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Management Uses For Cash-Flow Testing

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Summary: Cash-flow testing is used by actuaries for many purposes but is still an esoteric black box in the eyes of many top executives. This panel discussion includes presentations on:

- *Cash-flow testing and the understanding of risk*
- *The role of cash-flow testing in strategic decision making*
- *Cash-flow testing and the role of asset/liability management (ALM)*

This session focuses on the key communications link between the "technical" world of actuarial measurement based on cash-flow testing and the "real" world of day-to-day and strategic decision making at the top levels of insurance companies.

Ms. Karen Olsen MacDonald: I am chief actuary with Transamerica, and I have a lot of experience with cash-flow testing, since I have served as the overseeing appointed actuary since the requirements came into effect in the early 1990s. I am also a member of the Life Financial Reporting Section Council and was involved in setting up this panel discussion.

I thought I would give you a little background on why I believe this is a good topic. In our company we have 30 or 40 people involved in putting together the required regulatory cash-flow testing results. We do this with an as-of date of December 31. Therefore, it must be done within the crunch of all of our year-end reporting. It is a massive effort, and we are very proud of the output. I believe it is so useful to management that I have taken many steps to ensure that the output is not just a big brick of paper that I send to Sacramento.

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Note: The charts referred to in the text can be found in the document titled 94pdch.pdf.

This panel discussion is focused on some of the practical measures you can achieve so that all of the work and effort and insight from your actuaries does not end up being useless with respect to the task of managing your company. Because of this, I am really interested in your feedback.

Our first speaker is Glen Keller, a senior vice president of Conning Asset Management Company, which is based in St. Louis, Missouri. Conning Asset Management currently manages about \$28 billion of insurance assets. In addition, it provides advice on another \$30 billion, so it is a major player in terms of the management of insurance company investments. Glen is a moderator's dream because he actually called me and said, "I have a wonderful speech on this topic that fits your session, and I would love to come and present it for you. Would you let me come?" So I am really pleased to have him here today.

Our second speaker is Frank Sabatini, a partner with Ernst & Young who specializes in ALM consulting. Frank's topic today is the communication, and some might say the frequent miscommunication, that occurs between the actuaries who develop and run the cash-flow testing process and the executives who make decisions based on the results.

The third speaker is John Tillotson. While John is actually listed in the book as a speaker, he was not supposed to be one. Mark Davis of Tillinghast was going to speak, but he called my office on Friday and said he had a client emergency. John was able to substitute and quickly put together a presentation on the "Brave New World of Cash-Flow Testing," which I believe you will all find very interesting.

Mr. Glen D. Keller: I hope to give you a few ideas on how to communicate the information that is prepared in the cash-flow testing, how to use this information to help you monitor your risk position and, most importantly, how to use that information to drive investment strategy and have a real economic impact on your company.

Who are the users of cash-flow testing? The CEO wants to know about the risk position, how profitable the company is, and how to make more money. The chief financial officer (CFO) has the same objectives from just a slightly different perspective. The investment department is heavily focused on having the right investment strategy. Why do they want to have this information? Basically, it is to understand and control the risk position and to maximize profit. I am going to focus on how they use the cash-flow information to drive the investment strategy. Let us look at what happens at most companies at cash-flow testing time. We actuaries are the absolute best at building elaborate liability models. We then incorporate the asset cash flows, which we are also very good at. The models that

exist today, either home-grown or the ones you can buy commercially or from actuarial consulting firms, do a very good job on the asset cash flows as well as the liability cash flows.

One problem is getting the investment department to buy into using the asset cash flows that come from the liability model. After dealing with that, we test our New York scenarios. Then, after various manipulations and modifications, we sign the opinion, file the memorandum, and then stop.

It is a pain doing all of that work. Everybody has thousands of other deadlines, so we just move on to other tasks. I am here today to tell you not to stop there. There is a wealth of information and 85% of the work is already done. You should take the next step because this enables you to drive decisions that have a real financial impact. You can also elevate the actuarial function within your company by taking this information and communicating it to management. The result in my opinion is a much better managed company.

The first step is to turn on the stochastic interest-rate scenario generator. This is the key to moving beyond the New York deterministic scenarios in order to develop valuable information to evaluate your risk profile and to drive investment decisions. Whether you do 50, 100, 200, or 1,000 scenarios (we often get caught up in the correct number of scenarios to run), you will gain valuable information. These numbers may not be mathematically precise and rigorous, but then neither are a lot of the underlying assumptions. These assumptions have a lot of variability in their accuracy since they represent phenomena that cannot be reasonably predicted.

Therefore, striving for a great deal of accuracy by increasing the number of scenarios is often overshadowed by inexact assumptions. A key example here is the dynamic lapse assumption. How will policyholders behave in various interest-rate scenarios?

One valuable approach you can take is to test different deterministic scenarios. CEOs really like that sort of information. Another approach is to test various crediting strategies. Your product development people are probably already doing that.

What kind of risk control information can we gain from cash-flow testing? The key thing is to understand the distribution of the results. That, after all, is what risk is. I happen to like the present value (PV) of distributable profits as a key results statistic. Chart 1 is an example of one of the graphs that we often produce. This block of annuity and universal life (UL) business has a mean value of about \$103 million,

and the 50th percentile is right near by. The maximum value is about \$170 million, but the lowest is much further away from the mean at minus \$55 million.

