1994 VALUATION ACTUARY
SYMPOSIUM PROCEEDINGS

SESSION 9

Financial Projection of Health Coverage Short-Term Projections

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MR. ROBERT A. NELSON: When I was asked to participate in this panel discussion, I was told the topic was risk analysis. My background is in group insurance, but more recently, I've spent some time in the investment side. I've learned quite a few things on the investment side about analyzing risk. And I think some of those things are applicable to the type of work that we do.

The first thing is to get an intuitive feel for what risk is. I think that anybody's definition of it would probably include the chance of, or the severity of, something bad happening. And I'd underline that bad part. Just the existence of uncertainty is not enough for risk. If something changes, but the changes have no impact on you, or they are good, that is not necessarily risky. For instance, most of us wouldn't think of the risk of winning the lottery.

But the severity does matter. I mean, most of us are from different cities. If you're like me, then you probably picked up a newspaper at this meeting. It probably wasn't your local newspaper. But there wasn't much risk associated with paying 50 cents, because there was no severity to it.

Now I'll look at how to measure risk. One of the most popular measures is standard deviation, the familiar two-sided volatility that really measures change more than it measures risk. In certain situations, risk and change are synonymous. The classic situation is in the financial markets and a position called a straddle. A straddle is an option position where you buy both the call and the put on a stock. Imagine a stock trading for $42. If you buy the $40 call and buy the $45 put, then what you're hoping for is that the stock never changes. On the other side, imagine selling the call at $45 and selling the put at $40. Now you're hoping for no volatility. Standard deviation can be a good measure in one of these situations.

At last to the stochastic measure, which is my favorite. That's the one for which I think you can get the most bang for the buck right away. My image of it is a spreadsheet. You create a model office, over some time frame, and then you run simulations through it. Then you count up the number of times something bad happens. That something bad can be defined differently for different organizations. Invariably, it's going to have something to do with money, though.

The other thing you can do is, concentrate on the severity aspect and look at worst case scenarios. Once again, my own preference is for the measure they call in the literature the worst streak. The worst streak is defined as the most cumulative losses from any given starting point. These losses can either be as the result of one cataclysmic event, or the result of a sequence of small losses. In any case, you're trying to answer the question, "If I had to fund all the losses from a point in time, how much money would I have to have started with to afford that?"

In order to talk about risk, one of the things that you have to grant is, that there is uncertainty. In a certain world, there is no risk. If you absolutely know what's going to happen, and it has an economic cost, then I call that a price. That's not a risk. Now there are two ways to model uncertainty. In some of the literature on the subject, you find what I call the closed-form solution sets: Basically, you assume nice functions. These are functions with nice algebraic solutions that you can go about and solve for the tail. I have comments on this method. The functions are very elegant, although the math is often very complicated. The bad news is they're very hard to use because it's difficult to estimate the parameters to the functions. When someone comes to you with binomial normal distribution and asks you for the covariance between a couple of items, I wish you the best of luck. I know I can never figure that one out.

The other general method is to create a simulation model and go the "Monte Carlo" route. And in that way you validate your model by looking at the results of the model, rather than laboring over the inputs to the model.

Here's what I found is a good conceptual framework for creating these models (Chart 1). I like to think of the model as a spreadsheet having three sections. And I do, in fact, use a spreadsheet. Just as it is important to model out the claims and the expenses, I think it's also important to model out the assets, because in the end, each of the product groups that you try to project has the problem of what to invest the money in. And as I hope I can show you, there's a real relationship between the short-term plan and its goals, and the investment plan that should be utilized to get the organization the right risk/return relationship. Now in the three modules, the environment, that's basically creating your own *Wall Street Journal.* There you would keep track of interest rates, equity prices, or other relevant statistics. For instance, in some of the models that I've done for disability income, I keep track of unemployment. On the other hand, if you're doing a medical, small group model, I would keep track of medical trend.

