

DYNAMIC SOLVENCY TESTING:
BOUNDARIES OF RISK DEFINITION PHASE

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I. GENERAL COMMENTS

At the request of the Society of Actuaries (SOA) Committee on Financial and Investment Management Research, I have been asked to prepare a research paper to define certain areas where additional research regarding the boundaries of risk is necessary. This report identifies the risks that can affect insurance company solvency, provides information and opinions on techniques currently available, and comments on what additional research may be necessary. These areas are discussed in further detail below.

A note: the *Dynamic Financial Condition Analysis (DFCA) Handbook*, published by the SOA in April 1995, is an excellent source of information on this subject, particularly with respect to identification of risks. This report will attempt to cover information not specifically contained in that document. It will also list areas where the SOA is currently providing research, and will list areas where further SOA research (which may include compilation of research done by others) may be useful.

Consistent with the *DFCA Handbook*, this report uses the phrase "Dynamic Financial Condition Analysis"; in Canada, the phrase "Dynamic Solvency Testing" is more commonly used.

II. IDENTIFICATION OF RISKS

There are a number of sources of information on the types of risks that can affect insurance companies, and various insurance products.

A. Company Level Analysis

For dynamic financial condition analysis, one of the considerations is the overall health of the company. Information on this may affect the possible need for additional capital and new business. To get an idea of how this is measured, it is of interest to see how others view the industry. Therefore, rating agencies were contacted for their input. In addition, it is of interest to see how similar industries are viewed; specifically, investment banks were contacted to see if any additional information from a similar industry would be useful.

The *TSA 1993-94 Reports* research report "The Potential Role of Dynamic Solvency Testing in Preventing Insolvencies: A Historical Perspective"

by Robert S. Fillingham was also reviewed for relevance to this research report.

1. View from Rating Agencies. Two rating agencies were contacted in order to determine what they view as important in rating companies. This research is indebted to Mr. Neil Strauss, ASA, MAAA, of Standard & Poor's, and Mr. Joel Salomon, FSA, MAAA, of Moody's Investor Services.

Although the two ratings agencies take different approaches, and emphasize certain characteristics to different degrees, there is some agreement as to what is involved in rating the strength of an insurance company. An important point that was emphasized by both rating agencies is the amount of qualitative, as opposed to quantitative, judgment that goes into the ratings process. (One of the rating agencies stated that over 50% of their ratings were more dependent on qualitative, as opposed to quantitative factors.) This makes dynamic financial condition analysis, which attempts to quantify the factors contributing to company distress, a difficult process.

The following lists some of the items considered by ratings agencies, along with comments as to how the actuary can incorporate consideration of these items in dynamic financial condition analysis:

- o Business outlook: The ratings agencies have a general outlook for the life insurance business in general, and various lines of business in particular. Moody's distributes this as the *Life Insurance Outlook*, (published by Moody's Investor Service). The last published edition was released in August 1994. This reflects such outside factors as potential changes in taxes, accounting requirements, regulatory environment, competition from other sources, such as banks, and so on. For example, one rating agency viewed as a negative the potential for a new model investment law from the National Association of Insurance Commissioners (NAIC), since they viewed this removing some insurance company investment flexibility.

The actuary performing dynamic financial condition analysis needs to keep abreast of the latest developments that can affect the company being tested. There are currently many sources of information on this topic; e.g., the *Actuary*, the *Actuarial Update*, the *Life Insurance Outlook* cited above, various pronouncements from the Financial Accounting Standards Board, Canadian Institute of Actuaries Guidance Notes, model laws and regulations from the NAIC, various state laws and regulations, and SOA Section newsletters. It may be a bit difficult for all actuaries to keep up with all the changes that may affect the dynamic financial condition analysis for a company. It is recommended that the SOA assist in this task by having a document that would reflect current information. The plans to have an annual update of the *DFCA Handbook* should be helpful in this regard.

- Management and corporate strategies and risks of those strategies: A major factor in a rating agency's rating is the agency's view of management and management's plans for the future. It would be difficult for the actuary to quantify all potential management actions. However, an actuary can incorporate the effect of management plans (e.g., sale of a line of business, addition/deletion of distribution channels). There are some areas where the actuary should test alternative outcomes for management plans; for example, if management were planning to sell a line of business, the actuary can test the effect of the sale at the expected price and at prices 15% higher or lower than expected price, or what would happen if no buyers were found for the business at a reasonable price (e.g., the capital contribution required, the amount of any write-off, and so on). The SOA can assist by developing a list of items to consider in corporate strategies (which was done in Chapter 2 of the *DFCA Handbook*). In dynamic financial condition analysis, the actuary may need to perform sensitivity testing to point out the possible financial implications of management and corporate strategies. This is an area where it would be very difficult for an organization such as the SOA to do further research, since the actions that can be taken and the effect on a company are highly dependent on individual company circumstance. Therefore, no official research report is recommended in this area. However, this topic may benefit from articles that could be printed in various actuarial publications.
- Review of business-distribution channels: The rating agencies have some opinions as to which distribution channels they prefer. For certain lines of business, such as single-premium deferred annuities (SPDAs), some distribution channels such as stockbrokers, are considered to be "hot" money, and make results more volatile.

Another consideration is the cost of the distribution channel. A rating agency's view of different distribution channels changes over time. For example, one rating agency used to view a career agency force as a positive; now they are viewing this generally as a negative, due to the cost. This particular rating agency prefers the use of several distribution channels, so the rewards versus the risks of the various channels are maximized.

For the actuary, the distribution channels need to be considered in dynamic financial condition analysis. Some of the studies that the SOA conducts (e.g., the SPDA Lapse Rate Study) already reflect differences by distribution channels.