How is this useful to us? First, you have to determine what causes the negative values. A lot of the times it is what I call the stupidity factor in the model—that is where you keep doing something stupid in the model that you probably would not do in reality. It is very, very important that you investigate these outliers to determine whether or not there is some risk that is lurking out there that can be controlled.

After you have reviewed these outliers, try to figure out what you can do to compress the results. Usually it is a crediting strategy change—a change in strategy or the addition of some type of interest-rate cap or floor. In the latter case, you can work with the investment department to determine if you want to incur the cost of the hedge to prevent the huge downside risk.

You can illustrate the distribution of results on many different bases. These include the PV of ending statutory surplus, the PV of distributable cash flows, GAAP numbers, etc. The key point is that there is no single perfect statistic. You should pick the one that is most recognized by management and then continue to use it over and over again so that you get used to it.

Another statistic is value at risk, which is basically used to analyze dispersion of risk. I am not going to go into that subject in any more detail since there are thousands of presentations on that topic. Duration of capital is another risk control measure that I will discuss a little bit later on.

Let's talk about how we can drive investment strategy from the cash-flow information. I want to start with the premise that you need to take risk to get a return. The major categories of risk are duration risk, credit risk, liquidity risk, prepayment risk, and structure risk. Somebody will probably take me to task for including structure risk because it is usually just a combination of the previous four. I listed it separately, however, because Wall Street often pays people to do the analysis and work on a structure that is not unique. You can often get paid for taking those types of risk.

Let us talk about duration risk first. The key item is to calculate the option-adjusted duration (OAD). That is not the same as the modified duration. It takes into account the optionality of the cash flows on the liability side.

Just for an example of how drastically different the numbers are, if I calculated the modified duration on a UL policy based on the expected cash flows, a current

crediting strategy, and a level interest rate, I would probably get a result of about nine or ten years. Calculating the OAD, which is based on the stochastic, multiscenario process, I get a result that is very close to four years based on a five-year investment portfolio and a portfolio-crediting strategy.

Now, four and nine are vastly different numbers. You need to tell your investment department the correct number, or you will be exposed to a lot of risk. Similarly, you need to know the effective duration of the asset that is the equivalent of the OAD. On the liability side it takes into account any optionality in the asset cash flows, and it is probably available from any of the systems that are used by your investment department.

Also, the duration of capital is a concept used to determine how much interest-rate risk the entire company is taking. Duration of capital is equal to the duration of the assets supporting capital plus the leveraged mismatch of the duration of the assets supporting liabilities.

Basically, if you have no mismatch in the liabilities, your duration of capital is equal to the duration of the assets supporting surplus. If there is a mismatch, the duration of capital depends on how big the liabilities are with regard to the surplus. In Table 1, we have the statutory value and a quasi-market value. On the asset side, it is the market value. We use that because duration is a market value concept, used to predict how the market value of an asset or liability will change with interest rates.

TABLE 1
BALANCE SHEET SUMMARY (\$000)

	Stat. 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
Acc. Inv. Inco.	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 Liab.	14.7	14.7	0.1
Capital/AVR	130.2	212.1	14.3
Total Liab. & Cap.	1,811.1	1,895.6	5.1

You need to do all of the calculations at market value. The bonds in this portfolio all have a duration of 5.3. The total assets have a duration of 5.1. We calculated the duration of the liabilities to be 4.0, which translates into a duration of capital of

14.3. If you use a pro rata allocation of assets, the assets are supporting capital at 5.1. The duration of capital is 14.3 because the assets are longer than the liabilities, which means you have exposed the capital to interest-rate risk.

We at Conning generally recommend that clients go in the range of five to ten for this particular number. Chart 2 shows what the price change of a duration 14 asset is versus a 7.4 asset. I shudder every time I show these graphs to management because what I have done is taken a very complex system and made it into one number. As actuaries, we know that interest-rate risk is much more complicated than that. However, as actuaries we tend to overcomplicate things, so we need to be better communicators. Getting this information across at this simplified level greatly enhances the actuarial visibility within the company. Therefore, it is up to us to make sure we understand all of the other ramifications of how interest-rate risk affects the company.

Convexity and key-rate duration are additional items that we need to determine. Duration of capital is an indicator that tells a great part of the interest-rate risk story, and it is up to you to determine when you have to go further. Most actuaries do go further in their calculations and analysis, but do not necessarily go further in their communications to management.

Duration will tell the investment department how long the assets should be. You can also determine the maximum level of illiquid assets for the company. The market pays a premium for taking liquidity risk. It usually is in the 25–50 basis point range. That may not sound like a lot, but let us put that in perspective. An additional 25 basis points of annual return generally moves a median bond fund up into the first quartile. Therefore, we are looking at adding enough yield to differentiate a top quartile performer from an average performer.

The other good thing about taking liquidity risk is that there is currently no risk-based capital (RBC) charge for it. However, I do have a caveat. Even though there is no RBC charge for liquidity risk, there is a real business risk. The worst thing is to have a policyholder who wants his or her money back when you can't pay it. That usually means the end of the company. Somebody will have to take you over, so you do not want to play with this one too much. However, there is lots of room. There is a great reward for determining how much liquidity risk you can take.