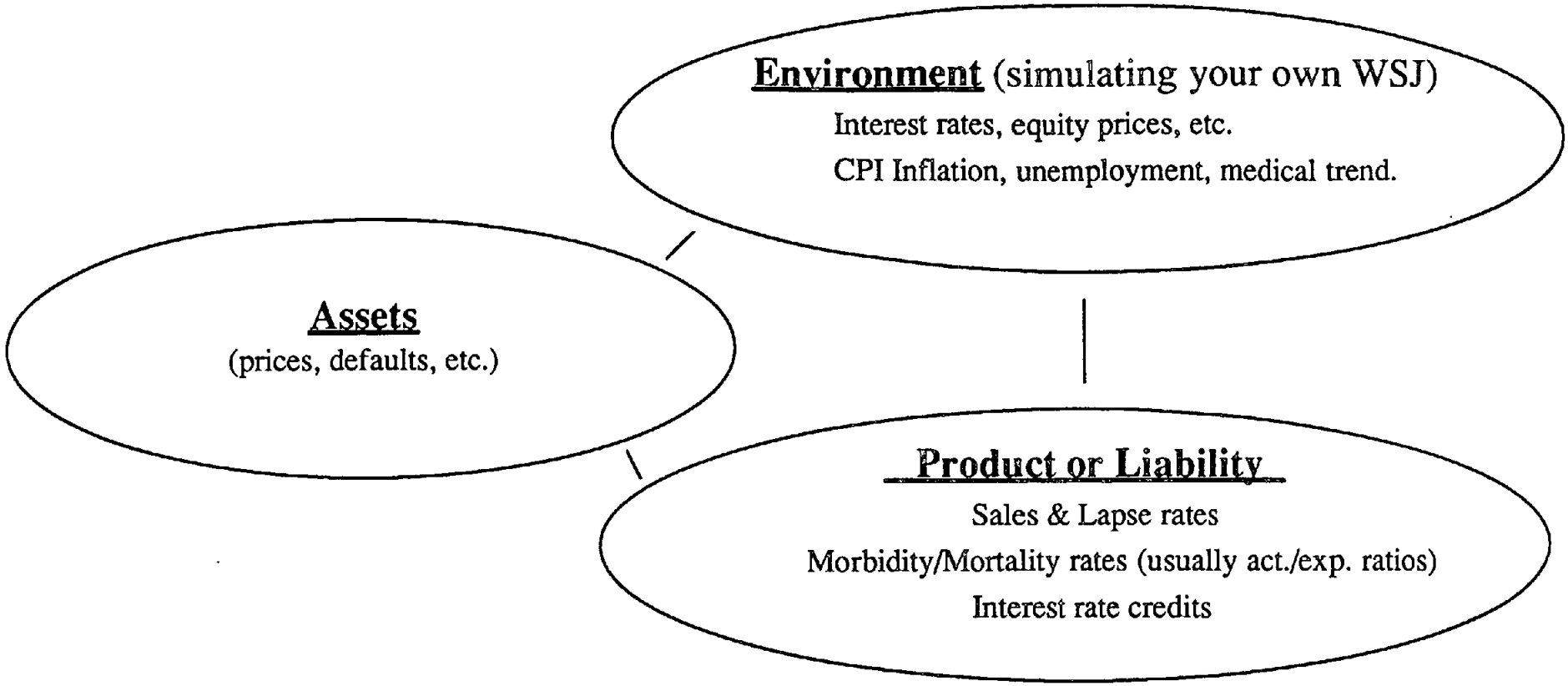
I also think of these things as being very interrelated. Obviously, the assets are related to what's going on in the *Wall Street Journal.* But in addition, the product or the liability side is also moving around. And it responds to what occurs in the external environment. I like identifying it that way, calling it the external environment, because there are very few levers or controls that any given individual or company can have on the environment. But you can control the assets and you can control the liabilities. That's sort of a general conceptual background. The next thing to do is come up with some stochastic inputs.

One of the nice things about stochastic inputs is you don't have to understand the "whys" of them. If we went over to our brethren on the asset side where they're modeling out the price of a derivative security, they're going to tell you that they

CHART 1

The Three Modules

A comprehensive model includes correlated behavior in three moving parts



have an interest rate process that has a volatility assumption. But if you asked them why it has the volatility or what it's supposed to represent, they just shrug their shoulders and wonder why you're asking that. To them, it doesn't make any difference why interest rates moved. And to a great extent, I think that that's true in the type of work that we can do.

