improve earnings.

Miller: Maybe we could bring this part of the discussion to an end by explicitly pointing out that both statutory and GAAP balance sheets are forms of valuation. They allow some latitude for making assumptions but either of them can produce an assessment of financial condition that is a long way from a valuation of economic net worth. Furthermore, balance sheets and other financial statements do not give any indication of the degree of uncertainty in the result.

Miccolis: We have talked about the use of valuations in appraisals and in performance measurement. One of the other areas we mentioned was in the determination of solvency and the related issue of capital/surplus requirements.

Miller: This is an important point. In the life insurance field the term "valuation actuary" has become almost synonymous with an actuarial opinion of an insurer's solvency. Of course, the need for actuarial loss reserve opinions for property/casualty companies has been principally a result of solvency issues. For life companies the solvency concern has been particularly acute where a company can be significantly affected by interest sensitive products, guaranteed interest rate contracts, and policy loan provisions. By requiring a valuation actuary to render an opinion as to the solidity of the company, the regulatory authorities

hope to decrease the frequency of insolvencies and to limit the extent of the insolvencies.

Miccolis: For Canadian property/casualty companies I believe that an opinion from an actuary is currently required that addresses the adequacy of both the liabilities and the assets. I do believe, however, that many casualty actuaries feel that an opinion for loss reserves is all that is necessary. This may be due to a perception that much of the industry's problems are the result of insufficient loss reserves and that interest rates do not have a material effect on loss payments or on the company's ability to pay the losses.

Miller: I believe that those property/casualty companies that discount their reserves are just now becoming aware of their need to more closely monitor their cashflow, investment income and asset values. In addition, because of the number of recent insolvencies, especially where there is a significant amount of assumed or ceded reinsurance, the interest in cashflow analyses has increased substantially.

II. FUNDAMENTALS

CASH FLOWS

Miccolis: Given the definition of valuation and the purposes of valuation that we have discussed, I think we should mention the basic, fundamental elements used in determining economic value.

Miller: It's possible to look at an insurer's business as being made up of a sequence of potential cash flows spread out over time after the valuation date. These cash flows are receipts or disbursements of cash. An example of receipts would be the interest and dividends received from investments; disbursements would be the payment of losses. There are many other potential cash flows associated with the operation of an insurance company.

Miccolis: We can group cash flows according to the activity that generated the cash flows. For example, municipal bonds are assets whose cash flows are: (1) the payment of cash to purchase the bonds, (2) the interest received in cash, and (3) the cash flow received from the sale or maturity of the bonds.

Miller: This means that every asset, obligation or consideration is associated with one or more items of

cash flow. In fact, the definitions of assets, obligations and considerations in the Statement of Principles are stated in terms of receipts and disbursements.

Miccolis: Before we go any further perhaps we should review what we mean by assets, obligations and considerations. We could use loss reserves as an example of obligations, premiums as an example of considerations, and stocks and bonds as an example of assets.

Miller: That's fine but I think we should point out that those are only examples and that there are many other type of transactions that should be classified into one of these categories.

Miccolis: We should also note that there can be significant interdependencies among cash flows connected with the same asset, with assets belonging to the same class, or with assets that are affected by similar kinds of environmental change. Similar statements apply to cash flows connected with obligations or with considerations.

Miller: In fact, there are even interdependencies among assets, obligations and considerations.

The savings and loan industry provides some interesting examples of interdependency between assets and obligations. When market interest rates rise above the rates being credited by savings and loan associations there is a tendency for the public to reduce the rate of flow of deposits or increase the rate of withdrawals. At the same time there is a tendency for borrowers to cut as far back as possible on prepayments of loans, which are mostly long term mortgages. Together, these two tendencies shorten the life of S&L obligations and lengthen the life of assets. The S&Ls have the least cash when they need it most.

When market interest rates go down the flow of deposits tends to strengthen, withdrawals drop in volume and the flow of prepayments increases. This lengthens the life of obligations and shortens the life of assets. The S&Ls have the most cash when they need it least.

Miccolis: Property/casualty insurers are not nearly as much affected by this particular type of change in the environment. However, when interest rates drop there is a tendency for borrowers to exercise the call provisions in their bonds. This has the effect of

giving insurers more cash to invest when the available rates of return are less attractive.

