

**1998 VALUATION ACTUARY
SYMPOSIUM PROCEEDINGS**

SESSION 28PD

MANAGEMENT USES OF CASH-FLOW TESTING

Craig W. Reynolds, Moderator

Nancy E. Bennett

Glen D. Keller

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MR. CRAIG W. REYNOLDS: Our first speaker will be Glen Keller, a senior vice president with Conning Asset Management. Glen is a graduate of the University of Manitoba with a bachelor's degree in commerce, a Fellow of the Society of Actuaries, a Fellow of the Canadian Institute of Actuaries, and a Member of the American Academy of Actuaries.

He's responsible for asset/liability management and insurance advisory services. He spent 15 years with Metropolitan Life, five years with National Life of Vermont, and has been with Conning since 1996. Conning specializes in insurance asset management. They manage \$28 billion of assets, provide advisory services on an additional \$27 billion, and provide investment accounting services on an additional \$30 billion. He should be well suited to this topic.

Our second speaker will be Nancy Bennett. Ms. Bennett has been employed with Minnesota Mutual for 17 years. Following eight years in individual life product development and division management, she assumed responsibilities for the corporate actuarial department and is the company's appointed actuary. Her responsibilities include cash-flow testing, reserve adequacy analysis, strategic planning, capital budgeting financial forecasting, the coordination of investment policy and product design, and the analysis of portfolio management and interest-rate risk. She has been overseeing the integration of financial management functions among all the company's divisions and is responsible for maintaining the integrity of the company's modeling system. She presents to various groups, including the company's board of trustees, rating agencies, and now the Society of Actuaries.

Ms. Bennett received a BA in mathematics and economics from the University of Northern Iowa. She has been a Fellow in the Society of Actuaries since 1988 and a Member of the American Academy of Actuaries since 1989.

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I'm with Milliman & Robertson in Seattle. I'm a consulting actuary and have been at Milliman & Robertson since 1989. I work in the areas of projections, cash-flow testing, and financial forecasting, and, in recent years, I have worked on dynamic financial condition analysis.

The session program says that our goals are to have a better sense of the degree to which the discipline of cash-flow testing is used to support decision making and to have a greater sense of where our companies fit within the universe of companies making greater use of the cash-flow testing financial discipline.

The bad news on that is that our two panelists are pretty far along the curve in terms of the types of work they're doing with this sort of tool. If your goal is to find out where you are in the universe of companies, I can tell you that most of you are behind these two companies.

Glen is going to talk a little bit about his experience at Conning Asset Management where he helped clients and moved beyond cash-flow testing. He'll be working through a fairly detailed example, where the numbers have been changed to protect the innocent. He will be describing some of the real work they have done in helping companies use their cash-flow testing models for further company analysis, and show how some of these tools that we use for cash-flow testing can be used to increase, gain, or decrease risk.

Nancy has a fairly similar presentation, but will focus on some of the work at her own company, Minnesota Mutual, where she has used these tools to develop transfer-pricing techniques, which is an area I'm interested in learning a little bit more about myself.

There is one thing I'd want to have you all keep in mind as you focus on these discussions. As you think about your own career development and where you want to be in life, job security, and related issues, one of the last sort of jobs you want to have is a job where your only responsibility is to follow through with a regulatory exercise, where no news is good news, meaning the company expects you to pass cash-flow testing. Thus, the only time you're going to have news that anybody cares about is when the news is bad, and where your work is viewed purely as a regulatory exercise

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with no value added to the company management. These speakers are going to talk about how to turn these regulatory exercises into something valuable to the company management and make you more valuable at the same time.

With that, I will pass the presentation over to Glen, who will provide you with some very important insights.

MR. GLEN D. KELLER: We have hurricane Georges bearing down on us and I thought I would just mention that I see another hurricane bearing down on the life insurance industry, and that is the hurricane of low interest rates. I think the industry is experiencing a lot of difficulties because of the current low level of interest rates. I want to warn you to be prepared for a long period of low interest rates. I hope that what I'm going to tell you will help you gain some insight for your management as to how to deal with both the risk of low interest rates, and perhaps how to offset some of the yield reductions in those low interest rates.

I warn you that what I'm going to tell you is probably pretty simple, but what I'm hoping is that I'll give you a couple of ideas that you can go back and discuss with your management so as to give them a little bit more insight on how to control risk, improve investment performance, and improve your company's operating results.

I want to add one other thing about my little blurb on low interest rates. The Goldman Sachs Chief Investment Officer (CIO) survey has just been released, and the number-one topic on CIOs' minds is yield enhancement. The reason is because of the low level of interest rates. Everybody is stretching for yield, which is not necessarily a bad thing; however, when you stretch for yield, you increase the level of risk. Actuaries are in a unique position to control, or at least monitor, that risk. I think what we're going to talk about—cash-flow testing—is a great tool for showing management the risk posture of the company. I think going forward it's going to be a very important element of what you do every day.

Who are the main users of cash-flow testing? It is clearly the Chief Executive Officer (CEO), the

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Chief Financial Officer (CFO), and the investment department. The actuarial department goes without saying; we all use that information. What are the uses of the information? Quite simply, it's to control risk and increase return. The investment strategy helps you to do that. I'm going to focus a lot on investment strategy because that's what my company does. However, there are many other ways the information can be used to change underwriting strategies, new business strategies, and acquisition plans, but I'm not going to focus on them. I'm just going to focus more on investment strategies.

Let's look at what happens at a typical company during cash-flow testing time. I'm not sure how many companies would be considered typical. We build elaborate liability models, something actuaries are very good at. We incorporate our asset cash-flows, and surprisingly, actuaries are very good at understanding asset cash-flows. I don't think we should take any grief from our investment brethren, although if there is one thing that I would say, we tend to be a little bit too technical and too theoretical about projecting asset cash-flows.

Next we test our New York seven or eight scenarios, we sign our opinion, and we file our memorandum. Then what do we do? Many of us just stop there. We have a million other things to do; the end of the year has been a very deadline-filled, stressful time of the year. We have all sorts of other annual statement things to do. We say we'll get to some of this information later on next year, and it never happens. I guess I'm just telling you that 85% of the work has been done. There is some valuable information that is embedded in all of that work that you have already done. If you just take the additional time to analyze it, you will provide your company with a great service. In addition, you will elevate the actuarial involvement in the entire risk-control process within your company. I think that's a good thing.

The one thing that I really want to focus on is making decisions or getting information so you can drive decisions that have real financial impact. It's great to have a nice theoretical exercise, but we're all in business to make money, and we want to make sure that what we do and what we say has some good, financial, positive results.

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What should we do? The first thing you have to do is turn on the stochastic interest rate scenario generator. I'm most familiar with TAS and somewhat familiar with PTS. All of the models have excellent interest rate scenario generators. It doesn't take a lot of work and research to be able to determine what parameters you should put into those software packages so that you can generate very good representative interest rate scenarios. The software developers have done an excellent job of making it easy for actuaries.