Next, based on the stochastic interest-rate scenario generator—whether it is 50, 100, or 200 scenarios—you can determine, based on the dynamic lapse assumption you feel comfortable with, how many lapses there are in your block of business. Those policyholders who do not lapse can be supported by illiquid assets.

All you do is run that through your **200** scenarios, and then you set, based on percentiles, how many illiquid assets you can have at every duration in the future. In Chart 3 we have a portfolio of about \$1.7 billion.

At the 95th percentile I can buy illiquid assets that mature in 1 year at \$1.6 billion. That means if I have illiquid assets of 1-year duration, 95% of the time I am OK to have \$1.6 billion in illiquid assets because, of course, illiquid assets become liquid when they mature.

Running that out in the future, if I want to buy **20-year** illiquid assets and have some bad scenarios out there or I have to turn this thing into cash to pay off the scenarios, I cannot buy very many of these assets.

Most illiquid assets are of the 10-year range—either private placements or commercial mortgages. In Chart 3, based on the 95th percentile, we could have invested \$700 million in illiquid assets or about 45% of the portfolio. If the company is more conservative and wants it at the 98th percentile, they can have about \$400 million in illiquid assets or about **25%** of the portfolio.

The rating agencies are clearly going to have some opinion as to whether or not this is appropriate. I always find in dealing with the rating agencies, however, that if you have a well-conceived argument backed by lots of numbers, they will listen to you.

The whole key here is that we have created a framework for determining how many illiquid assets a company can have. It is still up to management how much total risk there should be and how much risk they want to assume on the illiquid asset front. Nevertheless, it is a great exercise for determining and adding value in the company.

There are some other analyses that we go through at Conning in coming up with an investment strategy. We review credit position, RBC analysis, and risk tolerance, but basically it comes down to how much risk can we afford to take based on how much capital we have? How much risk is management willing to take and is that risk worth taking? Are we getting paid for taking that risk in the marketplace?

Another question is the extent to which the actuary can get involved in all of those things. A lot of the constraints that are put on an insurance portfolio are regulatory or accounting in nature, and the actuary is uniquely qualified to opine on those items.

A final question is, how efficient are assets based on RBC requirements? Clearly, the answer varies by company because RBC varies by company. Table **2** shows how

much additional yield I need to maintain the same ROE on my entire block of business when I have to allocate additional RBC to the business because I have taken on more investment risk. It also shows how much yield is available in the marketplace over Treasuries. The difference between the two indicates how efficient things are.

TABLE 2
RBC/INVESTMENT EFFICIENCY ANALYSIS

	ASSET TYPE					
	A Bond	BBB Bond	Com Mtge.	BB Bond	B Bond	Com Stk
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 Avail.	0.76	0.98	1.60	2.15	3.36	5.00
Gain or Loss (11% ROE)	0.60	0.49	0.78	-0.04	-1.27	-1.16

In terms of this efficiency, commercial mortgages win because we get paid a liquidity premium, and RBC does not reflect liquidity risk. I am not showing mortgage-backed securities because they carry no RBC charge, so of course they are going to win. That does not mean, however, that they are without risk. Similarly, one should not be making the entire investment decision on this—it covers only this one aspect of risk and profitability.

I would like to talk briefly about a case study. We looked at a company that had a very conservative investment strategy and was long. It had longer duration than its liabilities by about a year and a half. They had no illiquid assets. We determined that at a 98th percentile we could invest about 25% of their assets in illiquid assets, and they would have very little risk. We increased their credit risk profile so that they were getting paid for taking on credit risk, but we maintained an above-average RBC ratio for them and that was the constraint.

Thus, we were maintaining an above-average RBC ratio while moving down the quality curve. They decided, after analyzing this, that they did not want to collapse their duration mismatch. We determined that we would have to shave 10 basis points of yield off the portfolio to collapse that duration risk. They looked at that, translated it into dollars, and said we have a strong capital position. They wanted to just let that run.

I believe that is the type of give-and-take that needs to happen in a company. Having a perfectly matched portfolio is not necessarily the right answer. Understanding the dynamics of the risk/reward is the right answer, as well as making sure that everybody understands where they stand.

At any rate, we increased annual investment income by **6%** which translated into a dramatic 33% pretax gain. I am not sure whether or not your results can be quite as dramatic, but I would try it because lots of money may be left on the table if you do not.

To sum up, use the cash-flow testing rule and make sure there is a lot of actuarial investment/coordination. In the end you will have a better managed company, and the actuarial involvement will be elevated within the company, which I believe is a good thing.

Mr. Francis P. Sabatini: We are in New York. David Letterman does his show from New York, and what is David Letterman famous for?

From the Floor: Top ten lists.

Mr. Sabatini: OK. Here are Frank's top five management uses for cash-flow testing: (5) file cabinet filler for both companies and regulators; (4) high quality scratch paper; (3) a cure for insomnia; (2) the basis for firing the chief actuary; and (1) toilet paper.

Why doesn't management use cash-flow testing as originally intended? Is golf more important? Maybe we can tell by listening to the questions they ask when we show them the cash-flow testing results. "What is interest-rate risk?" "Could you explain all these assumptions again?" "How can I use this PV surplus to make decisions?" "Why did the results change?" "Has the chief investment officer (CIO) reviewed this?" "Did we pass?" And the number one question is, "How does this impact current GAAP earnings?"

