

**RECORD OF SOCIETY OF ACTUARIES
1990 VOL. 16 NO. 4B**

**EVOLUTION OF THE PRODUCT
DEVELOPMENT PROCESS**

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This session will cover the evolution of standards and techniques in product development for life insurance.

- o Traditional cost-plus methods
- o Surplus standards
- o GAAP issues
- o Optimization techniques
- o Technologies

MR. CHRISTIAN J. DESROCHERS: For many years, the conventional actuarial wisdom was that the price at which a product was offered for sale was determined by computing a net cost to that product and adding a profit margin. Pricing was generally based on a unit cost algorithm where each unit supported some measure of the average costs incurred by the company the prior year. In practice, this worked fairly well in large companies when the environment was stable, but it was often modified for smaller companies, or when the resulting product was not sufficiently competitive to satisfy management. For actuaries pricing individual insurance, the last few years have been a time of great change. Our tools available have become increasingly more sophisticated and the distinction between corporate modeling, pricing, and actuarial appraisals has blurred. The biggest single change, however, is the application of basic economic concepts to the pricing of life insurance. We are now considering the concept of supply and demand as well as the principle that economic decisions are made at the margin. Finally, there is an increasing recognition that the price at which a company offers a product for sale is, above all, a management decision, and it is not something that is uniquely determined by mathematics or calculations.

All of the panelists will address this issue from different perspectives, and I believe you'll be very interested in what they have to say. The first speaker is Dale Hagstrom, who is a consultant with Milliman & Robertson in New York. About 10 years ago, Dale wrote a paper, called Insurance Company Growth, in which he discussed several of the concepts that we've been looking at very recently. Our second speaker will be Larry Schreiber. Larry is the Chief Actuary of the Modern Woodmen of America, a fraternal benefit society. Larry's company has recently gone through a revision of their pricing approach, and Larry is going to share his experiences with you. The third panelist is Shane Chalke, President of CHALKE Incorporated. Shane recently has had a paper published by the Society entitled Macro Pricing, which is a very thorough treatment of the economics of pricing. That paper is also used by the Society as a study note for

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students. So, with that as an introduction, I'd like to bring on Dale, who is going to talk to you about his view of the pricing process.

MR. DALE S. HAGSTROM: About 10 years ago, I wrote a paper, finally published in 1981, called Insurance Company Growth. Chris has asked me to summarize that old paper. At that time people were pricing term insurance while there was a term war going on, and they would say, "Is it worthwhile selling this thing?" And they'd just simply say "If, on the margin, I made any profit at all, it was worth doing." Also some people thought that returns were adequate as long as their return on visible surplus strain was at least the same as they got if they didn't spend the money on new business and just left it in surplus. (After tax they might earn 6% on assets in surplus.) I think it's obvious to everyone that a mutual company, at least, can only grow as fast as its return on surplus. So, if inflation is well more than 6%, your return on surplus needs to be well more than 6%. Surplus here would include capital if I was talking about a stock company. Ultimately, in the short run, the amount of growth that you can get is limited by your surplus. You can only invest so much money in commissions and first year strain before you've sold too much that year. So, in the short term, your surplus that's there on your books is very quickly a limit to growth. Obviously, longer term, the return on your surplus, in effect, tells you how much your surplus will grow. If your surplus is growing 10% a year, your liabilities can grow 10% a year, and you'll have the same leverage, or said another way, the same surplus to asset or surplus to liability ratio. If you have a good ratio, then you can maintain that same ratio by having surplus grow at a certain rate that matches your growth rate.

Suppose you have a company that isn't explicitly limited by your surplus today. There were more such companies ten years ago. The likelihood is that inflation is picking up again here, so your liabilities may be about to grow rather rapidly. Your surplus will be hard pressed to grow as rapidly because you've locked in your pricing on all your in force, and your surplus is only going to grow at a certain rate, as those locked-in profits emerge. Five years from now, you may have a surplus constraint that you don't have today just because of inflation-induced growth in liabilities or new business strain. Therefore, now is the time to start using surplus efficiently.

So, you've got the surplus constraint, and if you like, you can think of that as just being a common denominator for any other constraint you do think you're limited by. You don't have enough agents? Well, fine, you could always spend a lot of surplus and get more agents. So it comes down to having enough surplus. I would argue, not only for stock companies, for whom it's probably second nature, but for mutual companies as well, you really have to maximize your profitability, subject to that surplus constraint, if you're to be using your surplus efficiently. So, in effect, what I further suggest is to take the profits released profit study method (where you define the profit study in terms of: start with assets equal to reserves and liabilities, infuse cash whenever there's a statutory strain, and take cash out every time there's a statutory profit, so assets equal reserves every year, and the interest earned is on assets equal to reserves every year), and treat target surplus as one more form of reserve. It's admittedly not tax advantaged. Setting it up gives you no tax deduction; the interest you earn on it is not tax shielded, but only when you can release it, because the liabilities go back down, can you take it out and use it as a profit released, recognizing that target surplus is part of your pricing. Such

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establishment of target surplus is an important drag on the profitability of the product, but is reality.