Now, run 50, 100 or, 200 scenarios. I think some theoretical pundits would say you have to run 1,000 scenarios to get statistically significant results, but, for all practical purposes, running 50 will give you a great deal of insight into what is going on in your company. I think a lot of other people have talked about modeling error at this conference. There is a great deal of modeling error. I have this favorite saying that says the accuracy is more apparent than real. Sometimes when you run those 1,000 scenarios, you get a level of accuracy in the model that is mathematically correct, but there are all sorts of unknowns in the assumptions, and other things that are going on that you can't predict accurately. Those things overwhelm the mathematical elegance of some of the modeling or some of the number of scenarios. In an effort to keep it simple, and to get some information that can actually drive management decisions, I suggest that you do 50. Also, run time on your computer will be reduced if you're doing 50.

You should also do some deterministic scenarios. I think we all mathematically understand that there is not a great deal of use for some of these deterministic scenarios; however, CEOs love deterministic scenarios. They will ask you, "What's going to happen if interest rates go up 200 or 100 or down 100?" It's good to have that information on hand; it will provide a great deal of insight.

Testing crediting strategies is another thing that can help with your pricing people. I'm sure your pricing people are already doing a lot of that work.

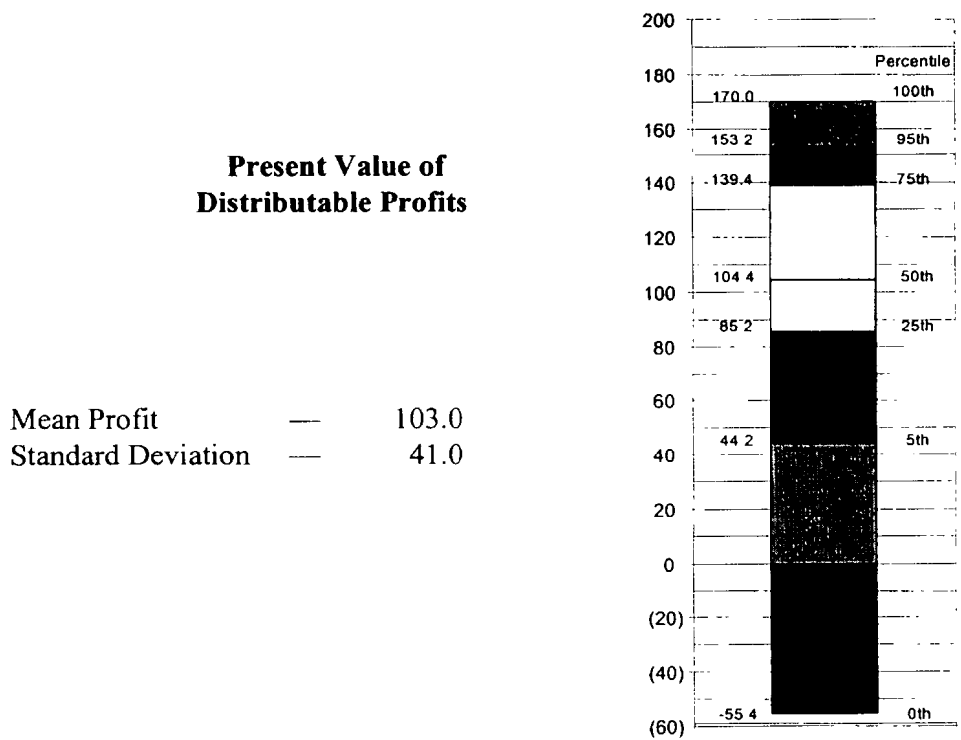
What kind of risk control information do we get after we turn on the stochastic interest rate generator? There is a myriad of information that is available. There are many ways to show information that relates to risk control. Some of the best information shows the dispersion of results,

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and dispersion of results is really what risk is all about. I happen to like the statistic present value of distributable earnings. That is only one of many ways that you can show dispersion of results.

I'm sure all of you have seen a graph like the one in Chart 1. This is from a company we have analyzed that had a block of universal life business and annuity business, as well as some other supplementary business. It had a slight duration mismatch, and its mean profit was \$103 million, but the range of results varied from positive \$170 million to negative \$55 million.

**CHART 1
Profit Distribution (\$Millions)**



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Now how is this useful? One of the key things you should do is investigate, especially, the negative outliers. You'll notice that this is not normally distributed; the skew on the negative end is wider than it is on the positive end, and I think this is very typical of what happens with insurance companies. What you should do is investigate those negative outliers, determine what the characteristics are, and then determine what type of action you can take to compress those results. Usually it's a crediting strategy change, or the addition of some type of interest rate floor or cap. By working with your investment department and showing this to management, I think you can really make great strides in controlling the risk posture of your company with a relatively simple exercise.

You can base your dispersion criteria on lots of different results—statutory results, ending surplus, present value of ending surplus, and GAAP results. There is no right or wrong answer. The key is to find one that is appropriate for your particular company and a statistic that you can track on an ongoing basis that your management recognizes as an important statistic.

Value-at-risk is essentially a risk control concept that incorporates all of the possible risks. I'm going to focus more on investment risks, and in particular interest-rate risk. I'm not going to elaborate anymore. There have been many other sessions on value-at-risk.

Duration of capital is the statistic that we use. It attempts to show how much interest-rate risk a particular company uses or is accepting, I'm going to cover that a little bit more in an example later on.

Now I want to move to investment strategy information. How can cash-flow testing provide information that can change the investment strategy. I'm going to start with a basic premise, which is that you have to take a risk to get a return—there are no free lunches out there. What are the risks that a company can take on the investment side?

One is duration—how long do you want your assets to be? You can also take credit risks—how risky do you want the chances of the company repaying your debt? You can take liquidity risks, which pertains to how you can't sell the asset until it matures. You take prepayment risk; this is

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really just a second order of duration. I mention it separately, though, because there is such a large body of assets that take prepayment risks; all mortgaged-backed securities, home equity loans, and a lot of asset-backed securities have prepayment risk. Prepayment risk also includes extension, but, generally, the major risk is that you'll get your money back early. Lower interest-rate environments tend to be more skewed that way than does the extension risk. The last risk is structure risk. You see a lot of unique structures in some of the exotic asset-backed securities or new types of securities. I only put it up there because you do tend to get paid for taking some structure risk. It really does fall into one of the other four categories.

How can cash-flow testing provide information? It can help you provide information on duration risk, liquidity risk, and prepayment risk. It really can't help too much with credit structure, so I'm going to focus only on duration and liquidity.

The first thing you should do is calculate your option-adjusted duration of liabilities, and I hope everyone knows what the option-adjusted duration is. It is not the modified duration. On the liability side, in universal life, and in annuities especially, or anywhere where there is some optionality in the liability cash-flows, the option-adjusted duration is significantly different than the modified duration. Recently I calculated what the modified duration would be for a universal life block based on expected cash-flows, and I came up with a number that was a little bit more than eight years. Then I turned on the interest rate scenario generator and the arbitrage-free rates. It had a portfolio crediting strategy. The asset portfolio that it was starting with had a duration of about five, and I calculated the option-adjusted duration of that liability portfolio and I came up with about four.

Four and eight are dramatically different. My experience has shown that the option-adjusted duration of liabilities is a function of the crediting strategy employed and the underlying lapse rates. Depending on the dynamics of either of those two, one can dominate as compared to the other. However, it's not intuitive to look at the policy without doing a relatively elaborate option-adjusted duration calculation. So make sure that you do calculate those. The software packages that are readily available generally calculate those things for you.