Management uses of cash-flow testing vary from company to company, and I have seen good, bad, and in-between. Over time you develop a sense of what works and what does not. There are some common themes and certain keys to getting management's attention.

First, you need to go beyond the New York 7 scenarios. You need to expand the cash-flow testing framework and make it into an ALM framework. You need to build a process for developing information in a form that will get management's attention. If they respond to visuals, then give them visuals. If they want a single number on a page, give them a single number on a page. If they do not want a thick book, do not give them one.

Whatever the case, define a process. Sometimes it is trial and error. Have them come to a meeting once a quarter, not once a year. Develop a process where

management is asked to discuss risk management issues on a frequent basis. Focus on presenting them with quality information that you have confidence in and they cannot question the integrity of. Think about what form of presentation will work best. One CEO told me I had a great presentation, but he never wanted to see that graph again. I got the message. Also, be persistent and creative.

It is actually easy and a lot of it is common sense. But it does take time. If you do not think you have enough time in your busy life, then find those things that are not as important as this and reallocate your time and energy. It is one thing to build a model to perform an annual exercise to demonstrate that your assets supporting your liabilities are adequate. It is another thing, however, to take great care in building a model that validates on both static and dynamic bases; a model on which different scenarios produce results that are reasonable, acceptable, and consistent with what you expect. You must spend the time. We spend so much time building models yet so little time making sure that they are producing good information.

You really need to work hard to shift from 80% building and 20% producing information to 20% building and 80% producing information, but it can be done. Like anything else, if you build quality models, you will produce quality information. And over time, with the right type of communication, management will start to develop a level of confidence in the information you are presenting. If their confidence in that information increases, then their willingness to use that information will increase as well.

You have to get into the stochastic world. It expands your analytic capabilities and the ways you can present information. It is very hard to ask management to make any kind of decision based on a pop-down scenario. Management will claim that interest rates may pop down, but they are not going to stay there for 30 years. They are right, but rates do go up and down. If they have not figured that out before, they certainly have recently.

Cash-flow testing should not be a once-a-year event. Its purpose is not to satisfy the regulatory requirements and then be thrown into the drawer. It is a process that in my view must be performed at least quarterly. That means four times a year the models are refreshed, the information is produced, and management is asked to react.

Also, there should be a series of analytics that are used to ask management to consider decisions, whether on investment strategy, crediting strategy, or some other course of action with regard to either the product side or the asset side.

This usually works if there is a champion. I have known Karen for a long time. She is a champion. She has led the charge at Transamerica, and they have had pretty good success with it. Somebody in the company usually has to step up. Management is not going to walk down and say they have been losing sleep for the past week. This is a really important thing that we need to address. Someone in the company has to decide that this is important and then make it important in the company. It is usually the actuary, but I have seen CFOs and others assume this role.

One of the nice things about the process in my experience is that at some point the momentum shifts from the champion pushing to the management team pushing back. Karen can tell you, and I have seen it in other companies as well, how the demand for information starts to outweigh the champion's ability to respond. Remember that this is one of the few frameworks where management gets to take a prospective look at the world. Everything else we do is either a snapshot of today or historical. Where else does management get to see any kind of projected earnings or projected performance on a going-forward basis? In most companies it is not the planning process. The planning horizon usually has a much different focus and is certainly not a stochastic process.

A little more on process. There is an organizational structure that I have seen in a number of companies that works extremely well. It works from the top down from the board of directors. One of the ways to get senior management to really pay attention is for them to know that they now have an obligation to present results to the board because they told them at the last meeting that they would.

It really works. The board, if you present it right, will give you a lot of feedback. Usually, there is some sort of investment strategy, ALM, or risk management committee reporting to the board. Committees are usually comprised of the CEO, president, CFO, CIO, chief actuary, and probably some key individuals in the company who have particular risk management expertise. It could be somebody from product line. And it is a decision-making group.

In some companies, there is a centralized organizational unit that coordinates all the activities and is responsible for risk management. It reports to the CFO or the president. In other companies this function could reside with the CFO or the corporate actuary, but it is usually somebody who has a corporate view of the world. That corporate area is then interfacing with each of the different lines of business or the different companies, and most of the work is done within the organizational units.

The models are being built, and they are getting rolled up. One of the nice things about the whole process is that it gets pushed up and aggregated, and management gets to see not just line-of-business results, but also a risk presentation on the entire company.

One of the problems in the ALM processes that have evolved in many companies is how to deal with a line of business that is substantially riskier than another line of business. Certainly, if your company is in both the par whole life business and the annuity business, the annuity people are naturally going to worry about investment strategy, interest-rate risk, and other risk elements more than the people in the whole life lines. The whole life people may feel they can always adjust dividends and that will take care of everything.

Even though the participating people may have done a presentation to management and made some representations about how much or how little risk they have, management may feel that this is out of context. They don't see how it fits in with the risk profile of the whole company. When you build it this way you can create the total company view, pull it all together, and, when you do cash-flow testing, do it for the total company.

You may be missing some really small liabilities, but most companies are taking a hard look and doing some sort of analysis on every liability in the company.