- Miller: Property/casualty insurers are significantly affected by inflation, however, and the timing of changes in inflation versus changes in interest rates can have a material impact on the economic value of an insurer.
- Miccolis: The impact of inflation would change the amount of the losses to be paid in the future. The changes in interest rates would affect the investment returns on the insurer's investments.
- Miller: Asset/liability management is certainly closely involved in the valuation process. The same methods and techniques used to effectively manage the cash flow risks associated with cash inflow from investments and cash outflow from paid losses can also be used in a valuation. The management of interest rate risk and inflationary risk also focuses on the impact that these risks would have on the value or earnings of an insurer.
- Miccolis: We should also remember that the timing of the payment of losses can vary significantly and thereby affect the asset/liability matching and the overall economic value of the company.
- Miller: A valuation is intended to produce an assessment of an insurer's financial condition. Conceptually, an insurer's "true" net worth - if there is such a thing - is equal to the combined value of all of its potential cash flows. In determining the combined value it would be necessary to take into account the offsetting nature of receipts and disbursements. It would also be necessary to take into account the uncertainty inherent in each potential cash flow as well as the interdependencies among the potential cash flows. In other words, the combined value of the cash flows is not a simple algebraic sum.
- Miccolis: Traditionally, actuaries have been concerned with reserving and ratemaking. Today actuaries have to be concerned with the financing of risk also. In other words we have to become familiar with the risks involved in investments. This part of the business has become vastly more complicated than it was a few years ago when interest rates were stable and many of the types of investments now readily available, such as "junk bonds", were either non-existent or hardly ever heard of. Asset defaults have been around for a long

time, but these "junk bonds" may increase default rates.

Miller: One implication of what you have just said is that there will have to be more communication between the underwriting and investment sectors of the insurance business. This doesn't mean that actuaries will be deciding on investment strategy or even that they will have to become familiar with the process of assigning credit ratings to investments. However, they will have to become familiar with the risks involved in investment and how investment performance is related to credit rating. In addition, actuaries will need to tell investment managers about the loss payment and variation characteristics of the risks being underwritten by the insurer. This will enable the investment managers to develop suitable strategies for financing those risks.

RISK BEARER

Miccolis: We have been talking about applications of valuations to insurance companies and possibly to self-insurers that are subject to property/casualty contingencies.

Perhaps we should rely on a more general understanding of what type of entities are subject to property and casualty contingencies and we can refer to such an entity as a "risk bearer". Hence a self-insurance pool, risk retention group, or individual self-insurer could be considered a risk bearer.

Miller: That's sounds good. Let's define a "risk bearer" as a person or other entity that is exposed to the risk of financial losses that may arise out of the occurrence of specified contingent events during a specified period of exposure.

Miccolis: The words "specified period of exposure" imply that a given person or other entity can be a risk bearer at some times and not a risk bearer at other times.

Miller: The words "specified contingent events" mean any types of event you care to specify as being subject to property and casualty valuations.

Miccolis: The words "person or other entity" are very broad too. It would seem to include individuals who knowingly decide they'll take the risk of "going bare" for certain types of coverage, such as professional liability, for example.

Miller: Some persons will object that there is no practical way to perform a valuation for an individual but I feel that practical considerations would limit the application to an individual.

Miccolis: However, as a conceptual matter, a person who "goes bare" has undertaken an obligation to pay whatever losses may arise while he is "bare". The individual's assets supporting his self-insured's obligations are probably inadequate because of the degree of uncertainty involved in the losses that might occur.

SEGMENTATION

Miller: The definition of valuation refers to the determination and comparison of the values of part or all of a risk bearer's obligations and the assets and considerations designated as supporting those obligations.

This means that a valid valuation can be made for some segment of an insurer's obligations as long as the assets and considerations supporting those obligations are specifically identified.

Miccolis: The idea of obligations being "supported" by assets and considerations is related to the financing of risk. In order to be able to finance a risk, a risk bearer has to have funds available to pay a loss arising out of the risk at the time the loss occurs. We have said that assets and considerations are intended to provide funds for paying those obligations. In the valuation process, it is necessary to identify the assets and considerations that support the obligations being considered in the valuation.

Miller: The concepts of obligations and the supporting assets and considerations should include "commitments", where a commitment is a promise to do something.