- Competition: The effect of competition is considered in the rating process. For example, one rating agency stated that SPDAs are viewed as a

- commodity product, with many competitors in the market. The actuary, in performing dynamic financial condition analysis, should take into account the potential actions of competitors. This generally means that margins on products are not likely to be wide for any length of time.
- Share of marketplace/business niche: The ratings agencies give additional credit if a company is strong in a particular niche. For example, if a company is well known in the financial planning arena, this may give the company a differential advantage. The same may be true of a company that specializes in upper income families and business owners. This is another qualitative factor that the actuary may not be able to directly reflect in dynamic financial condition analysis. However, the actuary may want to test what would happen if additional competitors entered the marketplace, or if a particular niche may be subject to additional outside forces (e.g., major changes in tax codes).
 - Lines of business: The rating agencies have opinions as to which lines of business may cause more volatility. For example, life insurance is currently viewed as less volatile than guaranteed investment contract (GIC) business. If a company is only in one line of business, this may also be viewed somewhat negatively, since risk is concentrated. The actuary can reflect this in the degree of dynamism in certain factors, such as expected persistency.
 - Financial flexibility: The rating agencies give extra credit if a company has relatively greater financial flexibility. For example, if there is a strong parent that can supply the life company with additional capitalization when needed, this is viewed as a plus. If, on the other hand, the upstream company needs the life company to pay dividends yearly to cover debt, this would be viewed as a negative. In performing dynamic financial condition analysis, an actuary can explore the various alternatives of funding any potential shortfalls. This would include issuance of debt or stock (if a stock company), reinsurance, issuance of surplus notes or demutualization (if a mutual), or securitization of liabilities.
 - Liquidity concerns: A growing concern of rating agencies with respect to several industries is liquidity—will the company have enough cash to meet its obligations? One way this is calculated is to compare the expected cash inflows for the next period (e.g., asset maturities, calls, prepayments, interest payments, and new premiums) versus the expected cash needed (e.g., surrenders, deaths, maturities, forward commitments, expenses, taxes, etc.). The actuary may develop a range of cash flows from the dynamic financial condition analysis. If relatively illiquid assets need to be sold in order to fund expected cash outflows, this should be pointed out to management.

This is an area where the actuary could use more assistance. A study of the potential reduction of the value (haircut) of certain asset categories that should be assumed if assets need to be sold quickly would be useful. There is little consensus on this. For example, one rating agency gives a 50% haircut to private placements in determining a firm's liquidity. However, private placements have been sold within a short period of time (e.g., week or two) of being placed with little loss in value. The secondary market in other asset categories, e.g., real estate and commercial mortgages, is not robust. Therefore, the SOA may assist actuaries by commissioning a research paper on liquidity. This paper could cover the potential reductions in value if certain asset classes needed to be sold in a very short period of time (e.g., a week), versus reductions if assets had to be sold over the next month versus any reductions needed if the assets had to be sold over the next six months. This project may be able to be done for \$5,000–\$15,000, depending on the extent of the research and the assets covered.

- Capitalization: The ratings agencies are concerned about the amount of surplus a company has available. They look at both statutory and GAAP numbers, as well as level of capitalization based on internal formulae. In dynamic financial condition analysis, the actuary is concerned with the entire financial structure of the company. For the U.S. actuary, this will be additional work beyond that required under the Actuarial Opinion and Memorandum Regulation. It is likely that company management would be interested in the projection of capitalization in various formats, e.g., the Risk Based Capital or RBC (Minimum Continuing Capital Reserve Standard or MCCRS in Canada), and projection of capitalization as a percent of total assets. It is anticipated that various companies may have different targets in terms of what numbers would be most useful to show.

Actuarial research was done to develop the RBC and MCCRS formulas; it is possible that additional research could give guidance as to appropriate approaches for target surplus (as a benchmark for the actuary to test any internal formula), and give guidance as to the impact that the actuary should recognize. Since the actuarial research was done by the CIA and AAA to develop the original formulas, SOA research in this area would be more in the nature of developing a list of factors to be considered; this may be best handled by expanding on this topic in the *DFCA Handbook*.

- Asset/liability process: The ratings agencies do review the asset/liability process within the companies being examined. For example, they review the type of asset adequacy testing being done. One telling comment was

that they do not review the number of scenarios that “pass” or “fail,” rather they look at the relative liberalism or conservatism of the assumptions, to see if the testing is reasonable. Dynamic financial condition analysis also should have as a goal giving an accurate, as opposed to the most positive, picture of the company.

The ratings agencies also check how integrated the asset/liability process is; for example, whether durational targets are used in determining asset strategies. In dynamic financial condition analysis, the actuary should reflect the process used by the company. This may be one area where the actuary can test additional strategies to see if improvements in the process can be beneficial.

- Assets: A number of insurance companies have gotten into trouble due to their asset structure. Therefore, the type of assets and concentration of assets in any single asset or asset type (e.g., real estate, commercial mortgages, or collateralized mortgage obligations or CMOs) is of concern to the rating agencies. The actuary can get a quick feel for these without extensive testing (e.g., by reviewing the asset schedules in the annual statement, to ensure that no one asset or asset category is a large percentage of total assets).

The actuary needs to review, evaluate, and quantify the assets structure in comparison to the investment policy of the company, and should review whether any concentrations of assets are in government bonds versus illiquid assets which may have volatile earnings patterns such as commercial mortgages. The asset vulnerability to C-1 risk can be tested quantitatively. Note: Assets are discussed more thoroughly in Section II.B.

2. View from Banks. Information from two New York banking institutions was used to determine if additional factors should be considered by life insurance companies. At their request, the information as to the identity of the banks is being kept confidential. Much of the concerns expressed by these institutions are similar to those regarding insurance companies. The following summarizes the major issues:

- Product structure: Both banks are concerned with diversification of products and services provided. One of these banks had been concentrating on the leading edge of the market (e.g., derivatives and synthetic GICs), so it does not have the steady income from certain more traditional banking lines, and has been criticized by some rating agencies because of this. (This is similar to diversification into various lines of business for life insurers.)