A little more on presentation. What are the things that management does not relate to? One, PV of anything. Many of them can deal with it, but it is really hard to put the PV of anything in a decision-making context, except if you are doing mergers and acquisitions (M&A) work.

Two, 30-year horizons. I do not know many 28-year-old CEOs who are thinking what their job security will look like in 30 years. They tend to be 35, like me. But a lot can happen during the next five or ten years, so let's focus on those shorter periods.

Three, duration and convexity. If somebody showed up one day and told the CEO that there was a duration mismatch of two years, what is he or she likely to do? Play golf? Commit suicide? Summon the senior investment officer into his or her office and tell him or her to restructure the portfolio? Well, believe me, the first choice is most likely. What does management relate to? Earnings and short horizons. So give them what they want.

You can quantify risk in terms of earnings. You tell management how much earnings are at risk and frame it in a way that they can understand it. They can then

decide whether it is too much or too little. Usually they think in terms of what it would take to fix it, so you go back, do the work, and come back with the answer. They will know right away whether or not they want to spend the money. How will they know? In my experience, they simply know it when they see it. You just need to get that information to them. Therefore, the key message is to develop presentation forms that management can relate to and keep it simple.

I am not promoting any one particular presentation form over another. You really need to figure out what works for your particular company. All I am showing here is the change in the value of the assets and the liabilities related to changes in interest rates. I am also asking anyone in senior management to be comfortable with the idea of the market value of assets and liabilities.

There are two investment strategies shown in Chart 4: Strategy 1 and Strategy 2. It is clear that Strategy 2 will give you more profit if interest rates rise and less profit if they fall, whereas you get a more stable value from Strategy 1. Crossover points are the same. But at least it is a way to present the relative values. This is just the net result of assets and liabilities. It shows the change in surplus for the change in interest rates. I can actually calculate duration from these numbers.

Chart 5 illustrates a risk-profile curve, which is a technique we use quite a lot. We have taken a stochastic set of 100 scenarios and rank-ordered the outcomes. The labeling says book value of surplus, but it could be cumulative earnings at the end of five years. It could also be discounted earnings, although you know I am not a big fan of PVs.

Now I can say to management that the average value is 68. The actual value could be as low as 20 or as high as 110 if we choose Strategy 2. If we choose Strategy 1, we have a slightly higher expected value with a low of 68 and a high of 78. Which strategy would senior management like us to use? Anybody want to vote for Strategy 2?

Although this is useful information, it does not tell you what is causing the bad results. There are ways to address that, however. Chart 6 is something we use called the rate level distribution. We take the stochastic scenario set and categorize each scenario by the level of interest rates along the path. It could be just taking the five-year Treasury rate and finding out what the average rate was on a year-by-year basis for ten years. If it goes up every year for ten years, it will be off to the right of the chart. If it has been declining, it will be off to the left. If it has been up and down, then it is going to be pretty much where it started.

So, we have categorized every scenario by its rate level. What you then do is compute the average value of whatever you are measuring, whether it is earnings or book surplus, over that horizon for all scenarios that are less than 6%, between 6% and 7%, between 7% and 8%, etc. If your exposure is to declining interest rates, your results will reflect that typical pattern. Then, if you want management to make a decision about Strategy A versus Strategy B, you can put the two results side by side. Management can understand how much value change comes from picking a strategy and how this will change their risk profile. From this sort of presentation you can also build earnings-at-risk demonstrations.

Be persistent. Do not give up. If you persist, you can get a process in place that is routine within the organization, not just an ad hoc event. You will begin to get more and more support for what you are doing. You must request action. Go and tell them the issues and the possible solutions. At the next meeting, present a status report and ask for a decision. If you give them enough information in the right context, they will make that decision.

Mr. John S. Tillotson: In my presentation today, I was going to predict the future of cash-flow testing. But yesterday, Dr. Lester Thurow told us we cannot predict the future. I realized I had not just one, but two strikes against me. If he is right, not only can I not predict the future, but my subject matter, cash-flow testing, which is used primarily for predicting the future, has apparently also been assigned to an impossible task.

Traditional uses of cash-flow testing, and I am using a very broad definition here of just about any kind of computer program that projects cash flows into the future, include: the pricing of products; capital project analysis, which involves determining whether to go ahead with a capital project and is usually based on ROI; statutory projections, including the statutory analysis done in ALM; and, more and more frequently in the last few years, M&A appraisals.

Typically the results have been, at least historically, based on a single scenario using best-guess assumptions, perhaps with a few sensitivity tests thrown in to see what effect certain variables have. Often there is a single point measure. As Frank said, that is what management likes to see. This measure might be the PV of profits. It might be an ROI figure. But it is frequently a single number.

As I discuss the future of cash-flow testing, I will be covering these items: (1) the expansion of its uses; (2) some of the environmental changes that are currently driving the need for these new uses; (3) the fact that computers (with their ever-increasing speed and power) will enable us to do things that we have not been able to do in the past; (4) advances in the theories that are the backdrop of cash-flow

testing; (5) improved ways to prepare output presentations, such as three-dimensional graphic displays; (6) the changed roles for the cash-flow testing actuaries and how they deal with management; and (7) potential enhanced applications in the M&A area.