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The other thing you need to do is make sure that you have effective duration on assets. Again, that is significantly different than modified duration. All asset packages have both of those numbers. Just make sure that you're using effective duration, because it is a much better predictor of how the value of the asset changes.

I'm going to give you an example of duration of capital. I'm going to define it here. Basically, a company has assets, liabilities, and capital. The duration of capital is equal to the duration of the assets supporting capital, plus the leveraged mismatch of the assets supporting the liabilities.

Table 1 shows a company that has mostly universal life and annuity business. I calculated the effective duration of the liabilities to be about four years. The effective duration of the assets, when you work in all of the various types of assets, is about 5.1 years. As you can tell, that's longer than the liabilities. But how do you quantify that it is longer, and determine whether or not that is too much risk? One statistic that we do use is duration of capital. The capital duration is 14.3. There's a greater leveraged effect because the assets are longer than the liabilities. This is a relatively simple calculation. I urge you to do this and communicate it to management.

The diamond line in Chart 2 shows what the price sensitivity looks like when you have a duration of 14.3. The other line has a price sensitivity of 7.5. We at Conning generally recommend, depending on company circumstances, that the duration of capital be in the range of 5–10. There are a couple of reasons for that. Many people recommend a duration of zero because that neutralizes capital. However, if you theoretically look at it, and you do your investment income allocation correctly, that implies that you have your capital invested in short-term securities. Generally, when the yield curve is positive, people will take the risk and get the longer-term investment returns.

Now I want to caution people on using duration of capital. Every good actuary has to have some caveats, and duration of capital is just one summary statistic. It is a good summary statistic, but it doesn't tell the entire story. It doesn't talk about convexity, and I'm not going to talk a lot about convexity because I wanted to keep the presentation relatively simple. I tend to support the 20/80

TABLE 1
Balance Sheet Summary (\$000)

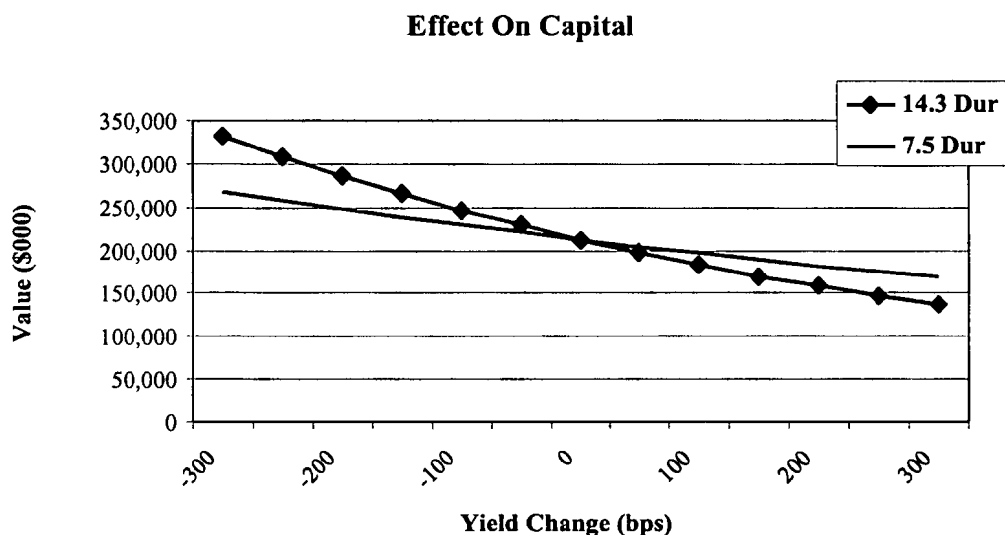
	Statistical Value	“Value”	Effective Duration
Assets			
Bonds	\$1,740.9	\$1,826.0	5.3
Policy Loans	19.6	19.1	4.1
Cash	17.7	17.7	0.1
Accrued Investment Income	30.2	30.2	0.3
Other	2.7	2.7	0.1
Total Assets	\$1,811.1	\$1,895.6	5.1
Liabilities and Capital			
Reserves	\$1,666.1	\$1,668.8	4.0
Other Liabilities	14.7	14.7	0.1
Capital/AVR	130.2	212.1	14.3
Total Liabilities and Capital	\$1,811.1	\$1,895.6	5.1

rule that you can, with 20% of the effort, get 80% of the results. With regard to asset/liability management, for most companies, 20% of the effort does yield 80% of the results. It is only in about 20% of the other companies and certain lines of business where you really need to do the other more detailed work. I'm not talking about key rate duration, but, again, these are some of the more sophisticated elements for determining the company's risk posture.

I want to talk about liquidity a little bit, because it's one of those risks that is out there. Companies can take it, but many companies don't take it; and given that we are in a period of time where every couple of basis points of yield is going to be dramatic, the average premium you get paid for taking

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CHART 2
Balance Sheet Summary



liquidity risk runs between 25 and 50 basis points. I want to put that in perspective. Though it doesn't sound like very much, on actively managed bond funds, the difference between median performance and first-quartile performance is generally about 25 basis points. So what we have is an asset class that, assuming everything else is done properly with regard to your credit work, you can get first-quartile performance just by taking liquidity risk.

One other good thing is that there's no risk-based capital (RBC) charge for taking liquidity risk, so you can take more liquidity risk on your balance sheet and your RBC ratio doesn't deteriorate. So what we want to do is determine the maximum amount of liquidity risk the company can take, because it is generally a very good thing.

I do caution you that even though the RBC doesn't have a charge for it, there is real risk here. If you ever get into a situation where you have the forced sale of one of these illiquid assets, this is a bad thing. There is real business risk associated with taking liquidity risk, so you don't want to get your

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company into a situation where you have to sell those assets. The stochastic interest rate generator, coupled with dynamic lapse assumptions, is a great tool for determining how much liquidity risk you can take.

Basically what you do is look at your asset portfolio, determine what assets are marketable when they mature, and project those out into the future. Then, on the liability side, with the help of the stochastic interest rate generator, you look at the worst-case scenarios to determine when the people have lapsed or stopped paying the premium. Basically you determine when you need the cash to mature those liabilities.

Chart 3 is a summary graph. The top diamond line shows that the current level of liabilities is about \$1.6 billion in this example. The square line shows the amount of illiquid assets you can take at the 95th percentile. The 95th percentile is dealing with the probability that you will have some negative event happen in the future that causes those policyholders to lapse, thus causing you to have to raise cash to pay them off. The triangle line is at the 98th percentile. In year two, both numbers are almost identical. That tells me that if I buy two-year illiquid assets, I can buy \$1.4 billion worth of them, and that I have only a 2% chance that I'm going to have to sell those before they mature. Clearly, illiquid assets become liquid at their maturity date, and so it depends on the maturity date of the illiquid assets that you're going to buy.