Next, use an adequate discount rate, much like the growth rate you want to achieve in your surplus. (People want to grow their companies faster than inflation because they want to outrun their expenses, obviously.)

The next concept is marginal profitability. Results on the margin are all you can really manage. The only thing you're affecting as you change your price or make a product more or less attractive is profitability on the margin. However, this is where the going gets rough, because there's lots of things that affect profitability. You don't simply take a profit study and say, "Well, I'll use only those expenses that are expenses on the margin: commissions, premium taxes, a few underwriting costs, and so forth." There's a lot more than just marginal expenses that affect the calculation of marginal profitability. Shane has presented this in his paper in a practical and helpful manner. My paper was from a corporate, top down, point of view, and Shane's paper starts at the pricing process and works up. I'd like you all to go away from this session with the idea that it is going to be very important to all your companies that you really integrate the bottom up pricing work that product development, "younger" actuaries do, with the top down corporate decision making that the President or the Chief Actuary is doing. Those two sets of decisions really have to be much better linked than they are sometimes today. And Shane's approach, macropricing, is very helpful in getting those two levels together, where they can have more overlap in terms of what they're looking at, and the language they speak to each other. If you change your price a little bit, not only are you selling a few more of these policies, but you are, in addition, lowering the profit on all the policies you would have sold even at a higher price. So, on the margin, lowering price a little bit may not be profitable -- you may lose more than you gain.

Another thing that Shane's paper and my paper both refer to is the different levels of decisions. There's the individual pricing of a particular cell or a particular product, then there's other levels of decision, such as, "Should I get in this business or get out of this line of business?" Those kinds of different levels have, in effect, different marginal expenses. At the lowest level, very few expenses are marginal. Most of them are fixed in some way or another. And so when you look at that part of the decision making, you leave a lot of the expenses out. As you go to higher and higher decisions regarding blocks of business, lines of business, you'll have more and more expenses that can be gotten rid of by a decision at that level. More expenses are marginal at higher levels of decisions; or, expenses that can be added, depending on whether you're contracting or expanding, obviously.

In Shane's paper, he talks about displacement. In effect, if you make one new product more competitive, you may well displace sales on some other product that you would have had. That displacement idea is important, again, when you're trying to analyze the marginal effect of anything you're doing. In my paper, I focus on a different example -- the effect on in-force business. To the extent you change the price of new business, you potentially have a replacement problem generated by being a lot more competitive on new business. For some mutual companies, the standards of practice are that you try to link the dividends and the modifications in the existing dividend formula to what you're

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doing on new business. So, clearly, if you changed the price on new business, there potentially is a very large effect on in-force business in a participating company that keeps a strong linkage between new business and business in force.

The key in pricing, I would argue, is the sensitivity of sales volume to price, and I would argue also for some other things like persistency rates to the extent I'm extending this to in-force business. That's the hardest parameter; that's the hardest curve to generate in practice. Price sensitivity is the key to this whole marginal profitability exercise. If you don't know how volumes or surrenders or the other various things will react to the change in price, then you don't know where the optimum combination is. And, again, I give kudos to Shane's paper in terms of laying out a structure to think about it and put it in the lap of the marketing people who, while they won't have the curve either, at least will have some reactions. Shane's found a way to present it to them that I think they can deal with, without having to tell them they need to tell you a sensitivity curve. Shane's method makes the marketing department responsible, at least regarding the new sales. Firms in other industries can run test marketing in different locations and say, "Where are the tradeoffs between price and volume of selling candy or cigarettes or soda?" or whatever it is they're selling these days. It's obviously very difficult for our industry to run test markets as economically because we have high fixed costs to get a product on the system. Once you've got it on the system, you've got to administer it forever. The marginal costs, after having invested that much in the system, are so small that you say, "Why should I just sell in the state of Colorado as a little test market?" And yet, you really would like to, theoretically. If you were to do a straightforward test of how to define this curve, you would try to take two or three different states that allowed you to charge two or three different prices, and charge those different prices in three different states. And when I say price, I obviously mean the whole ball of wax -- interest rates or credits, the design of the product, commission structure, and so forth, all that price sensitivity. In theory, you could do test marketing, but it's very hard for actuaries who were brought up -- especially in mutual companies -- to say, "Well, how can I charge different prices in different states unless it's based on different experience? Certainly, a priori, I wouldn't want to do that, just to find out some mathematical curve." And yet that's, in theory, what you want. In practice, making the marketing department responsible, and setting up the problem the way Shane does in his paper, I think, is very helpful.