For example, a reinsurer can promise to reinsure all of the policies written by a direct writer within a treaty year which may not end until after the valuation date. Policies as yet unwritten will create cash flows arising out of periods of exposure that have not begun as of the valuation date. This commitment, made before the valuation date, should be taken into account in a valuation.

Miccolis: Another example relates to the asset side of the balance sheet. An insurer may make a commitment before

the valuation date to buy a certain security after the valuation date. The values of the cash flows arising out of this transaction should be taken into account in a valuation.

Miller: In appraisals, the value of future new business that may be developed after the valuation date is often taken into account. Future new business involves commitments that have not been made as of the valuation date but are projected to be made after the valuation date.

Miccolis: This is an interesting point because it helps to make clear what periods of time may be taken into account in valuation. Some valuations take into account only cash flows that are related to commitments made on or before the valuation date. On the other hand, an appraisal often takes into account not just the cash flows arising out of commitments made on or before the valuation date but also takes into account cash flows arising out of commitments projected to be made after the valuation date.

DETERMINING AND COMPARING

Miller: Let's be clear on what we mean by valuation as the process of determining and comparing values of obligations and supporting assets and considerations.

Miccolis: This makes it sound as though the determination and comparison are separate sub-processes with determination coming first. Conceptually, it would be possible to determine the value of the obligations without reference to the supporting assets and considerations and vice versa. Such determinations would not directly reflect the interdependencies among the cash flows associated with the obligations, assets and considerations. By comparing values we mean that the process will account for the interdependencies between obligations, assets and consideration.

Miller: This is the practical way to go. In fact, this is the way that the Society of Actuaries' Committee on Valuation and Related Areas attacked the problem. This mode of attack resulted in the description of the C-risks relative to assets, obligations and interest rates.

However, the problem of assessing the combined effect of these types of risk or uncertainty remains substantially unresolved despite the publication of an

extensive, sound and interesting report by the Society of Actuaries' Combination of Risks Task Force.

Miccolis: The comparison step is the one that provides the basis for assessing the financial condition of the risk bearer. In effect, this step compares the positives with the negatives after taking interdependencies into account and comes up with a combined value. As we have said before this is not a simple algebraic difference.

Miller: The financial condition of the risk bearer depends on both net worth and the degree of uncertainty in the result of the valuation.

RULES AND ASSUMPTIONS

Miccolis: The application of valuation concepts requires the selection of rules and assumptions to be applied in carrying out the valuation. We should talk about what kinds of assumptions have to be made.

Miller: In theory, an assumption has to be made about each of the variables affecting every item of cash flow. This would be an impossible task. One solution is to make assumptions about the variables affecting classes of assets or classes of obligations or perhaps even all assets or all obligations. Of course, there are many other ways to select assumptions.

Miccolis: Environmental conditions also affect the degree of uncertainty in the valuation. Accordingly, assumptions have to be made as to whether and how to recognize this fact.

In short, assumptions have to be made about all the factors that:

- o are used in the determination of value, or
- o would produce uncertainty in a basic cash flows used for the valuation.

Assumptions that may restrict the recognition of uncertainty may simplify the process of carrying out a valuation. However, at the same time such assumptions may result in a valuation that is too removed from reality.

Miller: Valuations made for management purposes should reflect reality to the fullest extent practical. Valuations made for other purposes might be based on assumptions that deliberately move away from reality; for example

this is true of the statutory statement which is supposed to produce a conservative assessment of an insurer's financial condition.

VALUATION VARIABLES

Miccolis: While we recognize that many assumptions are needed to carry out a valuation, we should identify the basic variables that are the building blocks of each assumption. The four valuation variables that we have discussed many times are:

- o the occurrence of the cash flow,
- o the amount of the cash flow,
- o the interval of time between the valuation date and the date of occurrence of the cash flow, and
- o a rate of interest related to the interval of time between the valuation date and the date of occurrence of the cash flow.

INTEREST RATE

Miller: For one of those variables, the interest rate, a question that comes up frequently is what interest rate should be used in a valuation - assuming that a rate different from zero is to be used. Over the years, a great many opinions have been expressed on this point. You have described "a rate of interest related to the interval of time between the valuation date and the date of occurrence of the cash flow". This doesn't say whether the rate should be a risk adjusted rate, a risk free rate, an after tax rate or any other type of rate.