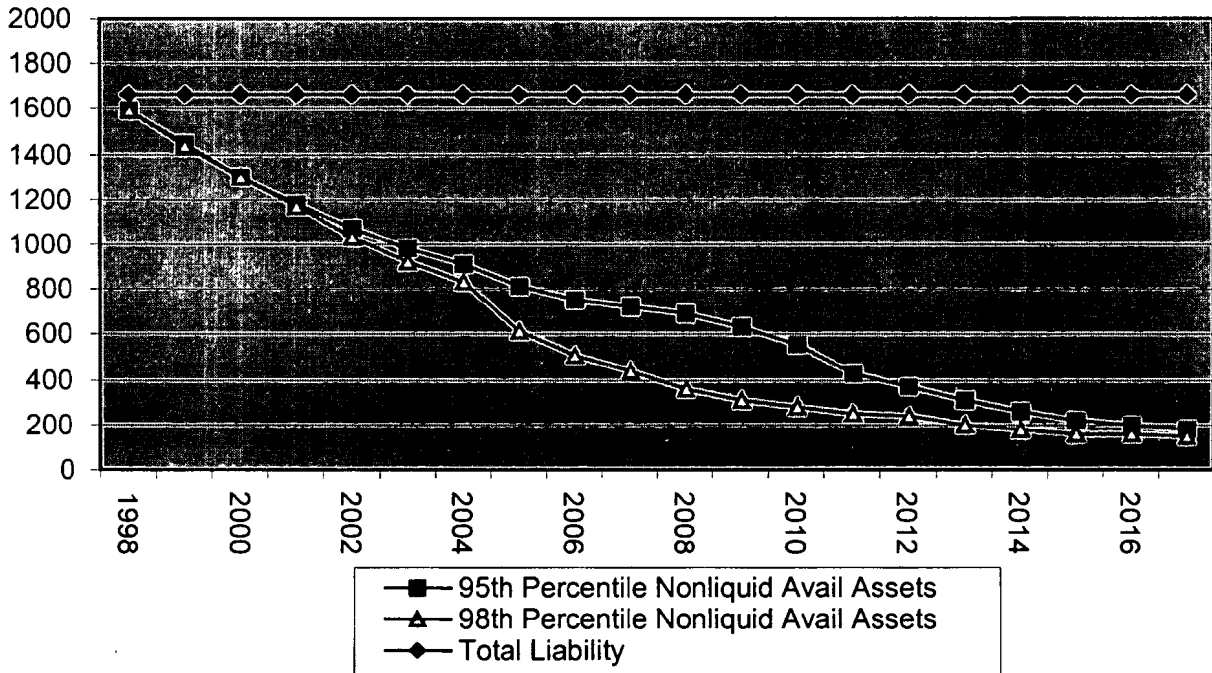
Most illiquid assets are ten years. The two most common examples are private placements and commercial mortgages. Almost every private placement and commercial mortgage written today has a ten-year maturity. In this particular example that goes ten years out, if the company is comfortable at the 95th percentile, they can invest \$720 million or 45% of their assets in illiquid assets. If they want to go to the 98th percentile, it's approximately \$400 million, or 25% of their assets.

I think all of you understand there is a scenario up there, perhaps one with 100% lapse rates, where these assets could run into trouble. By doing this analysis, you put a framework around the liquidity

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CHART 3 Liquidity Chart

ABC LIFE INSURANCE COMPANY Nonliquid Asset Report



risk, so that you can make management decisions. It's similar to the way people may take the framework and put it around credit risk or duration risk. I think this is very helpful. The rating agencies may have something to say with regard to the amount of liquidity risk you're taking. They may have a different estimate of what you should take. However, my experience in dealing with the rating agencies has been that if you have a sound, well-thought-out position, they do listen and will accept your work.

I'm going to talk very briefly about a couple of the other analyses that we go through in determining an optimal investment strategy. I'm not going to go through each and every one of them, but I could

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summarize them by saying that the optimal investment strategy is a function of how much capital you have, because you need capital to be able to take risk. Every one of our analyses is geared to determine how much risk you can take, so that you can get the commensurate return.

The actuaries can do a lot of work to help the investment people quantify that. Then it's up to your investment professionals to actually tactically implement and take advantage of short-term swings in the investment markets, and thereby add even more value.

I'm going to give you one example of another analysis that we do. It's called the RBC Investment Efficiency Analysis (see Table 2). That third line, called breakeven spread, is the spread required from an alternative asset so that the additional income from that asset provides the same ROE on the additional capital that you have to allocate to support the additional risk caused by that asset. Basically, for an asset, if you take more risk, you need to allocate more capital in support of that risk, and this is the amount of additional return you need. This is based on the RBC factors, the RBC determination of risk, and it is very company-specific. I'm sure all of you understand that the RBC formula of your assets is very much a function of the individual company statistics because of the co-variance formula.

TABLE 2
RBC/Investment Efficiency Analysis by Asset Type

	A Bond	BBB Bond	Common Mortgage	BB Bond	B Bond	Common Stock
Base RBC Factor	0.30%	1.00%	2.25%	4.00%	9.00%	30.00%
Net RBC Factor	0.37	1.22	2.20	4.89	11.00	29.27
Breakeven Spread (11% ROE)	0.16	0.49	0.82	2.19	4.63	6.16
Actual Spread Availability	0.76	0.98	1.60	2.15	3.36	5.00
Gain or Loss	0.60	0.49	0.78	-0.04	-1.27	-1.16

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Then, after we calculate the breakeven spread, we determine what spreads are available in the marketplace. This was taken about three months ago. Spreads have dramatically widened because of all the trouble in Asia, and we get a different result. Then what we do is we compare what the breakeven spread is to the actual spread, and determine which one is most RBC efficient. As you can see in this example, A bonds are more efficient than BBB. I won't even mention mortgage-backed securities because they have no RBC requirement. That could be a temporary thing because the C-3 task force is working on that. This is just another type of analysis that communicates to the investment department some indications about where they should be putting their money. This is clearly not the be-all, end-all, and you shouldn't base your investment strategy on this type of analysis, because it would lead you to inappropriate results. You can do this for other capital, the Standard & Poor's (S&P) capital formula. You can do a similar calculation, and I think your investment department will find it very interesting.

I'm going to briefly lead you through an example of one of these analyses that we did with a company. We came to a company that had a very conservative investment strategy. It was slightly long on its duration and it had no illiquid assets. After we did this analysis, (a lot of it had to do with the use of the cash-flow testing work), we determined that the company could take more illiquid asset risk and more credit risk. Even after taking more credit risk, it could still maintain an above-average RBC ratio that would be above the industry average and above the peer company competitor group. The company had a long duration, but it decided that because of its strong capital position, it would maintain its duration mismatch because it didn't want to give up the 10 basis points of annual yield that it would have to take if it collapsed its duration mismatch. That company had a risk, and determined the return compared to that risk. Did the company like that risk/return trade-off? It decided it liked that risk/return trade-off, so it didn't collapse its duration mismatch, which was a relatively small one, I might add. After we did all of these things, we increased investment income by 6% on an annual basis, which is a fairly dramatic increase. Because of the leverage effect, that increase added 33% to the pretax gain. You may not be able to get numbers that are quite as dramatic as this, but I think there is a lot of potential to drive financial results based on this analysis.

My conclusion is, use cash-flow testing. Get more involved with your investment department if

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you're not already involved. It will be interesting and very rewarding work, and I think the end result will be that you'll have stronger companies.