- Assets: There has been much attention focused on the assets that various banks are holding. One of the concerns expressed by regulators and ratings agencies is the amount of exposure in overseas debt. Another concern is the amount of derivatives. Several years ago, a major concern was the amount of real estate exposure. Life insurers have some of the same exposures.
- Regulation: Both banks expressed concerns over the level of regulation and the number of new requirements from both the regulators and the accounting industry. This is a concern of life insurers as well.
- Duration management: It appears that banks generally do not match their assets with liabilities, rather they attempt to control the spread risk by monitoring liquidity ratios and by establishing durational targets for assets. This is different than the trend of life insurers to do more asset/liability testing.

3. View from Research Report “The Potential Role of Dynamic Solvency Testing in Preventing Insolvencies of Insurance Companies: A Historical Perspective.” The SOA Committee on Financial and Investment Management Research also funded a report titled “Potential Role of Dynamic Solvency Testing in Preventing Insolvencies of Insurance Companies: A Historical Perspective.” This report, published in *TSA, 1993–94 Reports*, researched the cause of insolvencies for six life insurance companies that failed in 1991. The conclusions were as follows:

- Other testing would have shown problem: For one of the companies, a quick glance at the balance sheet would have indicated the major liquidity risk the company was taking, as a good portion of the assets were in equity investments (41% in real estate, 31% in stocks). Sometimes simple tests may be sufficient.
- Dynamic financial condition analysis would have been useful; simpler tests could be used: For some companies, specifically those with a large health insurance business, the conclusion of the report was that, while dynamic financial condition analysis would have shown problems, some simpler tests, such as a gross premium valuation, would have also indicated problems. This result indicates that the level of testing may be dependent on the type of business.
- Dynamic financial condition analysis would have been beneficial: For two of the companies examined, notably those with a large amount of interest sensitive business, the report suggests that comprehensive dynamic financial condition analysis could have given early warning signs of the problems that caused the insolvency. If the company’s management had been

aware of the potential problems several years earlier, steps could have been taken to prevent the insolvency.

B. Assets

A number of insurance companies have gotten into trouble due to the asset side of the balance sheet. A number of actuaries in the U.S. have not had extensive training in investments, and could use some assistance in determining what assumptions may be reasonable for different types of assets.

1. *Background Material.* There are many sources of information on assets. A brief review of some of these are given below:

- *Dynamic Financial Condition Analysis (DFCA) Handbook:* As mentioned previously, this handbook was specifically written to the actuary performing dynamic financial condition analysis. It should be considered essential reading for those actuaries involved in such testing. The *DFCA Handbook* provides a good overview of the different asset types an insurance company typically invests in, and the different risks associated with each. The handbook also contains extensive bibliographies, which detail other sources of information. The handbook is scheduled to be updated periodically to reflect further research, and to add information as necessary. This will most likely become a primary source of information for those actuaries conducting dynamic financial condition analysis.
- *Practice notes:* Practice Notes have been published by the American Academy of Actuaries for the past three years. Their purpose is to assist appointed actuaries in the U.S. who are performing asset adequacy analysis. Each of the Practice Notes is on a narrow topic (i.e., CMOs). The Practice Notes are in a question and answer format. The *DFCA Handbook* now serves a similar purpose for those actuaries who are performing dynamic financial condition analysis; however, the Practice Notes may provide additional useful information regarding certain aspects of different assets.
- *Study notes:* There are a number of SOA Study Notes that also contain useful information regarding investments, including those for Course 220 and 230, which are currently required Fellowship courses on Finance, and the study notes for the Finance and Investment tracks. For those actuaries who will be involved in dynamic financial condition analysis and who have not been exposed to these courses, it is recommended that a list of study notes be obtained from the SOA. The actuary may choose to order those on topics of interest.

- Investment Section newsletter: The newsletter of the Investment Section, *Risks and Rewards*, also contains many useful articles on assets. Many of the articles would be of direct interest to those performing dynamic financial condition analysis.
- Financial textbooks: Examples of financial textbooks are those edited by Fabozzi, i.e. *Fixed Income Securities* and *Mortgage Backed Securities*. These books are generally updated yearly. These texts are geared toward those with little prior knowledge in investments. These are useful for actuaries who would like to understand the basics of assets.
- Financial journals: The articles in financial journals such as *The Journal of Fixed Income*, *The Journal of Portfolio Management*, and *The Financial Analysts Journal* are generally scholarly analyses of specific characteristics of an asset type (i.e., the relationship between inflation and real estate returns over an economic cycle; defaults of bonds of various credit qualities over the life of the bonds). These publications are useful for an actuary doing dynamic financial condition analysis who would like to keep up with the current research.
- *The North American Actuarial Journal*: The SOA's Board of Governors has approved the start of a new actuarial publication to be called the *North American Actuarial Journal*. This journal is scheduled to have its first issue published in January of 1997. The journal would publish scholarly papers of various lengths on subjects of interest to actuaries, with both actuaries and nonactuaries as authors. It is anticipated that this journal will be publishing some articles of interest to actuaries performing dynamic financial condition analysis.

With all of the above sources, it appears that the SOA does not need to develop any additional sources of background reading material on assets for those actuaries performing dynamic financial condition analysis. However, some additional research into certain asset categories may be useful (see Section II.B.3. Additional Research on Assets).

2. Seminars and Other Sessions. Other useful learning tools for actuaries interested in investments include seminars and other teaching sessions. The SOA and the CIA have offered a number of sessions that are applicable to actuaries performing dynamic financial condition analysis. These include:

- Meeting sessions: There was a series of sessions at the Spring 1995 SOA meetings geared to those actuaries who became actuaries before having to study much on investments. The series include: "Course 220 'Lite': A 'Less Filling' Overview of the Fellowship Exam on Introduction to Asset

Management and Corporate Finance”; “Course 230 ‘Lite’: A ‘Less Filling’ Overview of the Fellowship Exam on Principles of Asset/Liability Management”; and “Course 485 ‘Lite’: A ‘Less Filling’ Overview of the Fellowship Exam on Advanced Portfolio Management.”