One point that I don't see in Shane's paper, that is the heart of my particular point of view, is that once you've done all this work (worrying about what the profitability is on the margin), you also need to look at the marginal use of surplus, because again, I'm saying your constraint is surplus. And if I do a little more of this, or I do set a price a little more competitively, or in some way or another use more surplus here because it's profitable on the margin, then -- according to my original assumption about how the company is considering surplus -- I have to do less and use less surplus someplace else. That's simply the way it works when I have a fixed sum of surplus to work with. So, what is efficient? Going back to the economics of supply and demand curves, it's a simple calculus problem. I set all the prices to get all the marginal profitabilities in relation to the marginal uses of surplus equal; then there's no tradeoff I can make that will make me better off. Whereas, if I have something up here that has a little bit more profit on the margin compared to marginal use of surplus, and one down here, I should pursue that one up here until on the margin its profitability comes down, in its relation

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to use of surplus, and do less of this one down here until on the margin I've got something that's more equal. Because once they're equal, there's no trade that I can make that improves my position. I've done the most I can. I've made efficient use of my surplus. I don't see that in Shane's paper, but I would recommend it to you as an addition, because once you've done the numerator, the marginal profitability, then the marginal use of surplus (the denominator) is easy, but it is necessary to find an efficient use of surplus. You need to work your way up, but then look at it from the total company view. This is very powerful, and unfortunately, therefore, complex to use, because really it says, look at the whole company: everything that in any way uses surplus. Do you own stock? Does that affect your target surplus? Yes. Do you go into group insurance? Does that affect your target surplus? Yes. Do you sell individual life and pay commissions and drain down surplus? Yes. All those things, using surplus one way or the other, relying on surplus, having the surplus to back you up to keep your rating, to allow you to do more junk bonds or whatever else, all those things that use surplus need to be looked at together, and for each, you must get this ratio equal, so that you can use the surplus you do have, efficiently.

That summarizes my point of view as laid out 10 years ago, and it hasn't significantly changed. I think Shane's done marvelous work in making the pricing exercise fit the framework I prefer to think in terms of. And I strongly encourage you to get those tops and bottoms together because I think that will be critical to companies in the next 10 years.

The other thing I would suggest from observation since I wrote the paper that I think is useful is not to stay only with marginal expenses. A parallel management exercise has to be expense control. There is a lot more to say than I can even hint at here. Once you've developed these products that you're going to issue, you say, "As a package, that's something I decided I want to do in the market and people have agreed this is the volume we're going to have at that price." You need to go back, and link the expenses that are in there as allowances. And then considering the other fixed expenses, that are not in there, necessarily, unless you had higher and higher decision points, you need to limit those directly. The variable expenses -- what amount to allowances in pricing -- should be linked back to actual expenses. Monitor all of these expenses, so people will feel as if their feet are held to the fire. Have it affect management compensation to get their attention. That's the other thing I think would be useful for people to be doing today.

MR. LARRY L. SCHREIBER: Chris needed a buffer between two of the heavy hitters in this area so I will share our product development process and its evolution with you.

Modern Woodmen is the sixth largest fraternal organization with \$1.5 billion in assets and \$14 billion worth of life insurance in force. Our products are limited to individual life and annuity offerings. They are distributed through a career distribution system. Lodge development and activities weigh heavily in this distribution process.

In a generalized actuarial department of 20 people, five are delegated solely to monitoring and developing products. Each actuarial position is assigned primary responsibility for monitoring and pricing a given product line. This person becomes the advocate for

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product development in his or her area of expertise. Our current divisions are flexible premium life, fixed premium life, and term and annuity product lines. Other than this minor assignment of responsibilities, Modern Woodmen is functionally organized.

HISTORIC PRODUCT DEVELOPMENT

The financial emphasis at Modern Woodmen has always focused on statutory statement results. Yet, little has been done to set specific statutory financial goals. A positive gain from operations and an increase in the "important" numbers such as premium have been sufficient to define success.

All product pricing has been done on a traditional, unit basis. The Actuarial Department has targeted a return on investment goal to be used in this pricing. The traditional methods of allocating all expenses to a unit basis have been used in the process. As is common, the decision on whether a product is profitable or not has been based on the results per unit. Little has been done to relate the present value of future unit profits to statutory statement results. The profitability of our offerings is presented to management as a lump sum of unit profits for the single, assumed sales goal.