MS. NANCY E. BENNETT: The Valuation Actuary Symposium is probably my favorite Society of Actuaries meeting, but I do have to admit to having mixed emotions every time I attend this conference because the Valuation Actuary Symposium always is a signal that cash-flow testing season is going to start. Given that this will be the ninth actuarial opinion that I'm signing for Minnesota Mutual, I have to admit that cash-flow testing just doesn't hold my interest the way it used to.

I always look at these meetings as an opportunity to hear about all the new ideas that people are looking at to enhance cash-flow testing.

I think most of the practitioners here recognize the limitations of regulatory cash-flow testing, and are trying to come up with ways to utilize the cash-flow testing systems for more sophisticated financial management. We're hearing actuaries talk more and more about risk management, and how we should focus on the underlying economics of our business. We've seen a proliferation of a lot of ideas over the last several years. We've had sessions at this conference on value-at-risk; actuaries routinely talk about the efficient frontier and what that might mean in the management of an insurance organization. The thrill for me of hearing all those ideas lasts about a week, until the time I get back and move into the cash-flow testing season. I find myself wondering if there's really any way to take some of these ideas and make them useful and practical in the management of an insurance company.

I must find a way to push past those concepts that largely serve to indulge my own intellectual curiosity and perhaps stave off some boredom with cash-flow testing.

I'm sure many of you are in a staffing situation where you have too few resources for the projects. We often just have to focus on getting the work done, which means we just focus on the regulatory work and the reporting and earnings work.

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If we're going to make some of this information useful, we have to have a financial management process that builds on our cash-flow testing systems. The process has to be visionary enough to move us beyond the regulatory requirements; however, it can't be so far ahead that it doesn't have any application to the day-to-day realities of reporting on a statutory and a GAAP basis.

I find myself in the same situation as many company actuaries; I want to capitalize on the company's investment in a cash-flow testing system, and make cash-flow testing a by-product, rather than the focal point of all of our financial management efforts.

As I look to do this, I ask myself what type of financial management solution is needed so that we really can build on our cash-flow testing efforts. One of the most important things I'm trying to do is to be able to evaluate the interest-rate risk. In order to evaluate the risk, I first have to be able to measure the risk. I have to quantify the risk so that I can understand what's going to happen as I change different strategies. I need to be able to use the financial management system to evaluate alternative investment and capital strategies. Along that line, I have to be able to establish complementary product and company-wide profit expectations. The bottom line is that I'm looking to strengthen the financial management infrastructure of the organization.

As I said, I spend a lot of time with the cash-flow testing, and it always ends up taking more time than I'd like. As I try to apply risk management principles to the management of our company, I end up running into a problem with the way financial reporting is set up and how investment results are allocated to the major lines of business. The way that Minnesota Mutual allocates investment results, and I suspect the way many companies allocate investment results, tends to commingle the contributions of the asset product and corporate managers. When you're trying to evaluate the results, it's hard to know who has done what and whose actions have actually contributed favorably to the bottom line.

As I have tried to come up with more and more practical solutions, I've come to the conclusion, and this conclusion of mine has really become a fairly strong conviction over the years, that the way companies allocate investment results to the product lines needs to be reconfigured. We have to

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reconfigure the way we set up our financial statements so that we can facilitate the management of the interest-rate risk, and, ultimately, facilitate the analysis of our capital, or our asset/liability management position (however you choose to describe it).

I go back to all of these interesting ideas I've heard before, and I say, "Given all the things I'm trying to do, recognizing the realities of resources and the fact that as much as I'd like to forget about statutory and GAAP accounting, I can't, is there something that can work?" There's no doubt that value-at-risk appears to be the darling for the moment, and we've flirted with different ideas in the past. Many people like distributable earnings. There also seems to be a fair amount of discussion of fair-value liabilities and its various definitions. While I think it's possible to get some information from fair-value or value-at-risk, I always get hung up on the accounting and the reporting end of things. Maybe that's just one of the by-products of being a corporate actuary, but I end up doing a lot more accounting and reconciling than I would care to do. However, I can't really ignore the reporting and just focus strictly in the theoretical world.

I have borrowed a concept from the banking industry, because the banks have had to deal with asset/liability management and the notion of interest-rate risk for quite a while. My idea is to design a transfer-pricing paradigm for managing the life insurance industry and to apply transfer-pricing concepts to a life insurance company.

This idea of mine took a while to come to fruition, and as much as I'd like to think it was my idea, it really wasn't; it is not a completely novel idea as others had the idea before I did.

I recognize that there are some of you who may have heard some things about transfer-pricing. It has been discussed at the last few seminars I have attended. Some of you may have some pre-conceived notions about what transfer-pricing means, and to the extent you're involved at all with the financial management of the banking industry, you also may have some ideas about transfer-pricing

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What I'd like to describe for you is the transfer-pricing system that is being implemented at Minnesota Mutual. We are in the process of revamping our asset/liability management system, based on transfer-pricing.

I'd like to describe this new ALM system for you so you'll understand what I mean when I describe our system as being based on transfer-pricing.

Of course, we have to start out with the definition. In our system we define transfer-pricing as intracompany reinsurance of the interest-rate risk. In the transfer-pricing, the product managers cede or transfer the interest-rate risk to the corporate line. Simply stated, transfer-pricing is merely a different way to allocate investment results to the lines of business. It's a different way to allocate assets, capital and liabilities.

Of course, transfer-pricing is a whole lot more than just an allocation or accounting system, but, in order to get more sophisticated financial information to manage all of our product strategies, it is necessary to first start out with a reconfigured asset allocation system.

Within transfer-pricing, there are three key components. The first is the creation of a centralized corporate risk function. Minnesota Mutual already had a corporate line, but it largely represents a balancing between the product lines and total company results. The corporate line contains some of the items that either product lines didn't want or are managed in one central area.

Within transfer-pricing, we're going to use the corporate line for things other than just balancing, and we're going to create a centralized corporate risk function. The interest-rate risk, or more exactly, the disintermediation risk, is going to be transferred from the product lines to this corporate risk function. The intra-product-line investment allocation is now going to be based on synthetic asset portfolios.

Those are the three key components. In order for us to understand transfer-pricing in greater detail, let's consider our typical asset/liability management paradigm.

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We're all familiar with an interest-rate risk profile. This is Minnesota Mutual's individual deferred annuity portfolio. I think you are all familiar with the way the prices or the present value of liability cash-flows change in different interest environments.

Given the issuance of this type of product, the first question that we have to answer on the asset side or on the investment side is, "What assets are appropriate to back the liabilities?" We know that, first and foremost, our job in an insurance company is to pay the benefit obligations. We must invest in assets that will provide cash-flows to pay off those benefit obligations with a high degree of certainty under a wide range of economic scenarios.

For the typical financial reporting structure (which is true for Minnesota Mutual, as I would imagine is true for most of your companies as well), we come up with a methodology for allocating the assets to the lines of business. While we make some attempt to correlate the duration or the risk profile of our assets and liabilities, I have to admit that there is a fairly loose correlation between our assets and our liabilities. Oftentimes our asset managers are doing things that make sense in their world, and the product managers are setting crediting rates that are competitive. However, both sides of the balance sheet don't talk to each other as much as they should. We have good intentions, but our results are more loosely correlated than we would like.