The expanded uses of cash-flow testing that are currently already underway include dynamic solvency testing (DST), strategic analysis (I am not sure, however, if anyone is actually using cash-flow testing for that yet), and communications to outside audiences, such as regulators.

I am sure you have all heard of DST. I am not sure how many companies are actually using it yet. It is needed because conservative statutory reserves no longer guarantee that you are going to be solvent for the foreseeable future.

We have moved to asset/liability testing, but we need to go further. At least that is what the proponents of DST proclaim. This would include adding all future new business to the model and using large numbers of stochastic scenarios to better assess the risks involved, not just to test for sensitivity.

There have been some actuarial committees working on dynamic solvency theory and techniques, but this is still in the early stages of development. Both the applications and the future usefulness of DST are still very uncertain today. Five years from now everybody may be using it, or we may be looking back and trying to remember what it is.

Can cash-flow testing be used to enhance strategic analysis? Currently, most companies are in the midst of reviewing their strategies. This might have to do with what markets to be in, whether to rebuild or dismantle the traditional agency force, or whether to merge with a bank, become a globalized company, etc.

In the old days a company might do a strategic analysis once every five years and focus on just one aspect such as new products (e.g., should the company develop a UL product?). But today virtually every life insurance company is struggling through a top-to-bottom strategic review, so the question is, can cash-flow testing be useful here?

Today strategic reviews are largely seat-of-the-pants affairs, focusing on the qualitative aspects of strategy. In the future, however, we may be able to use cash-flow testing to actually evaluate the different alternatives, quantify some of the key drivers of strategy, and make explicit risk adjustments.

How risky is it to get into a new market? How risky is it to go global? Can you actually measure the riskiness of investing in the foreign markets? For this last question at least, I am sure you would get a different answer today than you would have gotten a year ago, no matter how you make the calculation.

The incorporation of optionality into strategic decision making is another aspect that companies are barely aware of now. For example, should a company stay with its traditional agency system, or should it move to new forms of distributing products, like the Internet? Optionality means this should not be treated as an either/or question. The correct decision might be to do both for the time being, keeping the options open and waiting to see how the environment evolves.

So, the question is, is there some way you can put a number on that? Is there some way you can value that optionality? And, if so, can you incorporate this into your cash-flow tests of the future?

A final strategic use is to measure the performance of the strategies that you have adopted in the past. In order to establish the credibility of any particular use of cash-flow testing, you need to be able to look backwards after a few years and say, "Yes, the recommended strategy did work, and it worked within the parameters that we used in the cash-flow tests at that time." Or, perhaps, the strategy didn't work, and the old cash-flow tests can help us determine why.

Another important aspect of the future of cash-flow testing is communicating the results to outside audiences, not just to company management. These audiences include ratings agencies, investment analysts, shareholders, and regulators. You not only need to develop cash-flow tests that can perform all the calculations you want, but you also need to be able to illustrate the results using tables and graphs that your audience can understand and appreciate.

There are several environmental changes driving the need for expanded use of cash-flow testing. I am sure you are tired of all the speeches in the last few years about change and the pace of change. But change is not only happening faster—it has a much broader scope. Major simultaneous events are rocking the industry: changes in technology; the crumbling of the walls between industries, banks, and life insurance companies; globalization; and workplace changes, such as different cultures, different levels of skills needed, etc.

What are the effects of these concurrent changes? One effect is the reduced value of historical trends and data. This is both good and bad news for cash-flow testing. On the one hand the traditional method of simply taking past data and extrapolating

it into the future will probably not be very useful anymore. Things are simply changing too quickly.

An example is pricing, where you use data from a three-year-old persistency table based on a study done three years before that on even older data compilations, where the actual experience is spread over several years prior to that. Don't forget that you are predicting lapse rates at advanced duration on policies whose sales will be spread over the next several years.

We simply cannot do that anymore with any reliability. We need to rely more on common sense and develop new analytical techniques so that the cash-flow tests of the future will actually have meaningful results and not just be some kind of straight line trending of what we know happened in the past.

Another paradox here is that we have a greater need for complexity in order to adequately reflect all of the changes that are occurring. At the same time we need to have results that are quick and dirty. We cannot afford to tell management that we will have this great answer for them about their strategic direction or how to manage their assets, but that it will take a year.

We cannot insist on having six months to develop the program and a further six months to put the assumptions together, and then brag about how we will have this great report for them. They need it now, so we need to somehow develop cash-flow tests that are complex yet flexible enough to be changed and adapted on the run.

I do not know if that is possible, but I think it is what we need to work on. Otherwise, management will not even be listening to us actuaries in the future. They will just be doing it by the seat of their pants.

Potential technology trends in cash-flow testing, which will result from faster and more powerful computers, include: (1) A larger number of scenarios, perhaps routinely in the thousands. We need to study more carefully exactly what the right number is; (2) Real-time applications. For example, instead of entering acquisition negotiations with an appraisal, you might go in with a laptop and have your cash-flow test right there on the table and be able to change the assumptions as you negotiate; (3) More sophisticated risk adjustments, using more advanced theories of risk and uncertainty; (4) Shared execution by multiple users, although this one is really pie-in-the-sky. I don't really think it is ever going to happen, but the idea would be to have this gigantic cash-flow testing system in a company. All of the different lines of business and all the different levels of management input their data

and assumptions into the system and get their output from it, all in real time; (5) New types of output presentations, including three-dimensional graphic capabilities.