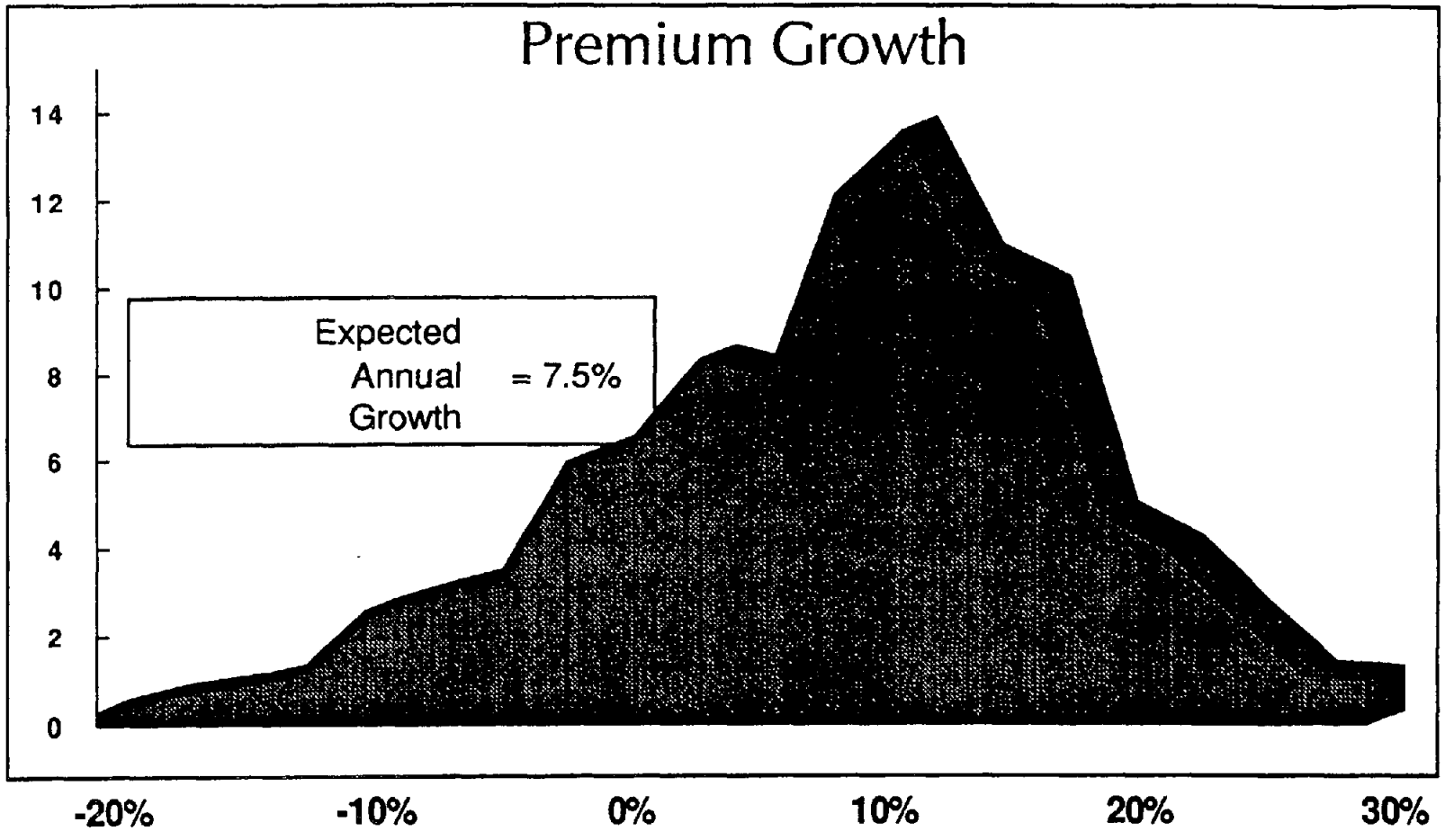
For example, in a health model, you can assume a distribution of loss ratios without attempting to explain why it happened. By looking at your own histories at your companies, you can probably have a good idea of what the volatility of those loss ratios are. Some lines just stay very stable. They vary within a very narrow band. Others jump around dramatically.

When I created the spreadsheets, there's a whole lot of stochastic inputs in them. Typically, there are seven or eight. This is an example of the premium growth assumption (Chart 2). The premium growth function is actually related to both the liability module and the environment module, because inside the environment module, it'll keep track of what the competitors' rates are. And different pricing strategies will result in different premium growth patterns. For example, if you have a pricing strategy that says you are always going to maintain your margin (in other words you peg a loss ratio and you assume an expense, and your pricing people are always gearing toward the exact same margin), then you should expect that your growth -- your premium, your new sales -- is going to be volatile. Why? Because there will be other groups out there that are pricing for premium growth, or to hold their market share, and they'll probably succeed. So if you were going to price for a certain margin, you would expect to have more dispersion in this type of display.

This was a rather simple function. And almost always, I use the same function in these work sheets. And that simple function is (once again, I stole it from the asset people) a lognormal, mean reverting process. I find that one to be very good.