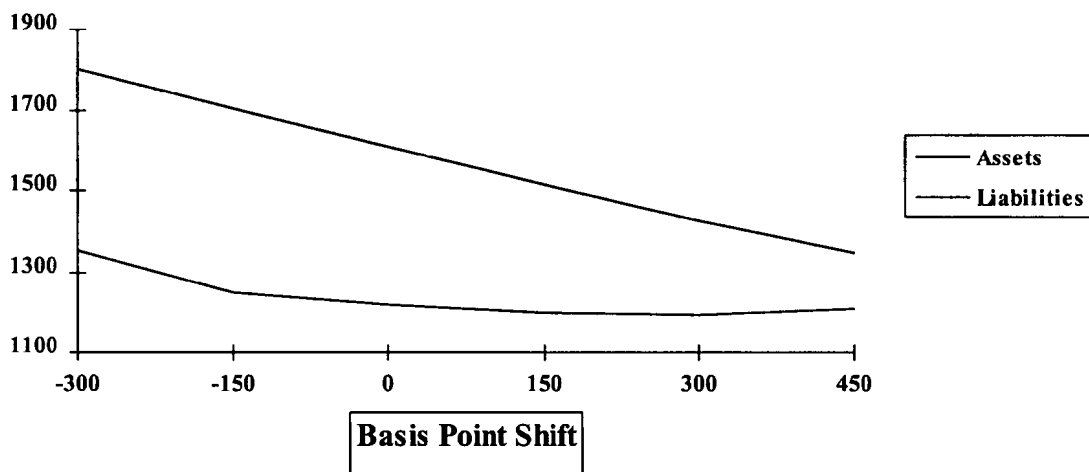
We end up with this type of asset/liability management paradigm, and we have to evaluate a graph like Chart 4. Once in a while, people do actually come and talk to me as a corporate actuary, and they want to know what I think about certain investment strategies or profit objectives. I'm not entirely certain how to answer their questions. I don't know how to evaluate different investment classes; I don't know if the different asset classes would be good or bad. I'm always afraid of saying no to something if I don't have adequate or complete information.

If we look at the graph in Chart 4, we see the value of the assets that have been assigned to back this liability are shown by the top line. So at least within the modeling construct, our assets are always

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greater than our liabilities. For the time being, I don't need to concern myself too much with the issue of insolvency, and I can focus on the financial management ramifications of our investment strategy.

CHART 4
Options Adjusted Value of Assets and Liabilities —
Typical Financial Reporting



You have to start asking some questions as you look at these graphs, and I have spent a fair amount of time looking at these graphs. Are the lines far enough apart? Should the lines be farther apart? Should we have more capital backing the line? Should we have less capital backing the line? The shapes of those curves are not changing in tandem. So there is interest-rate risk embedded in the assets and liabilities. Though we are not opposed to take on interest-rate risk, I think it's a necessity in our business, and I'm just not sure if we're taking on the right amount of interest-rate risk. Perhaps we can take on more interest-rate risk or less interest-rate risk, but truthfully, I just don't know the answer. I could roll up my sleeves and figure out a lot of stuff, but there are just so many interdependent and moving parts to analyze. It's a daunting task to figure out where to start.

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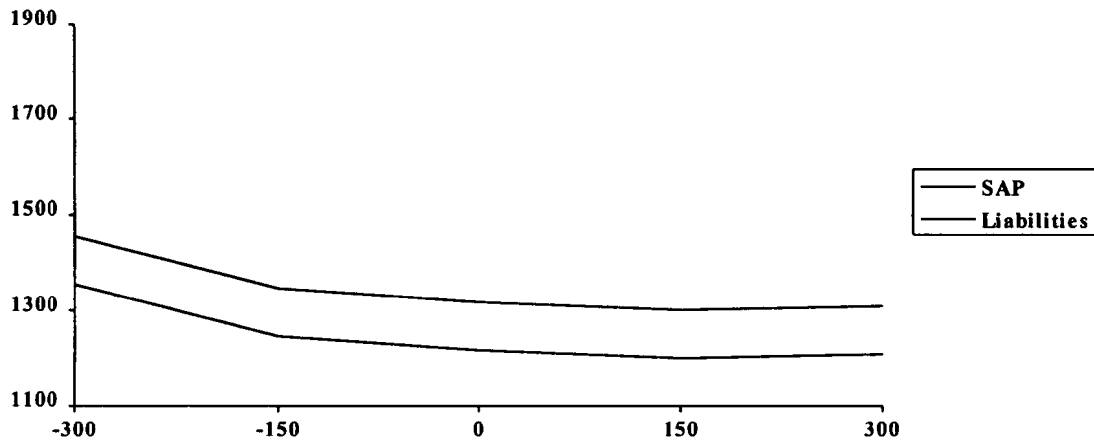
Within transfer-pricing, some of these issues are removed, at least temporarily. Within the transfer-pricing paradigm, instead of allocating the actual assets in some fashion to the liabilities, we're constructing asset portfolios of synthetic assets. These synthetic assets match the interest-rate risk profile of the liabilities. For the synthetic asset portfolios, we're using noncallable bonds and interest-rate derivatives, such as caps and floors, in order to mirror the interest-rate risk profile of the liabilities. As such, this synthetic asset portfolio will form the basis for allocating all of the investment results to the product lines. The synthetic asset portfolio will become the minimum threshold for evaluating our investment strategy and reviewing asset performance. These asset portfolios that contain noncallable bonds, caps and floors will, at a minimum, provide the asset cash-flows to mature the liability obligations. There are obviously some very important concerns with respect to competition and setting of crediting rates, but we can't ignore that our first obligation is to pay the benefit obligations to our policyholders. We have to first make sure that we discharge those obligations before we do anything else.

Let's take a look at the reconfigured asset allocation approach (Chart 5). This is now how our asset/liability management paradigm looks in a transfer-pricing framework. As you can see, the synthetic asset portfolio and the liability portfolio now have an identical interest-rate risk profile.

As interest rates change, the values of the assets and liabilities move in tandem. So we have, in effect, immunized the surplus that backs this product line.

The interest-rate risk or the disintermediation risk has been removed from the liabilities. These synthetic asset portfolios are theoretically ideal from a perspective of funding the liabilities. We've reconfigured our asset allocations so that now, instead of allocating the actual assets that have been purchased by the company, we're creating these synthetic asset portfolios. The differences between the synthetic portfolios and the actual asset portfolios that have been purchased by the company are going to flow through to the corporate line. So the corporate line or the corporate risk manager will be responsible for keeping tabs on the interest-rate risk profiles.

CHART 5
Synthetic Asset Portfolio Construction



As I said, we're in the middle of implementation. This is not a case study. I'm not showing you any numbers yet. We've spent about a year on the implementation, but we're not quite there yet. Give me a month or so and I'll be able to show you some numbers.

At this point I'm talking about the theoretical basis for setting up this system. Now, beyond setting up the theory, of course, we have to worry about some implementation objectives. We tried to stay fairly pure in our approach to setting up the system and looking at the results. We wanted to minimize any implementation constraints, and just let the theory dictate the results.