Miccolis: You're right. The choice would be dependent upon the actuary's purpose in making the valuation. His choice may be affected by the opinions of others or by regulations.

Miller: In particular, it should be noted that because the rate is described as "related to (an) interval of time" the effects of the yield curve can be taken into account. The statement puts no limit on the actuary's ability to recognize differences in yield resulting from differences in asset quality or from differences in taxability. The description has been deliberately kept very general.

Miccolis: Deciding on the rate to be used in discounting cash flows related to obligations and considerations involves answering some other questions. Should an average rate be used? If so, what happens when an important shift in the mix of business occurs and the length of the payment tails is significantly lengthened or shortened? Does the company have a policy of matching the durations of assets and obligations? Does the insurer have a policy of trying to predict trends in interest rates? If so, how much risk is the insurer willing to take in this area? How may net investment income be affected by this risk? Does the insurer have a policy of maximizing net income by maximizing net after-tax investment income? How is the discount rate related to whatever rate may be recognized in pricing?

Miller: You bring up many important issues that actuaries will need to deal with in performing valuations. I don't think there will be any hard and fast rules that would apply in all circumstances.

DEGREE OF UNCERTAINTY

Miccolis: In evaluating a company's cash flow in terms of each valuation variable associated with a given asset, obligation or consideration it is important to reflect the degree of uncertainty involved. The uncertainty will depend upon:

- o the nature of the asset, obligation or consideration,
- o the various environments (e.g. regulatory, judicial, social, financial and economic environments) within which the valuation is being performed, and
- o the predictive reliability of the data on which assumptions relative to the variables are based.

Miller: In the light of the uncertainty and interdependencies affecting cash flows, assets, obligations and considerations and the further uncertainty arising out of the process of combining them, it is plain that the assessment of financial condition produced by a valuation involves both a measure of net worth and uncertainty. Some of methods for measuring and controlling the degree of uncertainty are addressed in the papers presented at this meeting.

RESULT OF A VALUATION

Miccolis: This would probably be a good time to switch to a discussion of what is the result of a valuation. First, we ought to discuss what we mean by "a valuation".

Making a valuation requires the development of a model. The model may be probabilistic or deterministic. If it is probabilistic, for practical reasons such as those we have already discussed, it cannot take into account all the sources and degrees of variability in cash flows and combinations of cash flows. Thus, it will be necessary to make assumptions to make it feasible to use the model. Such a model would run several times to determine the average result and the degree of variability in the results. The actuary would need to test the effects of changes in assumptions on the average result and the degree of variability in the results.

Miller: If one approaches the valuation problem in this way, what is the result of a valuation?

Is each run of the model a valuation? It could be, but probably isn't. At the very least it suffers from the fact there is no experimental evidence as to what the degree of variability of the result might be.

Is the result of a valuation the average result of several runs of the model with a given set of assumptions? Once again, it could be but probably isn't. This result would suffer from a failure to have examined the effects of changes in the assumptions.

Is the result of a valuation a value and a degree of variability selected from the results of probabilistic runs of the model with different assumptions? This could be the result. But notice how much it depends upon judgment in selecting assumptions and in selecting a representative value and degree of variability on the basis of the outputs of the model under different sets of assumptions.

Miccolis: Deterministic models have been used to develop answers to practical valuation questions. Typically these models have made strongly constraining assumptions

about the probability of occurrence of cash flows and the time of their occurrence. Interdependencies of cash flows have been built into them on a deterministic basis. Insurer reactions to cash shortfalls have been prescribed in advance. Several interest rate scenarios have been defined in advance. Examination of the results produced by the model using each set of assumptions in turn has been the basis of statements about the combined value of given sets of obligations and assets. Some idea of the effect of changing assumptions has been derived from arranging the values in order of size and noting the differences and making judgments as to the probability of occurrence of conditions roughly similar to those assumed to underlie each result.

Miller: Still, when all is said and done, we have to select a single value and a single measure of the degree of uncertainty in the value to describe the result of what we have done. But why shouldn't a valuation be any of the things we have described?

Miccolis: If we have done all that is needed to select a value and a measure of uncertainty, then the result has to be examined to determine whether risks embodied in the system have been satisfactorily controlled and financed or whether some increase or decrease in value or uncertainty would be desirable.