CHART 2

An Example of a Stochastic Input



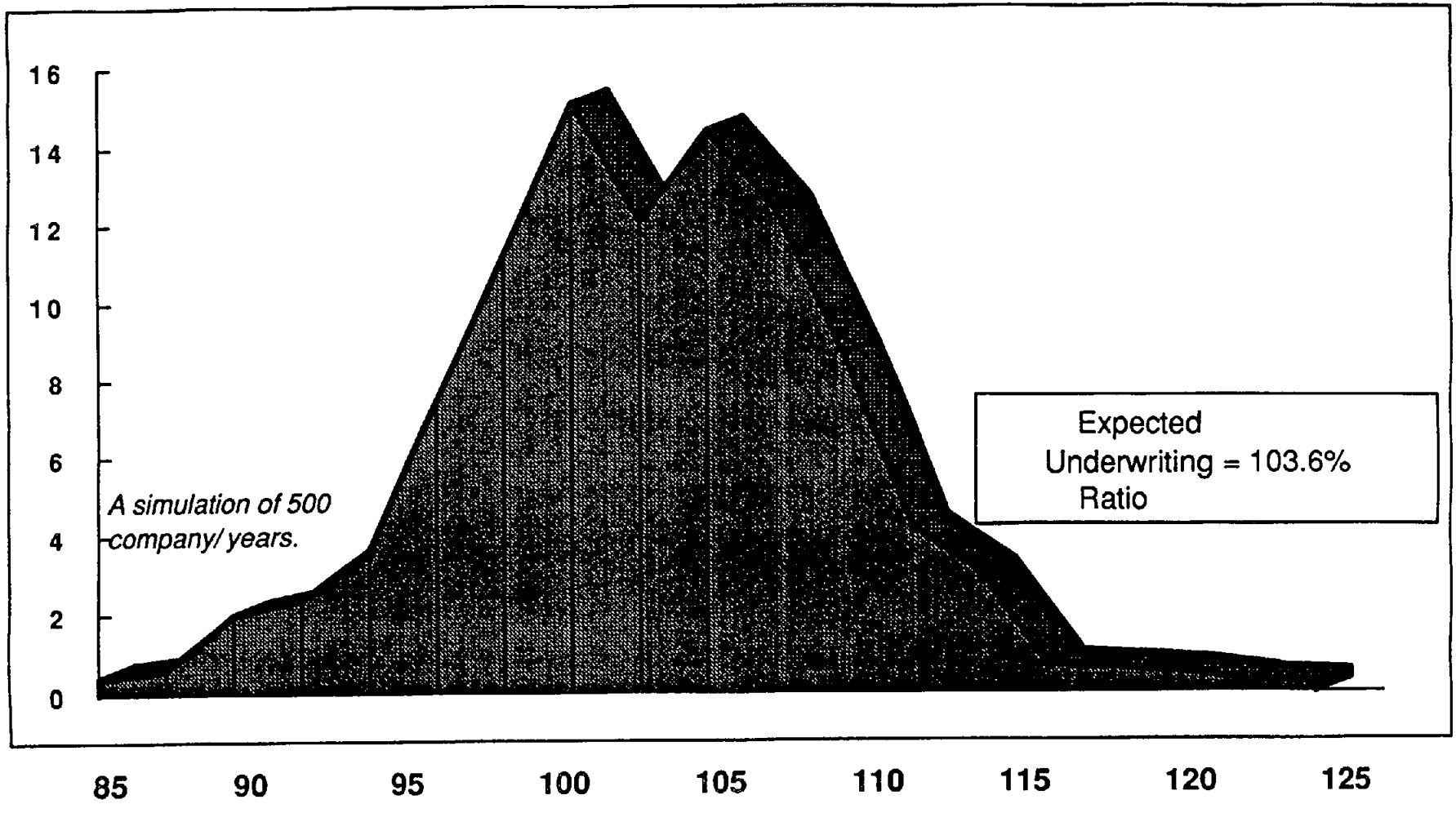
Because for instance, if I'm modeling expenses and I say, well, it averages 25% in this group health line, but I've seen it anywhere between 22 and 29%, what I know about the ratio of expenses is that there's a group of people whose job it is to manage those expenses to a specific target. And as they vary from their target, they take real actions to move back to some more normal number. Now that process is easily represented mathematically in the lognormal process with a mean reversion. The mean reversion factor represents the reality the management targets around that. And it produces the uncertainty.