Projects have generally been pursued based on perceived fraternal or marketing needs rather than financial rewards. Does that sound familiar? Competitiveness has often been more important than financial returns. The total effect on the organization of the project has generally not been considered. Field morale and perception of the product offerings is very important. Home office compensation is not tied directly to the financial results of the pricing.

The pricing exercise can be described as the traditional looping process that Shane has referred to in his writings. A small number of price structures are presented to an oversight committee. The usual requests to improve on those price structures are received and development loops once again. Resolution of differences is generally accomplished because of imposed deadlines or when the participants reach a "mutual level of perceived comfort." Beyond this, there is no structure for resolving differences of the concerned parties.

Once the products are designed and implemented, little follow up is done to verify the appropriateness of the pricing assumptions. Changes in actual marketing results from those assumed originally are not considered in the unit expenses. No comparisons of actual to assumed marketing results are made. Initial pricing is adjusted only for changes in experience over the life of the product. The major changes considered deal with mortality, persistency and investment experience rather than the marketing success of the product.

As might be expected, most players in the organization feel comfortable with this process. Enough conservatism or favorable experience has crept into the process to produce positive results over the years. While results have been positive, it can be debated whether they should have been better.

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SCENARIO PRICING

The latest attempt to change this process occurred during a recent revision of our annuity portfolio. Prompted by New York 126 Regulations, the Actuarial Department attempted to introduce scenario pricing techniques into the product development process. We attempted to run a given individual design through a variety of economic scenarios to review the financial impact on the organization. This was done for each individual design developed during the looping process rather than just the final design.

The output of this exercise was generally misunderstood. Means and variances resulting from many scenarios were confusing. Again, the emphasis on perceived competitiveness overrode most of the financial presentations.

One important change in the organization's product development process did occur, however. This project changed, ever so slightly, the emphasis from per unit results to aggregate, model office results. For the first time, we were getting people to realize the total financial impact on our statutory statement of a given product design.

FINANCIAL REPORTING

Allow me to digress for a moment to explain another thrust of the Actuarial Department that eventually will impact our product development process. As mentioned earlier, financial reporting is based on the statutory statement at Modern Woodmen. No other financial reporting systems are in place. Emphasis has been on what I call traditional activity measures such as premium, insurance in force, expenses, etc. These individual activity measures, by themselves, cannot describe the financial success of the organization. Management understands and is comfortable with statutory results. We have no mandated GAAP or tax reserve reporting requirements.

Because of the mixed signals produced by statutory accounting, we would like to have one internal comparison to decide financial performance. External comparisons of financial performance are not that important in our market. Further, the foreign nature of GAAP or modified-GAAP systems and their shortcomings make them inapplicable to our environment. We would also like to tie product pricing to financial results. As Dale mentioned, that's becoming more and more important. Value-added financial reporting concepts appear to be appropriate for meeting these desires.

Value-added financial reporting ties very closely with existing statutory systems and ideas. It provides source of earnings information and variances to help analyze performance internally. It values in force business, surplus use and the effectiveness of our distribution system. It is adaptable to changing circumstances and is oriented toward the future. The impact of future results can be used for strategic planning and product evaluations. Also important is the fact that it will not require a huge, expensive new reporting system to be developed.

Value-added financial reporting also ties directly to a program introduced three years ago to measure the profitability of our individual career agencies. This profitability measure evaluates agency operations and adjusts compensation accordingly. The effectiveness of each individual agency is determined by the maintenance of its existing block of business, the potential for new business and its level of expenses in relation to

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those priced into the products sold. This, too, is a value-added approach. Acceptance of this program has been mixed because the rules of the game have been changed from traditional activity measures that I mentioned, to economic value concepts mentioned by Dale.

MACROPRICING

The last piece of the product development puzzle at Modern Woodmen is macropricing. We are looking to implement these ideas into the product development process because we think they are logical extensions of the value-added and scenario pricing concepts. Macropricing is essentially project-related and looks for the total return of the project. It does not attempt to develop a unit profit value for decision making. The total cost or profit of a given project can be reflected on the statutory statement for various years into the future.

Macropricing takes us away from allocating overhead. This allocation process tends to become a sticking point in the traditional product development cycle. Macropricing allows us to consider the real life relationships between prices and sales volumes. It also requires us to look at the internal replacement of existing sales to find the total financial effect of the project. A drawback for Modern Woodmen is the increased number of calculations required of the computer modelling system. While the tools are in place to generate reams of numbers, such modelling has not yet gained credibility throughout management.