Miller: The association of a measure of uncertainty with the result of the valuation characterizes the principal difference between the result of a valuation and the surplus shown in a conventional balance sheet. Conventional surplus is simply the difference between assets on the one hand and liabilities on the other.

Miccolis: Of course, with suitable choices of assumptions the valuation process can produce a statutory balance sheet. The most important assumptions would be that there is no risk connected with admitted assets; that actual losses will not differ from those reflected in the reserves in the statement; and that the value of loss payments is not discounted for investment income. Notice that these assumptions effectively remove uncertainty from the picture.

VALUE

Miller: A valuation based entirely on cash flow analysis would give a good estimate of economic net worth. This makes

the idea of using this type of valuation to assess an insurer's financial condition sound deceptively straightforward and attractive.

You and I both know that it's extremely difficult, if not impossible, to produce a valuation based entirely on cash flow analysis. This should be evident from our discussion of the complications involved in combining the values of cash flows and the assets, obligations and considerations with which they are connected. But, for now we can say that suitable choices of assumptions will enable the production of a valuation that comes close to estimating economic net worth. Even so, there is real difficulty in getting an adequate measure of the degree of uncertainty or risk involved in the valuation.

Miccolis: This is a critical point because to a great extent the assessment of an insurer's financial condition depends upon the stability and profitability of its operating results. In order to achieve stability and profitability, an insurer must be a competent manager of risk. The less the uncertainty, the greater the stability. But reductions in uncertainty tend to reduce profitability. As usual, the trick is to achieve a good balance between risk and profit.

Miller: A question similar to "What is valuation" is "What is the meaning of value". For any item of cash flow, the answer to this question is that the meaning depends upon the assumptions made as to the valuation variables related to that item of cash flow. In other words, value for the purposes of a valuation is a function of the assumptions made in carrying out the valuation.

Miccolis: It is conceivable that the only assumptions as to any item of cash flow could be descriptions of:

- o a probability density function for each of the valuation variables associated with the item of cash flow;
- o the interdependencies (correlations) of each of those variables with the other variables associated with the item of cash flow; and
- o the interdependencies associated with each of the other items of cash flow involved in the valuation.

I can't think of another set of assumptions that would come closer to developing the "true" value of each item

of cash flow. At the same time, the idea of trying to carry out a valuation on the basis of such assumptions boggles the mind with its complexity.

Miller: On the other hand, I'd say that the closer you can come to producing a valuation on this basis the closer you can come to developing a good estimate of the economic value of the insurer or self-insurance system being valued. This once again highlights the importance of selecting assumptions that will most closely imitate reality and at the same time be completed for reasonable amounts of time and effort.

RELATIONSHIP TO RESERVING AND RATEMAKING

Miccolis: The definition of valuation refers to determining and comparing the values of obligations and the corresponding assets and considerations. The comparison step draws an important distinction between the valuation process on the one hand and the reserving and ratemaking processes on the other.

Miller: There is a question as to how the valuation process is related to the reserving and ratemaking processes.

Let's discuss the relationship with the reserving process first. Loss payment triangles are regularly used as a basis from which to project future loss payments. Conceptually, each of the elements in the triangle is the product of a number of payments and the average amount of payment. The aggregate of the amounts of the payments in an element of the triangle is related to a particular interval of time which can be assumed to be concentrated in a point. This enables the determination of a time interval between that point and any other point in time such as a valuation date. Then, if the person developing the reserve wishes to do so he can associate an interest rate with interval of time from the valuation date. Finally, it can be assumed that the numbers, amount, time interval and interest rate are all "experimental" values resulting from some random processes which can be summarized in some formula that can be used to project future values for corresponding intervals of development. This formula might even provide a way to estimate the degree of uncertainty in expected values that could be calculated with the help of the formula.

Miccolis: Plainly, the information and assumptions used in the reserving process could be used in valuation. It's

plain also that the same "valuation variables" are involved in both processes. It's common knowledge that the degree of uncertainty in reserves is influenced by the nature of the coverage to which the reserves are related, the various environments in which the coverage is provided and the predictive validity of the data used to make the projections of payments. Finally, there are interdependencies between the amounts of payments. For example, it is a common experience that the average amount of a loss payment that is long delayed after the date of occurrence tends to be larger than the amount of a loss that is paid quickly.