I said that one of the ways to judge a stochastic model is not by debating what the inputs are, but by taking a look at what the outputs are. Chart 3 happens to show the underwriting ratio for automobile insurance. At Fortis, we have a number of different lines. This one happens to be for an automobile insurer. And then in the casualty world, the underwriting ratio is the total of the expenses and the claims divided by premium. This is a simulation of 500 company years. So this model was run on a quarterly basis, but I believe it was five years, and it was done a hundred times. I then looked in the third year and said, well, what were the underwriting ratios through all these simulations? And I get a dispersion that looked like Chart 3. When I say the proof is in the results, it's because this is the combined effect of the mean reverting processes and some of the expense controls. The same thing happens on the loss ratio. It turns out it's not that difficult to come up with simple formulas to express the process that the renewal pricing goes through, which is basically, if the loss ratios are too high, raise rates. If my loss ratios are too low, or better than pricing, I project trend and I subtract something from the rate increase.

Now I show this type of display to the management and presidents of the company. With their experience, they can look at this chart and say whether or not that represents a reasonable graphic of the dispersion associated with the line of business. And in that way, I can validate the stochastic inputs.

CHART 3

The Proof is in the Results



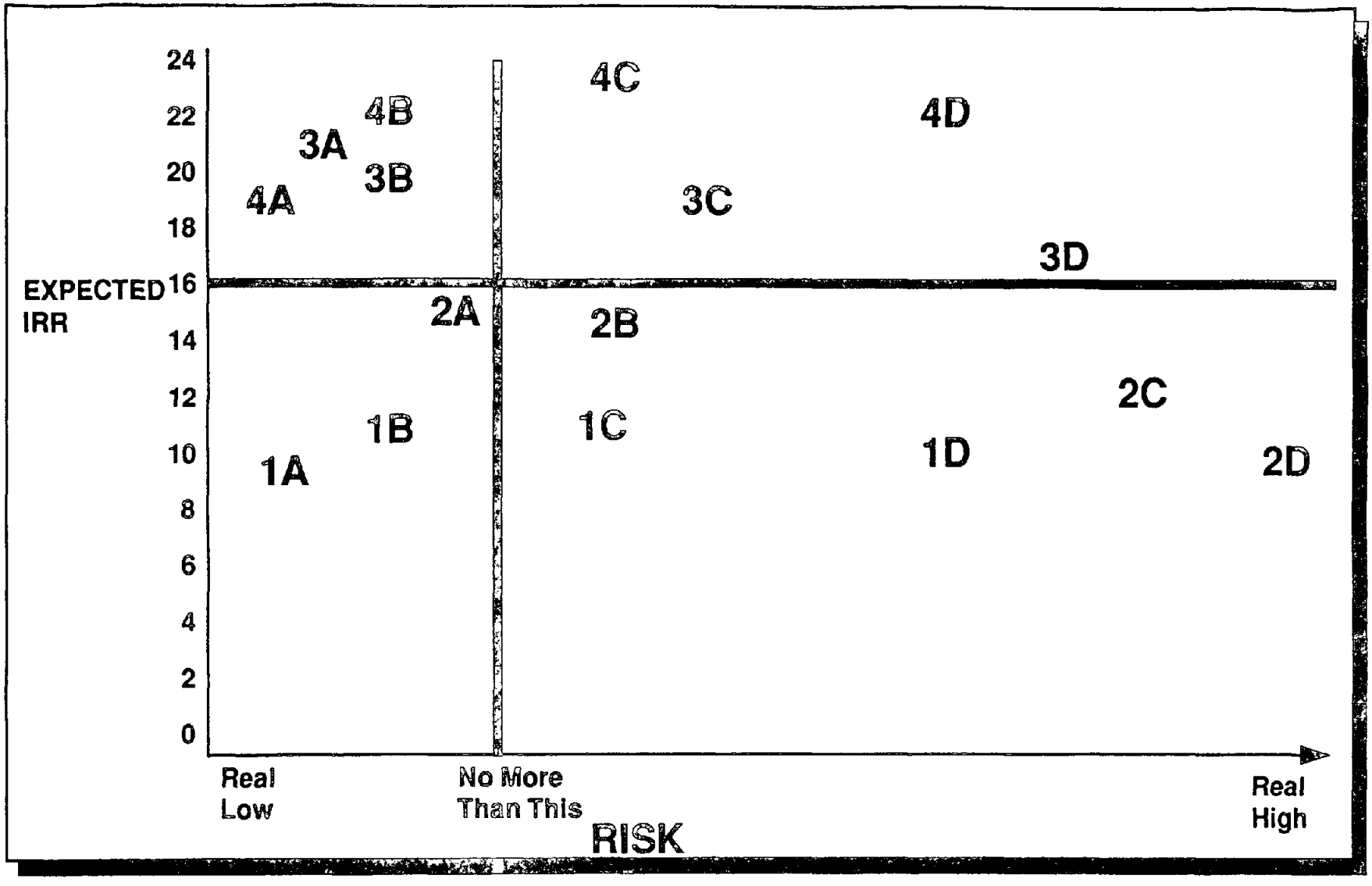
Two levers are appropriate for a short-term plan. One is pricing and the other one is investments. And I talked a little bit about different types of pricing strategies. Hold the market share or aim for growth are two typical strategies. It shouldn't surprise you that those two different strategies in pricing would result in different types of investments. A group that's going to always hold the line on price is unlikely to be able to hold long assets. The group has to grow and shrink to accommodate its need for hitting the same margins. Whereas, the group that just has set its sights on the goal -- we're going to triple in seven years -- might as well buy long bonds since the group anticipates having very positive cash flow.