Concurrent with all of the environmental and technological changes, there will be theoretical advances that will be made largely in the academic community but also within the actuarial profession.

How do you transform uncertainty into risk? A lot of people use these words interchangeably, but I believe Dr. Thurow hit the nail on the head yesterday when he talked about uncertainty as the unknown unknowns, and risk as the known unknowns. He added that you cannot deal logically with uncertainty. Therefore, to the extent that we can transform uncertainty into risk, we can use cash-flow testing from that point forward to quantify it.

There are advances in chaos theory that may or may not have real applications to the work we do in the future. These may lead to the development of improved stochastic scenario generators as theoreticians study the true nature of risk and probability.

Another field of theoretical research is the attempt to separate signals from noise. What has happened to your business in the last year or two? What data do you have? Does it predict anything for the future or is it just random fluctuations? How do you get at that? You need to attack that problem in order to develop some kind of credibility for whatever your output is that you show to management.

Finally, we need a better understanding of risk aversion. Who decides the risk aversion of a company? Is it the CEO? Should it be the CEO? If the CEO has a one-year time horizon and is only interested in what is going to happen next year, should the actuaries simply say, "OK, that is what we will give you?" Is there a correct way that we should look at risk aversion and then try to push that onto management, or should we simply accept what they are saying? Is there some kind of in-between negotiating that could occur here? I believe there is a lot of theoretical work being done on these questions that may eventually find its way into the kind of thinking and work that actuaries do.

I have recently seen several demonstrations of advanced output presentation. These include three-dimensional graphs that would move as you watched them. It was like being in an airplane flying around this terrain looking at these hills and valleys of data from different angles. I am not sure how useful it is, but if you want to impress your top management, maybe this would grab their attention.

With 3-D, you can set up direct interaction between your executive audience and the output you are presenting. If the CEO has questions about the company's sensitivity to lapse rates, you can punch a few buttons and have him watch the profit mountain erode down to a mere hill.

Another advance in graphics is to show clusters, clouds, and footprints instead of just points. These are a few of the names now used for showing the results of thousands of points of data from stochastic tests in a comprehensible presentation. A cloud might be a three-dimensional footprint. The audience can directly visualize how much of the footprint or how much of the cloud is on the wrong side of a risk tolerance line. This may or may not turn out to be a superior method for eliciting management's risk aversion parameters.

What are the chief roles and competencies for cash-flow testing actuaries as we peer into the future? First, we must have access to broad but recent data. We can no longer rely on 20 years of data for something that is changing rapidly. Therefore, we need access to studies on a much quicker basis. Possibly the Internet will be the tool of choice for this.

We must learn to bridge the communication gap to executives. We must focus more on decisional analyses. At Transamerica we refer to "how-about-that" analyses where results are interesting and actuaries love to do the work, but it simply doesn't lead anywhere. If you are going to the CEO, you must have something that leads to a decision. As Frank said, if the CEO does not think in terms of PVs, it is hard for him or her to look at a PV number and know what to do with it, other than perhaps say, "Wow! How about that?"

The cash-flow testing actuary must develop business judgment as well as analytical skills. Again, this relates to the communications gap. You need to put on your CEO hat before you talk to the CEO. Be familiar with the business trends and the environment that your company is working in and anticipate the questions you will be asked. Otherwise, you will arrive with your fancy presentations and find everybody staring at the ceiling because you are not addressing the issues they want to hear in the manner they want to hear them. Finally, you must learn the true agendas of the various stakeholders. This may get into politics and short-term thinking. Learn as much as you can about these things, even if you find them somewhat distasteful. You might become confused as to why you are being given risk aversion assumptions that do not appear to make any sense. You'll wonder why your airtight recommendations are always rejected or ignored. In short, you need to be aware of everything going on politically and psychologically, as well as in a business and economic sense.

I was trying to think of some possible future applications for cash-flow testing in the M&A environment. The ideas I came up with are probably outlandish, but I believe it is always a good idea to think of blue skies in the future. Maybe something good will come of it some day.

One potential M&A cash-flow testing application is what I call the winner error effect. This is based on a proven theory. If you have enough companies bidding for an acquisition, the company that wins probably has made a large analytical error. Every bidder is likely to make an error here or there, so the company that comes in with the highest bid is often the company that made the biggest error.

This phenomenon may be amenable to analysis. It certainly has Bayes' Theorem written all over it. For example, if your company strategy is to buy companies cheap and then turn around and sell them, you could develop some kind of cash-flow testing formula that works on this theory. It would be based on the number of serious bidders, the variance in their strategic needs, the likelihood of large errors or bias, etc. If it enables you to buy cheap and sell dear, why not do it?

Another potential M&A application of cash-flow testing is the modeling of dynamic future environments. For example, what would happen if we make this acquisition and three years from now there is an international economic crisis? Or, what is the likelihood of being able to sell the company if we cannot integrate it? What are the different environments in which this would be possible? Can we quantify the synergies?

Most M&As today rely heavily on synergies for pulling out expenses, leveraging marketing efforts through cross-selling, increasing advertising effectiveness, etc. How can we quantify these? If we cannot develop ways to quantify them, then we as actuaries may not have much of a role in future decision-making processes.