- Valuation Actuary Symposium: The annual symposia, sponsored by the SOA and American Academy of Actuaries for U.S. Actuaries and by the CIA for Canadian Actuaries, present topics of direct interest to the actuary performing asset adequacy testing. These topics would be of interest to those performing dynamic financial condition analysis as well.
- Wharton seminars: The SOA has sponsored an intensive three-day seminar on investments at the Wharton School. This is an excellent seminar for those actuaries performing dynamic financial condition analysis who want to explore some of the theoretical underpinnings of asset pricing and scenario generation.
- Investment seminars: The SOA’s Financial and Investment Management Practice Area is also scheduled to conduct seminars on investment topics for actuaries. These will be conducted in the evenings over a number of weeks.

The CIA Committee on Investment Practice also holds one-day seminars on investment topics.

- Financial Risk Management Seminar: The SOA is scheduled to conduct a seminar on managing financial risk later in 1995. This should also be a good source of review on assets and other topics relating to dynamic financial condition analysis.

As more actuaries become involved in dynamic financial condition analysis, it is anticipated that the SOA will conduct various sessions, seminars and symposia to fulfill the training needs of such actuaries.

3. Additional Research on Assets. Even with the multitude of sources of information on assets, there remain topics that could benefit from either additional SOA research or having the SOA summarize research done elsewhere. The following summarizes some of these topics:

- Study of credit risk associated with private placements and commercial mortgages: The SOA has conducted a survey to determine the credit risk associated with private placements and commercial mortgages. This study is being updated for information through 1994. The SOA is in a unique position to conduct such a study, since life insurers are a major investor in these asset classes. It is recommended that this study be continued, to determine the effect of an entire economic cycle on these asset classes.

- Study of prepayments on mortgage backed securities (MBSs): There is a significant amount of research on prepayments of mortgages. Each of the major investment houses has their own prepayment formulae. In a survey of valuation actuaries in the U.S. in 1993, this was one area where many actuaries stated that they would have preferred more information, indicating that the tools they were now using to project cash flows did not seem adequate. It may be useful for the SOA to sponsor a research project exploring different prepayment models, and perhaps suggesting possible ranges for the variables used in the models in order to assist actuaries performing dynamic financial condition analysis. The information needed for this study would be based on currently available material; therefore, it may be possible to do such a study for about \$5,000. Note: If it is determined that the current prepayment models do not perform adequately, then a project to develop a reasonable prepayment model could be undertaken; this would cost considerably more than \$5,000. However, this step should probably not be taken until the current models are reviewed.
- Real estate: The advice in most of the actuarial literature on this topic is to examine each piece of real estate on a seriatim basis. However, it would be useful if the actuary would have some idea about how certain geographic markets and real estate types (e.g., hotels versus office buildings) are doing. There are several good sources of real estate information (e.g., the Equitable Real Estate Investment Management company's annual *Real Estate Outlook*). It would be useful if summary data on such information were published periodically for the actuary. This is not a specific research project; it could be made part of either the *DFCA Handbook*, Practice Notes, or the equivalent of the *Statistics for Pension Actuaries*, which is published by the Pension Section of the SOA and jointly sponsored by the SOA, the SOA Committee on Retirement Systems Practice Education, and the Pension Section.
- Credit (C-1) risk on bonds: There has been extensive research on the default risk of publicly traded bonds. One good source of information on the default risk is the work done by the industry summarizing the results of other studies in conjunction with the development of Asset Valuation Reserve factors developed for U.S. statutory accounting. It would be useful if this data were summarized for actuaries. This can be done in the next edition of the *DFCA Handbook*.
- Other asset types: Insurance companies are developing and purchasing new types of investment assets. Structured notes, credit tenant loans and other derivative instruments are some examples. One way information on

new asset types can be disseminated to actuaries is through the *DFCA Handbook*.

C. Specific Lines of Business

A source of information on different valuation methodologies for insurance liabilities is the proceedings of the December 7-8, 1995 conference presented by the SOA and New York University's Salomon Center regarding the fair (market) valuation of insurance liabilities. This publication is expected to be available during the second quarter of 1996. The *DFCA Handbook* does an excellent job summarizing the state of the art of asset adequacy testing for various lines of business.

The SOA conducted a survey of what economic assumptions actuaries considered important for various lines of business (e.g., individual life, individual disability income, individual annuity, individual medical insurance, etc.) The results are currently available from Actuaries OnLine.

Another source of information regarding dynamic financial condition analysis is the Canadian Institute of Actuaries papers. There are a number of papers of use; e.g. "Dynamic Solvency Testing" and "Valuation of SPDAs." Other CIA papers of use to those performing dynamic financial condition analysis are the "Consolidated Standards of Practice" (currently an exposure draft has been released), the Valuation Technique papers, and Guidance Notes. Notice of these papers and how to obtain them should also be made available to actuaries practicing in the U.S.

There are certain areas where other sources of information would also be useful to the actuary performing dynamic financial condition analysis. In addition, there are certain areas where additional research by the SOA may be useful. These are mentioned below by major product line:

1. Individual Life Insurance. Individual life insurance includes participating and nonparticipating whole life insurance, universal life insurance, variable life insurance and term insurance. The major risks are mortality, lapse, premium cessation, expense and interest rate risks. Besides the *DFCA Handbook*, additional sources of information, and additional potential SOA projects, are discussed below:

- o Mortality: The SOA has a Life Insurance Experience Studies Committee that is continually studying insured mortality. The results of the studies are published periodically in the *TSA Reports* of the SOA. These studies include select and ultimate mortality and smoker/nonsmoker mortality. There are certain areas where additional information would be helpful to actuaries performing dynamic financial condition analysis. These include

preferred risk mortality, joint and last survivor mortality, and older age mortality. Other mortality studies that may be of interest are mortality on extended term (an update of the 1980 CET table) and mortality on group conversions and term conversions.