I don't want to suggest here that I operated completely in a vacuum. I'm aware of the fact that we have competitive issues that affect the crediting rates and dividends, and that our product lines are going to wonder what's happening to their returns and how they're going to be evaluated on that income. We still have to work through many of the transition details, but if we move too quickly at getting into what I generically call some political issues, we might violate the spirit of transfer-pricing.

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We had a few implementation objectives. The simplest objective was that total company results could not change. The first thing we're doing is reallocating investment results between the product lines and the corporate line, so we always had a checkpoint which was, of course, that the total couldn't change.

While working through the implementation details, we had our company modeled in what we called the pre-transfer-pricing world, and the post-transfer-pricing world. As we constructed the synthetic asset portfolios, we knew that we couldn't change the current crediting rates, so all of our crediting strategies remained intact. After all, we really are only reallocating the investment results, and crediting is really more a function of competition and the company's desired competitive position. We didn't think it was fair to change the crediting rates because the investment allocation methods were changing. I should emphasize that I'm talking about crediting rates, and not crediting spreads.

In implementing this system we did reallocate our target capital. Minnesota Mutual does use the NAIC risk-based capital formula as a basis for allocating capital to the lines of business; as such, we have some issues pertaining to C-1 and the C-3 capital. We have reallocated some of that capital from the product lines to the corporate line, and this reallocation of capital is consistent with the assumption of risk and which department is really responsible for managing that risk.

We also had an objective that corporate line profits are approximately zero over the lifetime of a business cycle. That is not to say that the corporate line at any given point in time might not be positive or negative. Hopefully it's not going to be negative too often because that will indicate some problems. We didn't set up this system with the idea of creating a profit center for our corporate line. Over time I'm sure this is the one area that will receive a lot of attention, but for the moment, we did not intend to set up a corporate profit center.

One of the benefits with transfer-pricing is that the lines of business are going to have more predictable income statements because the investment income that's flowing to the business lines

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is based on these synthetic portfolios. The synthetic assets are noncallable assets; as the interest environment changes, these assets aren't going to get called or prepaid, which would create income fluctuations.

Minnesota Mutual has a relatively high exposure for some insurance companies of investments in equities and venture capital. Those types of securities have not only a high risk-based-capital requirement, but the investment results also fluctuate significantly due to the statutory accounting for those particular asset classes. So with transfer-pricing, we're looking at more predictable income statements at the line of business level.

So far I've talked about transfer-pricing as an asset and capital allocation philosophy or system. But, transfer-pricing is a whole lot more than that! In order to get more information, we had to first start out with the allocation basis.

With transfer-pricing, performance measurement and understanding what's going on inside the organization is going to be easier. With transfer-pricing, the contribution of the asset, product, and corporate managers is going to be disaggregated into its individual or distinct components.

Product managers aren't going to be able to blame or look to asset manager performance as a reason why their earnings aren't quite what they had hoped. Conversely, the asset managers aren't going to be able to point to the product managers and say certain options are mispriced. We're separating out what the asset and the product sides do so we can evaluate individually.

Some of the performance measures that we plan on using with transfer-pricing are not particularly unique measures, but take on a unique meaning in a transfer-pricing framework. We will calculate return on equity, return on assets, projected earnings volatility, and the volatility of the company's surplus.

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One particular performance measure that I wanted to briefly touch on is that of Sharpe ratio. The Sharpe ratio is a measure that quantifies the additional return on an asset portfolio relative to the risk assumed. We all know that you can earn additional return as long as you take on additional risk. While we may look at the additional yield earned over and above a risk-free rate, we don't always measure the additional risk.

The Sharpe ratio equals the additional return of an asset over and above the risk-free Treasury rate divided by the risk or the variability of the return in that actual asset portfolio. In the context of transfer-pricing, we define the risk-free rate as the synthetic portfolio rate because, at a minimum, we have to invest in assets that will provide cash-flows to mature our benefit obligations. We can evaluate how much our asset managers have earned over and above the minimum threshold to fund our obligations.

As I mentioned, Minnesota Mutual is in the middle of implementing this. We've been working on this for over a year. Our plans are to have the infrastructure in place by January 1, 1999. We will be running parallel with our current asset allocation system for some time in order for all of our members of management to become familiar with the results, and understand what's really happening within the theoretical framework.

I fully expect that both the systems and the procedures will evolve as we look at this. We have exposed the idea to our investment managers, to some of our product managers and to senior management. We have received good support from all of our areas. I haven't worked on a project like this for quite a while. It's quite exciting, and I think there's a lot of information that we can gain from this transfer-pricing paradigm.

I think this transfer-pricing paradigm provides a basis for evaluating the risk and the return of different investment strategies. It provides a basis for evaluating the impact of alternative capital and product strategies, it allows us to set a customized benchmark for asset manager performance, and ultimately it allows us to evaluate the bottom-line contributions of our asset and product managers.

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I've only been able to scratch the surface of transfer-pricing, but I truly believe that transfer-pricing is a very effective paradigm for managing the financial condition of a life insurance industry. I really believe that transfer-pricing is in fact the elusive answer that the insurance industry has been seeking to manage the interest-rate risk and to move beyond regulatory cash-flow testing.

MR. REYNOLDS: I have a stack of questions I've built up myself, but I prefer to yield to the floor for questions if there are any.

MR. RICHARD S. MATTISON: This is a question for Nancy or perhaps a request for a little more dialogue.

With the corporate line getting some capital, I think one would assume that one could expect some return on that capital. Can you talk a little bit more about the philosophy of having a zero-expected return for the corporate line?

MS. BENNETT: The question had to do with the philosophy of expecting that the corporate line profits will be approximately equal to zero.

I think you're right. We definitely would expect a positive return on the corporate line, but, we must recognize that, at any given point in time, the contribution could be positive or negative. In addition, that implementation objective is based more on theory. We have a number of what I'll call transition details to work through. We have entertained the notion of reallocating a portion of the corporate product line income back to the lines of business. In effect, the product lines will receive investment income in two components, the first coming from the synthetic portfolio and then the second being a reallocation of a portion of the corporate line profits.

I think there will be some interesting discussion in terms of the theoretical profit objectives and allocation methods. That implementation objective had more to do with a kind of long-term theoretical position.

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MR. ALBERT J. ZLOGAR: Is there any circularity involved to determine the synthetic portfolio? It somewhat depends on the crediting strategy, and the crediting strategy depends on the real assets that you have, some of which are in the corporate line. Could you elaborate on that a little more?

MS. BENNETT: I think the margin depends on the actual assets. As far as the product lines are concerned, the synthetic asset portfolios are going to become their real assets. What the company's really investing in, from a product line perspective, will not matter as much. The crediting strategy, expressed as a spread off the portfolio yield is probably easiest to understand. Typically, the crediting rate is a portfolio yield minus a certain spread (where that spread is expected to recover the cost of certain risks if they materialize). With synthetic assets, the methodology will be the same; we'll just now look at the portfolio yield on the synthetic assets.