IMPLEMENTATION CONSIDERATIONS

Several important issues have developed during the implementation of value-added financial reporting and macroproduct pricing. It was necessary to get corporate level direction on these issues before implementation could continue. The issues surround the three following topics: membership growth, equity and the macroproduct pricing process itself.

Our first major development problem was that our fraternal nature emphasizes membership growth. The driving force statement of our corporate plan states that, "The dominant strategy at Modern Woodmen of America will be growth in membership of the Society . . ." Further, the plan states that we will accomplish this growth in a, "responsible fiscal manner." That's the only reference in our corporate plan to financial results. Many of you share similar concerns about increasing the number of policyholders to improve the viability of your organization. However, this focus is our primary reason for existing.

The conflict between financial and membership growth is obvious. On one extreme, we could give our products away, increase membership tremendously, and go broke in the process. On the other extreme, we could have the most profitable products in the industry, but our membership might not grow at the desired rate.

The challenge to our financial reporting and pricing systems is to balance the two. We have chosen to do this by targeting a minimum growth in membership that we will attain regardless of cost. Once this minimum membership growth is attained, we will optimize the return on investments for the remainder of our financial resources. This optimum

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return is not necessarily the maximum one, but one that satisfies our corporate surplus goals -- Balancing Surplus Usage (Chart 1).

This chart was used to help explain to management the idea of balancing growth goals. For a fraternal, surplus is the source of all investment. Our challenge is to control the flow from each spigot so that total surplus never spills from the bucket or falls below the minimum required to keep the organization going. Investments in either side will, hopefully, provide returns to the bucket. Leaks should be kept to a minimum. The pumps at the bottom should be as efficient as possible.

We realize that the membership spigot is rusty and difficult to turn. We have much more control over the alternative investment spigot. Our solution to controlling the level of surplus is to first open the membership spigot so that we attain our minimum required growth in that area. As I said, we're going to do this regardless of cost. We then open and close the alternative investment spigot. If we open it too far, surplus will fall, and we must adjust. If it is not open far enough, surplus will spill out the top.

If the alternative investment spigot is closed and surplus continues to fall, our minimum membership goal is too high, and that valve needs adjusting. Similarly, if the alternative investment spigot is wide open and surplus continues to rise, the membership goal can be raised and the spigot opened further.

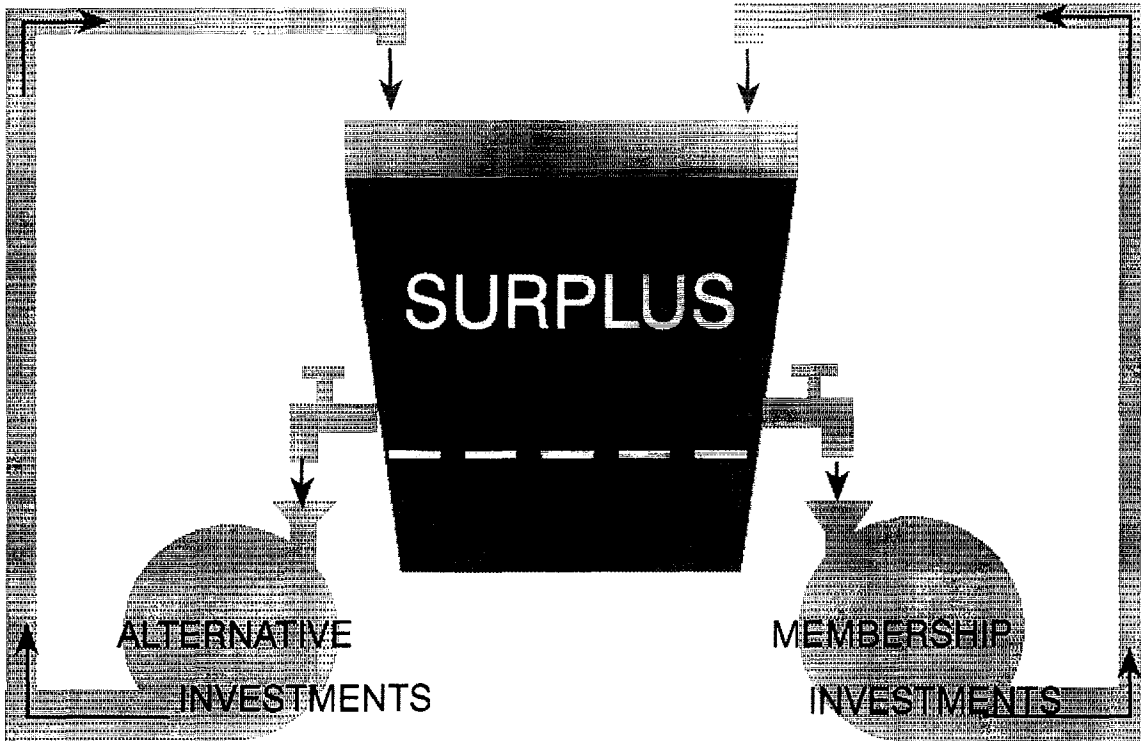
Our second major development problem dealt with member equity. I agree with Dale here. Because of our fraternal and mutual nature we realize that surplus is our only means of growth. We decided to optimize the growth of surplus to the extent membership goals and competitive position allow. This provides for the best possible growth potential of the Society. A larger surplus also provides for additional membership growth and more benefits to existing membership.