The CIA Committee on Expected Experience publishes periodic reports on Canadian Standard Ordinary Life Experience.

- Lapses: Lapse studies on individual insurance products are typically performed by the companies. The SOA, in conjunction with the Life Insurance Marketing and Research Association (LIMRA), conducted a lapse study for universal life products. The universal life products are thought to be more susceptible to lapse due to changes in interest rates than traditional products. Unfortunately for the usefulness of the study results with respect to interest rate changes, during the period surveyed (the late 1980s through the early 1990s), interest rates were relatively benign. It would be worthwhile to repeat this survey periodically. A similar lapse study for term insurance and traditional products could provide information on lapses by duration and distribution channel, and should be considered.

The CIA Committee on Expected Experience has published reports of lapse experience under lapse supported policies.

Another worthwhile project may be to study the effect of new or more competitive products on lapses; this would assist in measuring the average shelf life of a product. However, the latter may be highly influenced by internal replacements (i.e., the company's own agents and brokers replacing a product by the "new and improved" version), so it may be hard to measure on an industrywide basis.

- Relationship between lapses and mortality: There are at least two papers on the relationship between additional lapses and mortality. "Pricing a Select and Ultimate Annual Renewable Term Product," by Jeffrey Dukes and Andrew M. MacDonald, is included in *TSA*, Volume XXXII (1980). Dr. David Becker and Theodore Kitsos subsequently published modifications of the methodology ("Pricing for Profitability in ART," *Best's Review*, September 1984, p. 26). Updates of the information used in these papers may be useful.
- Premium cessation: For universal life, the premium cessation rates may be as important as the lapse rates. The SOA/LIMRA study contains some information on this aspect of universal life.
- Expenses: Expense allocation is becoming a major issue in the U.S. The proposed (April 1995 draft) of the U.S. Actuarial Standard of Practice on illustrations would require full allocation of expenses for each cell of

individual life insurance products. This is not necessarily the method used by many companies in determining the level of expenses each product should carry. Various articles on pricing have been published in a variety of journals in the past several decades. In the actuarial arena, Shane Chalke's paper on "Macro Pricing: A Comprehensive Product Development Process," which was published in the *TSA*, Volume XLIII (1991), gives a method for allocating various types of expenses to individual products. It seems most logical that the actuary performing dynamic financial condition analysis would want to allocate expenses consistent with how their company views the expenses. One possible way the SOA may help in this issue is to do a call for papers regarding expense allocation.

On a practical level, the Life Office Management Association (LOMA) performs a yearly expense analysis study. These numbers can provide guidance to an actuary whose company does not have sufficient credible experience to develop the expense factors to be used for the products tested. It may be useful for the SOA to investigate publishing extracts from this study for the benefit of actuaries who do not have access to this study.

- Interest rate risk with respect to policy loans: Many traditional insurance products currently being sold have a dynamic policy loan interest rate, which varies with an outside index. There are, however, a number of products still in force that have a set level of interest rates. This is being handled in some companies by "direct recognition," directly recognizing the effect of policy loans on the interest rates credited. Policy loans may still impact companies because they present a liquidity risk: a company still must have enough liquid assets to meet policyholder demand for loans. An SOA study on the liquidity risk of policy loans may be useful. This study would require gathering information from a number of insurance companies, perhaps by a survey. It would therefore take time to implement, although the direct costs should not be high.
- Investment strategies used for traditional products: Various Valuation Actuary Symposia have discussed the interest rate risks associated with a variety of investment strategies for particular products. Certain new strategies are investigated periodically by various actuaries. Since this is an evolving topic, the best way to cover such items may be encouraging submissions of articles on this to the new *North American Actuarial Journal*.
- Other issues: There are external issues to consider when performing dynamic financial condition analysis on individual life insurance. These include potential changes in tax laws, Securities & Exchange Commission (SEC) changes, and changes in regulations. The SOA can assist in this

subject by following these external developments and reporting them to actuaries performing dynamic financial condition analysis through articles in *The Actuary* and other publications, and through reports at SOA meetings and seminars. The Life Practice Advancement Committee of the SOA has recently formalized having a representative present at NAIC meetings, so that results can be reported to interested actuaries in a timely manner. The American Academy of Actuaries also has a representative of the Committee on Life Insurance Financial reporting to follow SEC, tax, and federal regulatory developments.

2. Individual Annuities. Individual annuities include SPDAs, Flexible Premium Deferred Annuities (FPDAs), variable annuities, Single Premium Immediate Annuities (SPIAs), and structured settlements, which are typically structured payouts in court cases. These have similar risks to other types of individual insurance, e.g., mortality, lapses, premium cessation for FPDAs, expenses, and interest rate risks. In addition to the *DFCA Handbook*, additional sources of information, and additional potential SOA projects, are discussed below:

- **Mortality:** Individual annuity products have been using the 1983*a* Individual Annuity Table for a number of years. Several companies have conducted internal studies and concluded that these mortality rates are no longer realistic. It may be desirable to replace the 1983*a* Individual Annuity Mortality Table with a table reflecting recent mortality improvement. The SOA is setting up a committee to study this issue, one of the problems being the ability to obtain data. Various interim solutions are being proposed for the next few years for those involved in projects which require consideration of annuity mortality; e.g., to use the Projection Scale G mentioned in the *TSA* paper that discussed the 1983*a* Mortality Table development.

In June 1995 the CIA Committee on Expected Experience published an "Individual Annuitant Mortality Study for the Policy Year 1992-93."