I think we're going to be able to credit the same rate to the policyholders, or the rate that's embedded in the dividend scale, but I think the margin that's required is going to go down. After all, the default costs for the lines are going to go down. The interest-rate risk is going to go down at the line of business level because all that's going to get transferred to the corporate product line. Thus, it's that corporate product line income that is going to be used to offset those risks if they materialize.

MR. REYNOLDS: My sense is that at many companies, while the credited spread ought to reflect some measure of risk coverage within it, it may not be explicitly there. The risk has, in effect, been ignored, so that when you force them to credit off what is presumably a lower synthetic asset portfolio yield rate, you may end up with a lower credited rate?

MS. BENNETT: I'm not sure. I think there is no doubt that this will force some interesting discussions about our crediting practices. One of the things that I've looked at as I've been trying to model our crediting strategies is to try to have each of the product areas articulate the crediting strategies. The discussion goes like this: "We started out with this rate, and we subtract a spread, and that's the crediting rate." Of course, management judgment comes into play, and the earned

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spread can be different than the priced-for spread. It has always been difficult for me to understand how the product line actuaries have articulated the risk that's required in the spread. I think that's where most of the interesting discussion is going to be. Of course, it's all going to boil down to what the return is going to be by line of business.

MR. REYNOLDS: I have a question for Glen. One of the things that I've struggled with a little bit myself is the issue of the tail when you do a large number of interest-rate scenarios. To what extent have you found that company managements are willing and able to understand the risks that are at the tail? If you identify that there is a 1% or a 0.5% chance that the company will have truly unacceptable results, be it insolvency or what have you, is there a tendency to insist on covering every one of those risks so that there's essentially a zero chance of that happening? Or are they willing to take some risks? Do companies really have a well-thought-out risk tolerance?

MR. KELLER: I think the answer varies by company. I think when every company first sees the results, it decides it needs to get rid of that tail. Then you tell the company about the cost of the hedge or the cost of the interest cap or floor. When they find out it's going to cost \$1 million to take out that 1% change of going insolvent in the year 2010, they often decide not to do it. It really depends on the company management and the flow of information. We have put some caps and floors in to limit risk, and we've put some deep-out-of-the-money ones that really just take the real tail out to try to minimize the risk. I think the key is to have the discussion, show them what the cost will be and then let company management, which I think is what they're getting paid for, determine whether or not they want to take the hit to current earnings or to projected earnings to cover that risk.

MR. REYNOLDS: I have a question for Nancy. I'm presuming, that your line managers will now be compensated on the basis of these synthetic asset portfolio yields and the profitability of the line that is a function of the synthetic yields. How comfortable are they with that, and what education process have you used to make them comfortable with it?

MS. BENNETT: Initially, the compensation will not be directly tied to transfer-pricing.

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MR. REYNOLDS: That makes it easy then.

MS. BENNETT: At Minnesota Mutual, we don't tie a lot of our compensation to return objectives. We are going to restructure as a mutual holding company in the near future, so the world as we know it may change. At this time, we're not tying our compensation to any financial performance measures. There's no doubt that before we do that, people would have to be comfortable with this. We're going to have some pretty interesting discussions, but the hope is that the transfer-pricing infrastructure will provide a quantitative basis for these discussions. We don't really have a quantitative basis today, and I think getting manager compensation based on transfer-pricing is pretty far down the road.

MR. REYNOLDS: Glen, you commented about how you thought that actuaries, when they were dealing with liabilities and assets, tended to be much more experienced with the liabilities. I certainly wouldn't disagree with that, but there was one comment about the asset cash-flows and I wonder if you could elaborate on that. You stated that actuaries tended to be "too technical or theoretical." Can you expand on that and tell me what you mean?

MR. KELLER: I think actuaries tend to want to model and have a model that understands the entire world for our asset cash-flows, and the investment world tends not to look at things quite as technically as actuaries do. I think when we set up our models, we do tend to almost over-engineer projected events within the scenarios. It's great to have a model that projects some of these things that can happen, like prepayments or calls or whatever. The real investment world isn't always completely technical, and it operates in strange ways. Sometimes you don't get economic lapses, or prepayments, and so I think we tend to create models that are too elaborate. Then the difficulty isn't that they're inaccurate; the difficulty is that when you get into a meeting with the investment department, or somebody else, they tend to not have enough confidence in them. I would say, you should rely on some intuition, and that your investment department can add some of the things that affect assets and affect the asset cash-flows.

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MR. REYNOLDS: My question is directed either towards our panel or towards anyone in the audience who would care to comment. It certainly seems that, at least prior to the advent of risk-based capital, credit risk was something that almost looked like a free risk. If you looked at expected default costs by most measures, they tend to understate the additional yield pickup that you can get by investing in lower-quality instruments. I wonder if anybody can comment on whether they have done anything resembling the equivalent of interest scenario testing, or what is in effect, default scenario testing—where they're doing something like Monte Carlo simulations to measure the likelihood of the company getting into trouble if there are a surge of defaults.

MS. BENNETT: I guess I can answer the question. In terms of default risk, Minnesota Mutual has a pretty squeaky-clean asset portfolio, and it really always has. We got practically down to no credit risk, and boiled out any credit risks there might have been early in the 1990s. I think the rating agencies forced the credit risk to be addressed. We're not seeking credit risk as a significant issue in 1998. What I see is that the credit risk has been taken out of the portfolios. The asset managers are assuming more equity risk to earn higher returns. So we're seeing a lot of fixed-income investments that have an equity component to them that, for accounting reasons, still look like fixed-income securities. For example, an equity-linked note or a structured note, or something like that, really has equity risk.

MR. KELLER: I would just add that asset credit risk is a diversifiable risk, as opposed to interest-rate risk, which tends not to be. To the extent that you have your large portfolio, and it depends on the size of the company, it becomes less of a factor. I think the default rates have been historically low, and you have been paid for taking that risk historically. I think it is appropriate that the default premium that you get really should be made up of two components: one that covers expected defaults, and one that covers a risk premium for assuming that return variability. Even though there is a ton of data, it is difficult to draw statistically significant results with regard to default parameters. I think our studies have shown that the total premium you get for taking default risk has not only exceeded the expected defaults, but probably given you even more risk premium than you should have deserved based on the variability. But I do caution that the statistics aren't completely robust in supporting that last claim.

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MR. REYNOLDS: As far as cash-flow testing itself, it seems that our two panelists have focused mostly on interest-rate risk and have somewhat avoided the discussion of liability-related risk, be it expense risk, mortality risk, or anything else. To what extent are company managements interested in looking at those risks, and can you offer any special insights on good tools for measuring those risks?

MR. KELLER: When you do the basic analysis, the liabilities are there. I think I am a proponent of analyzing the risk that has the greatest impact, and because mortality is a diversifiable risk, we tend not to analyze the results. This is also true of expenses. We haven't done a lot of work on that side because we feel that the interest-rate risk and the credit risk is so much larger than those risks. Maybe Nancy has some additional comments.

MS. BENNETT: I would basically agree with Glen, that I think our largest risk is in fact the interest-rate risk and the credit risk. We spend a lot of time actually modeling our liabilities. It seems like that has been our main focus, and even though we continue to try to model our crediting strategies and our lapse behavior, we sometimes get counterintuitive results. The interest-rate risk and the credit risk are still the largest risks facing our company given our distribution of products.