Because we are very concerned with equity, we needed to balance this growth and surplus accumulation for existing members. How much surplus should be retained and reinvested for growth and how much should be distributed to the existing membership? We believe that the pursuit of optimal surplus growth is an appropriate form of equity if the organization is better off over the long-haul. It is our intention to distribute excess surplus between generations and classes as equitably as possible when a distributable amount is determined.

The equity problem was also a consideration when setting up a macropricing product development cycle. We view the macropricing process as one in which returns from an investment are maximized. The maximization of future profits is somewhat at odds in a participating organization where profits ultimately need to be returned to the members. Dale alluded to the problem of repricing and equity for your in force business. To solve this problem, we chose to optimize future profits at issue for the block of business. "At issue" is the key here. This optimization is chosen considering the competitive constraints imposed by the market and our membership goals.

To maintain equity, we use the target profits determined at issue as our goal over the life of the block of business. Thus, we do not try to optimize profits again upon repricing.

Balancing Surplus Usage



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CHART 1

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All changes in experience are passed through to the member. This concept is similar to participating insurance. The return of favorable experience is to those that contributed to it. This contribution principle is the same as that used for our dividend paying products. Our target profits determined at issue are maintained.

As with our dividend paying products, permanent contributions to surplus are required without the expectation of benefiting from those contributions. These contributions provide for the contingency margins and vitality surplus needed to operate as a going concern. These contributions also reflect our view of equity.

The last implementation concern was the way we would apply macropricing concepts to our organization (Chart 2). In developing a macropricing grid for a variety of product designs, we found that our current practices place additional restrictions on the decisions.

Chart 3 shows the traditional macropricing decision grid. A demand curve of estimated production would be required of the Marketing Department for the suggested product designs. In the absence of external constraints, product design A might be the one chosen, i.e., the most profits are generated by this design.

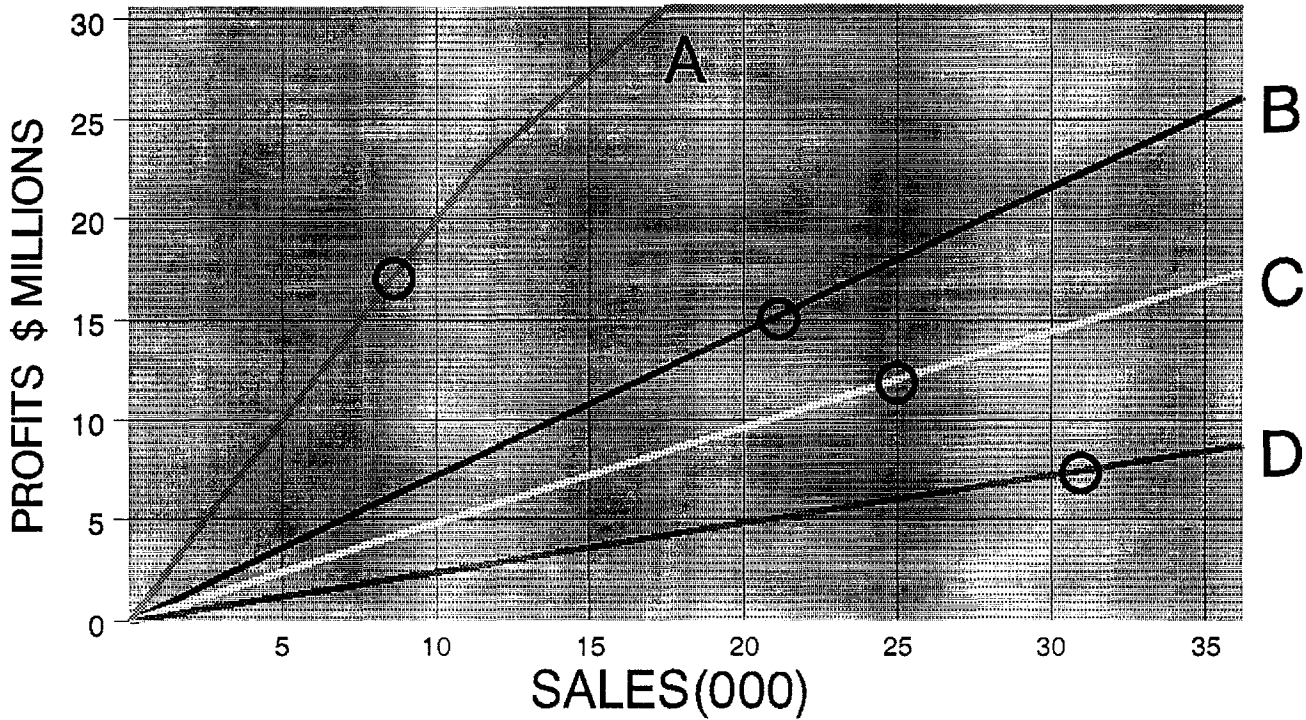
As mentioned earlier, Modern Woodmen has a constraint on the product development process in the form of a minimum membership growth requirement. This constraint draws a vertical line on our decision grid (Chart 4). Thus, it is likely that design A will not be chosen because it does not meet those minimum membership growth goals.