A separate mortality study has been completed for structured settlements ("The 1983-89 Structured Settlements Experience," published in *TSA Reports*, 1991-92). Early indications from the structured settlement mortality study show that the mortality is much worse for these products than for other products, so the use of a projection scale with the 1983*a* table would probably be excessive. Separate tables for structured settlements, versus other types of individual annuities, seems desirable.

Examining mortality for individual annuities is of importance to actuaries performing dynamic financial condition analysis.

- Lapses: The SOA, in conjunction with LIMRA, has completed an SPDA lapse study. This study shows lapses varying by duration, amount of surrender charge, and distribution channel as well as other characteristics. It would have been helpful if analysis of the relationship between lapses and the credited versus competitor rate could have been performed; unfortunately for the usefulness of the study results with respect to interest rate changes, during the period surveyed (the late 1980s through the early 1990s), interest rates were relatively benign. It would be worthwhile to repeat this survey periodically; this is already under consideration.
- Premium cessation: For FPDAs, premium cessation is an issue. The next study of SPDA lapses, which has been extended to include FPDAs, is underway and will include analysis of FPDA premium cessation.
- Partial withdrawals: Most annuities do not have policy loans, but instead allow partial withdrawals. The SOA/LIMRA lapse study covers considerations of these as well.
- Expenses: The expense discussion above on life insurance products also applies to annuities.
- Risks from secondary guarantees: A recent cause of concern to U.S. regulators is secondary guarantees within variable annuity contracts, particularly minimum death benefit guarantees. An SOA Task Force and an American Academy of Actuaries Working Group have been working together to study this issue. A report from the Working Group addressing the immediate concerns is expected to be completed by the end of 1995.
- Investment strategies: Considerations of investment strategies for individual annuities are similar to those for individual life insurance. The SPDA product in particular has been the subject of a number of sessions at various Valuation Actuary Symposia. Certain new strategies are explored at various times by individual actuaries (e.g., use of equity products such as common stocks to back long-term liabilities, including structured settlements.) Again, this is an evolving topic, which can be covered by encouraging submissions of articles on this to the new *North American Actuarial Journal*.
- Other issues: The external issues to consider when performing dynamic financial condition analysis on individual annuities are similar to those for life insurance. These include potential changes in tax laws, SEC changes, and changes in regulations. An additional source of external concern for insurance companies here is other competitors, such as banks, entering into the annuity marketplace. The sources of information is the same as for individual life insurance, e.g., articles in *The Actuary* and other publications, and through reports at SOA meetings and seminars,

with a representative of the SOA Life Practice Advancement Committee providing input from NAIC meetings and a representative of the American Academy of Actuaries Committee on Life Insurance Financial Reporting providing input on SEC, tax, and federal regulatory developments.

3. Group Pension Products. This category includes GICs, pension close-out business, unallocated and other forms of allocated pension plans. The major risks are mortality, surrenders, early retirement cessation, expense, and interest rate risks. Besides the *DFCA Handbook*, additional sources of information, and additional potential SOA projects, are discussed below:

- **Mortality:** The SOA Board of Governors has recently (May 1995) approved the issuance of a new mortality study for group annuities (GAR-94). For other pension plans, an uninsured pension table was also completed (UP-94). These tables limit the problem of obsolescence by building in generational mortality factors. These tables should cover the needs of most actuaries performing dynamic financial condition analysis.
- **Surrenders:** Some pension products do not allow a client to surrender, or require a full market value adjustment upon surrender. In other contracts, there may be no market value adjustment upon surrender, or the market value adjustment may not relate to the underlying assets. This has been a cause of concern in several of the recent insurance company insolvencies. Because company products differ widely in the pension area, it is not likely that a SOA study could be done in this area. A source of information on this subject is the Pension Section newsletter.
- **Early retirement:** Many pension plans that are funded through insurance companies include provisions for enriched early retirement pension payouts. Pricing and valuation actuaries typically use estimates of utilization in their projections. This area has not been studied by the SOA. This may be an area where the SOA can do periodic studies. However, it is questionable whether an SOA study will provide much useful information, since utilization of enriched early retirement programs depend on a number of factors, including the economic cycle, type of industry, and employer practice.
- **Expenses:** The issues raised above regarding expense allocation within a company (particularly the allocation of overhead expenses), apply to this product as well.
- **Interest rate risks:** Several major companies took significant losses in GICs, due to the presence of "open windows" (where a client could add additional monies at guaranteed rates), and inadequate asset/liability management. One current risk is the presence of very long-term interest rate

guarantees on pension closeout business. It is necessary for the actuary performing dynamic financial condition analysis to ensure that these items are closely monitored. Again, papers in publications such as the *North American Actuarial Journal* could assist those actuaries performing the dynamic financial condition analysis.

An excellent source of information on various economic assumptions needed by pension actuaries is the *Statistics for Pension Actuaries* publication produced annually by the Pension Section of the SOA, which also publishes updates of the tables on the Web Site: www.soa.org.

- Other issues: The external issues to consider when performing dynamic financial condition analysis on group pensions are similar to those for other types of insurance. These include potential changes in tax laws, SEC changes, and changes in regulations. An additional source of external concern for companies writing pension plans are Employee Retirement Income Security Act (ERISA) regulations. One of the SOA's Spring meetings is devoted to pension and health topics, and typically includes speakers from government organizations. Other sources of information include articles in *The Actuary* and other publications, and reports at SOA meetings, seminars, and teleconferences. The Pension Section newsletter is also an excellent source of current information.

Another issue for insurance companies in the pension business is competition from other providers such as banks and investment firms. Knowledge of new products for pension plans (such as synthetic GICs) are also necessary for those actuaries performing dynamic financial condition analysis, since they may impact projections of new business, and what products will be offered by a company. Besides the sources of information mentioned above, the *Pension World* newsletter could be of value.