In other words there is a very strong relationship between valuation and reserving. The key difference is that "comparing" step in the valuation process.

Miller: Let's take a quick look at the ratemaking process.

Assume a block of policies providing a specified form of liability insurance is to be issued over a given interval of time, such as a policy year. The assumption about liability insurance is made simply to convey the idea that there will be available some information about the distribution over time of loss payments and possibly even numbers of claims. The payments can be assumed to be concentrated in a series of points in time one year apart. The issue of the policies can be assumed to be concentrated at the mid-point of the policy year. These assumptions help to define the intervals of time between the date of premium payment and the date of loss payment. Knowledge of current market interest rate conditions and the insurer's investment and tax strategies will help in the choice of an interest rate if interest is to be taken into account explicitly. Finally, just as in the case of the reserving process we described earlier, it can be assumed that the numbers, amount, time interval and interest rate are all subject to some random processes which can be summarized in some formula. This formula might even provide a way to estimate the degree of uncertainty in expected values of occurrence, amount, timing and interest rate.

Miccolis: Plainly, the information and assumptions used in ratemaking are closely related to the information and assumptions used in reserving. Accordingly these kinds of ratemaking information and assumptions could be used in valuation. The projections would be subject to the same kinds and sources of uncertainty as those encountered in the reserving and valuation processes.

In other words there is a very strong relationship between valuation and ratemaking. The key difference is that "comparing" step in the valuation process.

Miller: The importance of these relationships is that large numbers of the membership of the CAS are already actively involved in work that is closely related to valuation. That work is directed at the determination of the aggregate amounts of loss costs and expenses. Valuation is directed at the determination of the values of those amounts once the fundamental ratemaking and reserving work has been done. Valuation further involves the comparison of those values with the values of the supporting assets.

Miccolis: We should also say that the inclusion of interest as one of the valuation variables is not intended to mean that we are advocating changes in rating and reserving practices. What we are doing is recognizing what has been a fact of financial life for centuries. Money has time value. In practice, ratemakers and reservers have assumed, for reasons of conservatism, that rates and reserves should not explicitly take interest into account.

Miller: This is just one of the many kinds of important assumptions that can be made about how specified items of cash flow may be affected by any of the valuation variables. Other examples are the common assumptions that all policies are written in the middle of the year or that all cash flows occur either in the middle of the year or at the beginning or end of the year or at a fixed period of time after a policy is written. These assumptions are made to simplify analysis without significantly reducing the usefulness of projections based on them. Projections are most useful when they closely imitate reality without creating undue expense.

RESEARCH

Miccolis: Listening to these questions raises another question - "What valuation questions are most in need of research?"

Surely the question of what discount rates should be used is one of them. There is currently a considerable amount of work being done on this question.

Another is the development of a method for using cash flow analysis to assess risk in a portfolio of obligations, especially loss reserves. There is a method for determining the variance of a pure premium but it does not deal with the variability of the distribution of loss payments over time nor the change over time in the average amount of loss payments arising out of a given period of exposure. Likewise there is little, if any, published research on the question of how the random variability of timing of payments may affect present values of losses. The papers presented at this seminar, however, definitely will contribute to this research.

Miller: Until recently there has been surprisingly little research reported in the area of methods for using cash flow analysis to assess risk in a portfolio of assets. Financial analysts have done some work in this field and life actuaries have also published some papers. However, much remains to be done, especially in the area of assessing differences in risk by quality of assets. Another question is how to optimize the risk/reward balance in a portfolio of assets.

Miccolis: As we have already said, the Combination of Risks Task Force of the Society of Actuaries Committee on Valuation and Related Areas has done some analysis on the question of the interdependencies of the asset, obligation and interest risks. But a lot more could be done.

Miller: Interest rate risk has been the subject of a great deal of research and a large volume of literature has been produced in recent years.

So, to sum up, the greatest present need and opportunity for research seems to lie in the fields of the obligation risks and the asset risks. Perhaps after this work has matured some, it will be more useful to make further investigations into the problem of combination of risks.

Miccolis: We could go on to discuss the individual principles of valuation and the relationship between principles and standards of practice. However, we probably should take some questions at this point.