Finally, can actuaries figure out how to quantify the morale or cultural effects of a merger or an acquisition? Many studies have been done looking backwards at acquisitions to find out why so many of them have failed. I believe the most often quoted reason is the morale and cultural effects. People were demoralized. Too many of the good people quit before the merger could be integrated. Morale went down the drain, or all the good people quit before the acquisition even occurred because rumors got out.

Are there identifiable and measurable drivers that will enable us to at least roughly predict these effects before they happen instead of after they happen? Can valid research be conducted on these drivers? Probably not today, but maybe five years from now when all of the acquisitions that have occurred in the last few years have

had a chance to succeed or fail. Perhaps then we can do some real research on why they failed, why they succeeded, and how big a role was played by various morale and cultural factors.

Finally, of course, even if we can do all that, can we build that into cash-flow testing assumptions in a way that is useful to a company that is using acquisitions as part of its growth strategy?

Just for fun, I developed a top ten list of morale and cultural drivers. Most of them are probably difficult to quantify, but there may be practical possibilities here:

- (10) The average employee work week;
- (9) The employee turnover rates;
- (8) The average age of the executives;
- (7) Average duration of employees;
- (6) The expected level of expense and personnel cuts;
- (5) The relative size or influence of the two parties;
- (4) The number of employees promoted from within relative to those hired from outside the company;
- (3) The elapsed time since the last trauma, meaning the time since one of the parties had a substantial acquisition or downsizing;
- (2) The extent of any necessary relocations. Does one of the two companies involved have to move their people?
- (1) The extent of prior M&A integration experience with either party.

The idea is that five years from now we can look at each of these factors across a broad array of the M&As that have occurred during the 1990s and try to find the correlation between these factors and the success or failure of the acquisitions. Then we could develop hypotheses as to which drivers are critical. We would then build these into our cash-flow testing models. Then once again, we would be the experts that management will want to consult to make important M&A decisions.

So, the future of cash-flow testing is very uncertain at this point. There are a lot of possibilities. Most of what I talked about may never come to pass, but I think it is worth thinking about as you go back to your day-to-day use of cash-flow testing.

My own personal prediction, or imagination I should say, is that there will be a larger role for cash-flow testing as we go along. There will be a larger and higher level role for the actuaries who can use cash-flow testing. We need to avoid overselling our tools until they have been battle-tested. We have a credibility issue here. We can address a lot of the problems we have talked about, but there is still a lot of uncertainty. As Dr. Thurow said, you cannot predict the timing of an earthquake, but you can predict its effects and prepare for them.

Finally, continuous improvement will be required here. We cannot stand still at any point. We must keep looking for ways to improve cash-flow testing so that we can continue using it to justify ourselves and to remain useful to top management.

Mr. Howard H. Kayton: Frank, would you care to comment on what is likely to happen if present interest scenarios continue to year-end and we come out with our cash-flow report?

Mr. Sabatini: Five-year Treasuries were at 4.22% on September 30, 1998 so for those of you who do cash-flow testing as of September 30, I guarantee that you are going to be rerunning your models as of December 31. Any of you who have any kind of significant minimum guarantees are likely to have some difficulty with your pop-down scenarios. It depends on how much profit is in your product. It will be on a case-by-case basis. If it was close last year, then it will probably cross the line this year.

Mr. Mark E. Alberts: I have a couple of practical issues that I would like the panelists to comment on. One is a limitation of cash-flow testing for management purposes—the fact that it is a closed block snapshot. I would like to know how the panelists have dealt with new business issues. Second, on stochastic testing, my company has a number of subsidiaries we run. With more than 20 models, it would take us probably 2,000 hours to do 100 stochastic scenarios. I'm wondering how people have dealt with the resource limitations.

Mr. Sabatini: The answer to your first question is that you must bring in the new business. If you are going to provide earnings numbers, at least statutory earnings numbers that they can relate to, then the first year of the projection should produce a number that looks like the business plan. You definitely need to bring in new business. The real question is whether to do new business for five or ten years. Then you build in all sorts of dynamics. In terms of models, I think our general tendency is to build large models because we think they are better. My experience would suggest, however, that this is not true. You need to build models that validate. It is almost an optimization process. What is the minimum number of cells of the right products that will give you the best validation in terms of all the different elements that you are trying to validate to? Plus the machines are faster. Eventually you are going to get there, just on machine speed, although that is not a reason to keep building big models.

Ms. MacDonald: With respect to the models, a lot of times your purpose is to compare the relative value curve for a couple of scenarios. So, you are able to make simplifications in terms of what the baseline is if you are just trying to compare one specific variable across all the scenarios.

Mr. Keller: With regard to investment strategy development, I think we do tend to have overly complicated liability models, and we should simplify them. With regard to how you take into account new business, it really depends on the risk you are analyzing. Clearly, if you are trying to analyze liquidity risk, new business generates cash. You definitely need to take that into account. To the extent that you are trying to analyze duration rate, it depends on whether or not the product is priced to the market at the time that it is put on the books. In this case you would tend to exclude new business. However, to the extent that the product is not priced to the market at that date, then you need to incorporate new business.