4. *Group Life Insurance Products.* Group life insurance is typically issued as one-year term insurance (with expectations that many groups will renew the business in the following year.) As such the major risks are mortality, nonrenewing, and expenses. The interest rate risks, unless the insurance company has particularly unsuitable investments, is typically minimal in this product. Besides the *DFCA Handbook*, additional sources of information, and additional potential SOA projects, are discussed below:

- Mortality: Group insurance is not typically underwritten, and the mortality experience is similar to general population mortality. Various tables are available from the Web Site: www.soa.org.
- Nonrenewal: This issue is important in group insurance, as assumptions regarding the percentage of business which will renew in the second and

later years are typically made in order to spread the cost of acquisition of the business over more than one year. Since the groups insured by insurance companies differ widely, it is doubtful that a study performed by the SOA on the percentage of business that does not renew would produce useful results. Periodic articles in various actuarial publications on this issue may be helpful.

- **Expenses:** The issues raised above regarding expense allocation within a company (particularly the allocation of overhead expenses), apply to this product as well.
- **Investments:** The actuary performing dynamic financial condition analysis should ensure that the investments made for this product line will provide the needed liquidity.
- **Other issues:** The external issues to consider when performing dynamic financial condition analysis on group life are similar to those for other types of insurance. These include potential changes in tax laws, and changes in regulations. Sources of information include articles in *The Actuary* and other publications, and reports at SOA meetings.

5. Health Insurance. There are many health insurance products, e.g., medical, hospital indemnity, disability, long-term care, catastrophe, and major medical. Due to the number of different products, it is difficult to develop standardized tables for assumptions. In this area, there are sources of information in addition to the *DFCA Handbook*. Some additional sources of information are discussed below:

- **Health Practice Notes:** There are a number of Health Practice Notes, each written on a specific type of health insurance (e.g., disability, small group health insurance.) These Health Insurance Practice Notes were originally aimed at the actuary performing asset adequacy analysis of health products, and were released by the American Academy of Actuaries in 1993 and 1994. In 1995, responsibility for the Health Practice Notes has been moved to the joint SOA/Academy Health Practice Committee. These will prove a valuable addition to the actuary performing dynamic financial condition analysis on health products.
- **Long-term-care valuation paper:** The SOA Board of Governors recently (May 1995) approved the release of a white paper on valuation issues regarding long-term-care insurance. What was covered in this paper can also be applied to those performing dynamic financial condition analysis. An Academy group is continuing to work in this area, to provide further guidance to the NAIC on reserving issues. Work done by this group will be of interest to actuaries in this field.

- Academy monographs on health issues: In 1994, the U.S. Congress was exploring the issue of health care reform. Because of this, the American Academy of Actuaries Health Practice Council produced a series of monographs on health insurance and the effect of this reform. Although generated to specifically address various health care reform issues, several of the monographs such as "Actuarial Solvency Issues of Health Plans in the United States" may be useful for an actuary performing dynamic financial condition analysis.
- Benefits: The type of benefits provided varies widely by product and company in health insurance. A major consideration in many health insurance products is the effect of medical inflation, which has been higher than the rate of inflation for a number of years. The level of medical inflation is published in various sources, including the SOA's Health Section newsletter.
- Expenses: The issues raised above regarding expense allocation within a company (particularly the allocation of overhead expenses), apply to this product as well.
- Investments: As with other lines of business, the actuary performing dynamic financial condition analysis should ensure that the investments made for this product line will provide the needed liquidity.
- Other issues: In the health insurance field, state and federal regulation can significantly impact the products that can be sold and the coverages offered. Alternative provider systems must also be considered. The American Academy of Actuaries have people who are actively following these developments, and have representatives at all the relevant NAIC meetings. Periodic updates are given in the *Actuarial Update*, the newsletter of the Academy of Actuaries.

Other external issues to consider when performing dynamic financial condition analysis on health insurance are similar to those for other types of insurance. These include potential changes in tax laws, and changes in regulations. Sources of information include articles in *The Actuary*, the Health Section newsletter and other publications, and reports at SOA meetings, particularly the Spring meeting devoted to Pension and Health topics.

III. ANALYSIS TECHNIQUES

The *DFCA Handbook* details various methods of performing dynamic financial condition analysis for various product lines. Other sources of information include Guidance Notes, published by the Canadian Institute of Actuaries, and Actuarial Standards of Practice, published by the Actuarial Standards Board.

Some additional comments follow.

A. Cash-Flow Testing

The methodology suggested for use for testing products that are interest sensitive is cash-flow testing. This involves projection of cash inflows and outflows under a number of scenarios. Certain issues with regard to this include the selection of interest rate scenarios and the relationship between interest rates and cash flows from products and assets.

- Scenario generation: The SOA “Research Report on Selected Dynamic Solvency Testing Topics,” by Dr. Allen Brender and Donna Claire, published in *TSA 1993–94 Reports*, discusses interest rate scenario generation. Much work is being done on this subject by researchers throughout the world. The research paper mentions the state of the current testing. It also suggests that the SOA can be involved in supporting the worldwide research.

Cash-flow testing can be generalized to test vulnerability to risks other than interest rate risk. It is likely that actuarial practice will evolve in this direction, including testing a combination of factors. The SOA should take a proactive stance by running research projects, symposia, and so on, on such topics as what risks to model, how to model, and sources of data.

- Relationship between interest and other assumptions: The SOA has already acknowledged the importance of developing reasonable relationships between interest rates and other assumptions. The SOA is negotiating with a potential researcher for Actuarial Modeling I, a research project that is intended to explore some of these relationships. A project titled Actuarial Modeling II (with Dr. Allan Brender as chairperson of the Project Oversight Group) which would explore these relationships further, particularly as they relate to actuarial modeling, is being developed. Both of these projects will provide valuable insight to actuaries performing dynamic financial condition analysis.