There are two ways that I know of to choose between different pricing and different investment philosophies. One is utility theory. It uses some expected returns and adjusts them with some risk measures to come up with a single number. Now you can rank order all your possibilities by that number. The other method is an efficient frontier framework.

I kind of prefer an efficient frontier approach (Chart 4). Chart 4 shows, for a small group carrier, all the different possibilities that were run through a simulation model. Now, each point is labeled by a number and a letter. And the number refers to its investment policy that it'll pursue. And the letter refers to type of pricing action that you'll take over the next 18 months. And I think when you take a look at this, it's fairly easy to immediately disregard a couple of the strategies that might otherwise seem reasonable. In particular, investment strategy one can't be a good choice. That's not a rational investment vehicle. Two doesn't look very appealing either. Those both happen to be short investments. One and two as opposed to three and four are short investments, meaning a duration of about a year and a half. Three and four have a duration of about five. The difference between three and four and the difference between one and two is whether or not the portfolio contains equities. Equities not only increase the return on the account, but also they increase the volatility of the results.

CHART 4

The Efficient Frontier Diagram and Decision



Pick the combination of benchmark portfolio and credited rate strategy that produces the most attractive risk/reward tradeoff.

For the pricing strategies, basically C and D are growth strategies. And what I would say is, this doesn't tell you exactly what to do, but it does tell you that, well, there's no sense doing 4D, no rational person should choose that. You can get a higher return by coming back on your pricing strategy a little bit. Regarding the pricing strategies, when you go from A to D, what it's saying is, from A, how much do you want to stay in the market to D being now, I just want to hit my profit margins. We found it very helpful to do this on a regular basis. We tend to do this in the summer, working with each one of the product groups and developing the investment assumptions then, that will embody whatever we call the one-year plan or corporate plan. The investment people want to have some idea of what the cash flows are going to be coming out of the product area. And of course, just like most of your companies, I'm sure, it ends up being used for compensations purposes, for goals. This way we get the investment people and the marketing and product line people talking to each other. Now there's no guarantee that if you price for margin, you're going to get it. And there's no guarantee that if you price for growth, that you'll get that. But what I can tell you is, that at least you'll have a plan for different groups, different departments in your organization that have things tied together. And I think that's one of the big advantages of doing this type of modeling. One is that you understand the risks and you're able to quantify them.

Another is that you can get some insights into a contingent plan. Let me give you an example. Imagine running a small group model. It's possible just to go in and arbitrarily kill off the business after three years. Let's say that we think that that's when national health care insurance will go through. And at that point, you're in a liquidation point. By analyzing the results of a lot of simulation, you can see which companies do best at liquidation, based on their investments and their pricing, and which ones don't do so well.

Now that's a pretty important piece of information because, if you ever get to the point where you think, hey, we're about a year away from national health insurance,

now you know where you want to position the company at that time. You want to guide investments this way and guide the pricing so that you have the best chance of survival through the whole episode. I think that doing stochastic modeling in the short-term plan is a vital part of our profession. Really what we bring is an expertise on risk. And I think stochastic modeling has been kind of a weak sister through a lot of our work. We've developed target surplus formulas and pretty much assumed that there's a thing called a profit and risk charge, but there hasn't been a lot of qualitative and quantitative work. It is nothing like what has occurred on the asset side. I would encourage people to talk to some of the asset people. I mean, if you have investments inside your company, you'd be surprised at the tools that those people have laying around that you could easily modify and use in your short-term planning process.