B. Gross Premium Valuation

Gross premium valuation concentrates on the cash flows generated on the liability side. This is currently the preferred method of asset adequacy analysis for products with little asset risks, such as health insurance. Sensitivity testing is done by varying the expected cash flows (e.g., by increasing the expected rate of incidence of disability by $x\%$) and determining the result of these variances on expected surplus. The Health Insurance Practice Notes

gives details on what sensitivity would be useful to explore. Given the changing nature and variety of these products, a static study would not provide much useful information. Keeping the Health Practice Notes and/or the *DFCA Handbook* up to date appears to be the preferred method for updating this evaluation methodology.

C. Probability Based Methods

There are actuaries who believe that certain probability based methods can be used in dynamic financial condition analysis. These methods include, for example, the use of Monte Carlo simulations and other methodologies in an attempt to obtain a "probability of ruin." Discussion of some of the potential problems with these methods is given in the "Research Report on Selected Dynamic Solvency Testing Topics."

Stochastic models have been in use in the United Kingdom and elsewhere for a number of years. One of the more popular models is the Wilkie Model. An update of this, entitled "More on a Stochastic Asset Model for Actuarial Use" was presented by A. D. Wilkie at the Institute of Actuaries conference in April 1995.

There are a number of instances where probability based models perform reasonably. They will give a feel for the relative likelihood of various adverse outcomes. Probability based models are also used within other types of models. For example, interest rate scenario generators are, in many cases, probability models.

One problem with probability based models for the full model is that they may lose the trees in the forest: i.e., one may get the overall picture of whether a company is viable, but these methods may not show what the items are that can cause a major problem to a company (e.g., that a spike in interest rates of 200 basis points may cause major problems). Another caveat is that the use of probability models at this time may lead to a false sense of comfort: the answers depend on the numerous assumptions that must be made for the model; an answer that the company has a 95% chance of surviving the next 20 years is meaningless if the actuary is only 90% sure of each of the many assumptions that went into the model.

D. Other Methods

There are other evaluation methods in use for various products. This includes projection of historical trends, and development methods, which are used to project certain types of health products. These methods may be viewed as simplifying methodologies (rather than conducting a comprehensive

cash-flow analysis). However, there are times when simplicity may be preferred. The actuary performing dynamic financial condition analysis must keep in mind the reliability of the information provided, and be aware of the cost/information trade-off. Periodic updates to the *DFCA Handbook* should cover new developments in this field.

Periodically, new methodologies are developed. These cannot be predicted. The best the SOA can do to follow new developments is to keep abreast of worldwide research, and actively encourage submissions to the *North American Actuarial Journal*.

IV. AREAS OF POTENTIAL FUTURE RESEARCH BY THE SOA

This section summarizes the areas mentioned above where further examination by one or more of the SOA's Research Area Committees may be useful (Note: continuation of existing studies, e.g., the credit risk study on private placements and commercial mortgages, is not included in this list):

1. Liquidity: The issue of liquidity is important for insurance companies, since illiquid assets have contributed to the downfall of several insurance companies. A research paper on liquidity, a discussion of its importance in relation to various types of insurance products, the "liquidity" of various asset types, and how the consideration of liquidity should be reflected in dynamic financial condition analysis would be quite useful. Depending on the level of research, this project may cost \$5,000 to \$15,000.
2. Prepayment study on MBSs: This would summarize existing research and give guidance to actuaries as to a range of reasonable prepayment assumptions. This may cost \$5,000.
3. Real estate—summary of risks: There is very little published on real estate risks by the SOA. This is not a suggested research project per se, rather a suggestion that a request be made that the *DFCA Handbook* expand its coverage on real estate issues and sources of information.
4. Expenses: The treatment of expenses by insurance companies is becoming a hot topic in the regulatory arena in the U.S. A call for papers on the topic of expense allocation methodologies, and how expenses may be projected in the future, may be helpful.
5. Policy loans: A research project to survey the importance of policy loans on companies may be useful. (Note: This may best be handled by making it part of a general survey of valuation actuaries in connection to a project to update practice notes).
6. Effects of policyholder behavior: It is expected that the Actuarial Modeling I project would discuss the effect of interest rates changes on

insurance companies, and Actuarial Modeling II would discuss the interactions of policyholder behavior and economic assumptions. These projects will advance the knowledge of actuaries who need to perform dynamic financial condition analysis, so it is recommended that these projects be given high priority.

7. Use of other methodologies: It may be helpful to fund a research project on the use of probability models in dynamic financial condition analysis.

V. LIMITATIONS OF THE ANALYSIS

It is important that the actuary doing dynamic financial condition analysis be aware of the limitations of the analysis done, and disclose these limitations to management. As stated in the "Research Report on Selected Dynamic Solvency Testing Topics" paper, there are not only things that are currently unknown in actuarial science, but also they may be unknowable.

In performing dynamic financial condition analysis, the actuary must consider the costs involved in relation to the information obtained.

It is also important for the actuary to remember the audience of the work, which is expected to be company management. The items of most import to the company and the information they are most interested in must be a priority. Refining the answers to the nearest dollar is probably an unproductive exercise.

Each company has a unique set of risks. No matter how much research is done, there will always be at least one (potentially fatal) piece of information that could not be quantified. No matter how much research is done, it is doubtful that an actuary will ever be able to state that insurer X has only a 5% chance of ruin if they continue business as is. It is important, however, for the actuary to begin to quantify the known risks, in order to provide guidance to management of insurance companies. It is also important for the actuary to point out material risks to management, even if they cannot be specifically quantified (e.g., if there is strong consideration of changes in the tax law, but the details are still sketchy, this may qualify as an unquantifiable material risk that should be disclosed.)

The pursuit of knowledge is a worthy goal, and it is recommended that the SOA consider more research into the areas mentioned above.

VI. SIGNATURE SECTION

I will be available to explain or amplify anything in this paper. Please contact me at the address listed below:

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