Finally, management has not necessarily embraced the idea of optimizing profits and remains concerned with traditional measures of success. The net result is that they may be satisfied with a product that meets minimum profit standards if that product helps the members, improves field morale, etc. This minimum profit standard may be the level of profit on products being replaced or some arbitrary amount chosen to impact surplus in a certain way. This approach draws a horizontal line on our decision grid. Now, any combination of product design and sales that fall in the upper right-hand corner of the grid will be acceptable to management. Pricing does not have to provide the maximum return possible, just one that satisfies our corporate profit goals.

In this example, it is likely that design C would be chosen over design B because of our traditional slant toward more activity rather than more profit. In practice, we will probably present the decision grid to Marketing with the horizontal and vertical constraints as well as the profit curves. This will give them an idea of production requirements before committing to a given design.

While this sounds good on paper, the actual implementation of the system has yet to be accomplished. Since such implementation is not a top-down request, care is being taken to explain the ideas to senior management as we proceed. Initial concerns surround the accuracy of using computer models and a reluctance to buy into fancy theory without seeing concrete results. To increase the comfort level, a system that recreates historic results is a high priority. To be successful, the entire organization must understand and buy into the results.

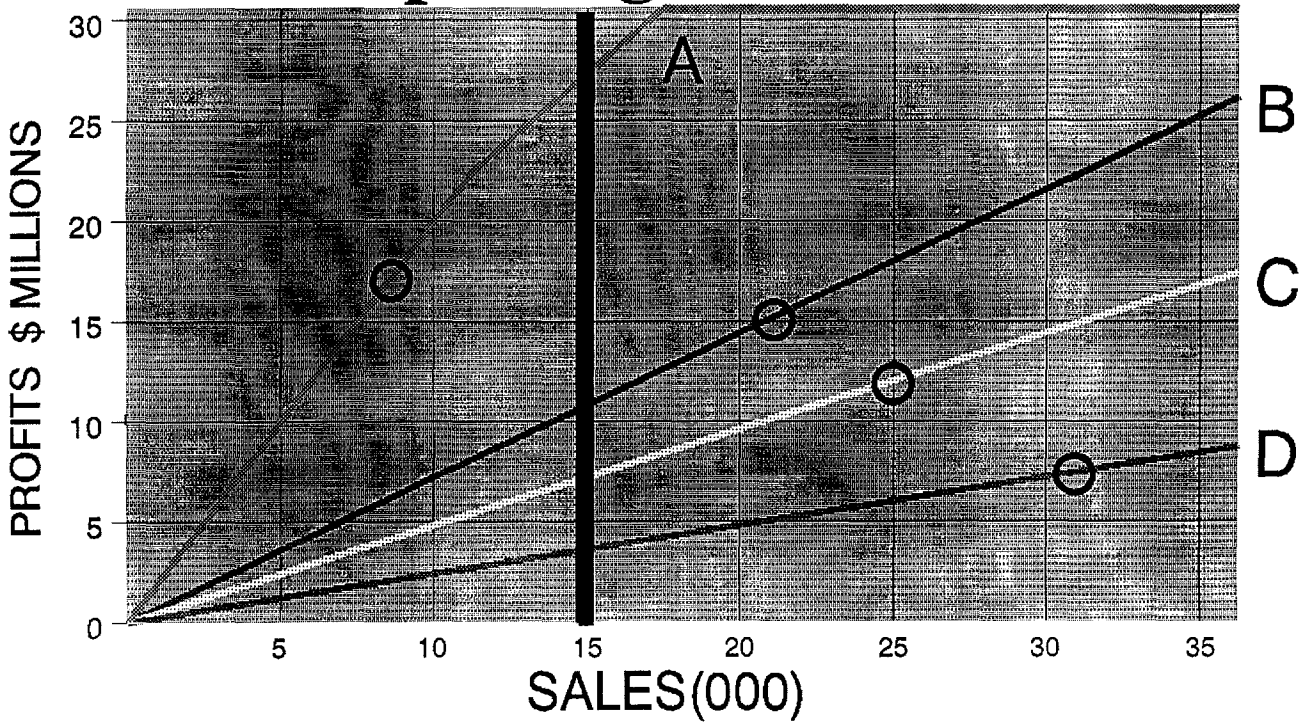
Macropricing Decision Grid



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CHART 2

Macropricing Decision Grid



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CHART 3

Macropricing Decision Grid

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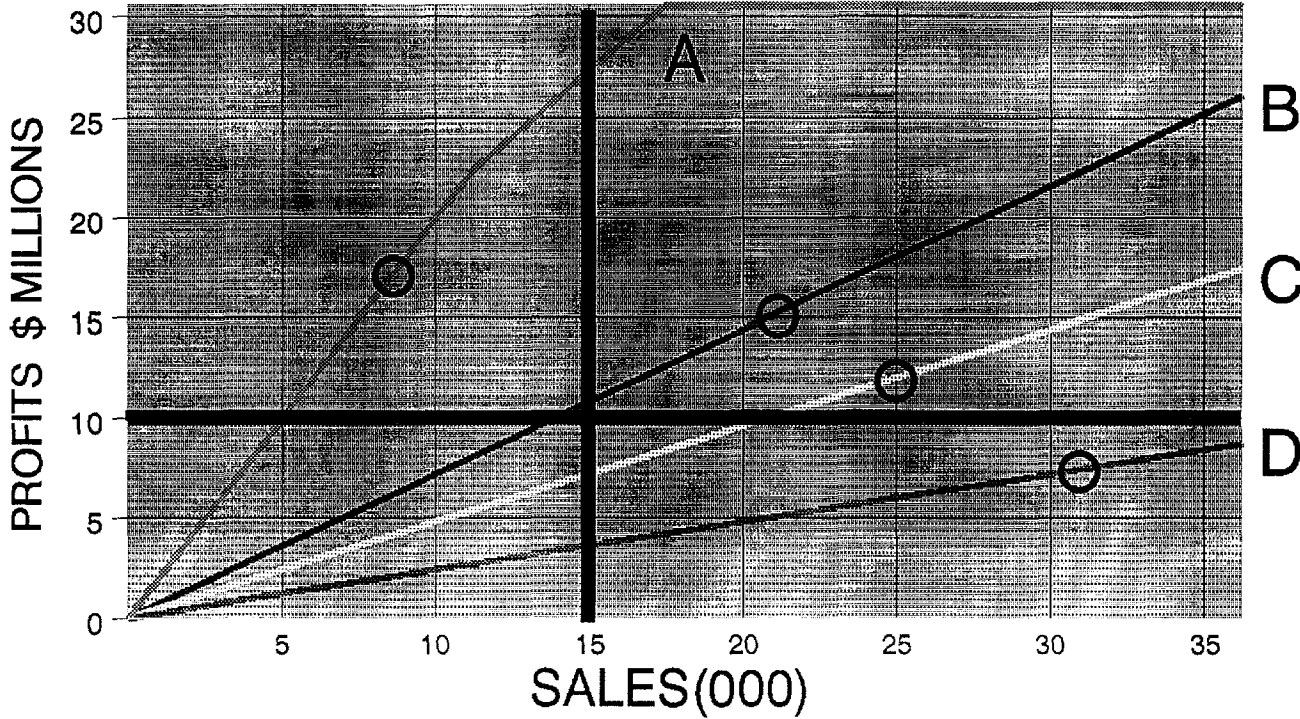


CHART 4

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Our goal is to produce a credible system that can be used to predict the financial impact of our product development efforts accurately. Such a system should improve the product development process by increasing accountability. Eventually, compensation should be tied to these results. Time will tell if we are successful.

MR. DESROCHERS: The final speaker on our program is Shane Chalke.

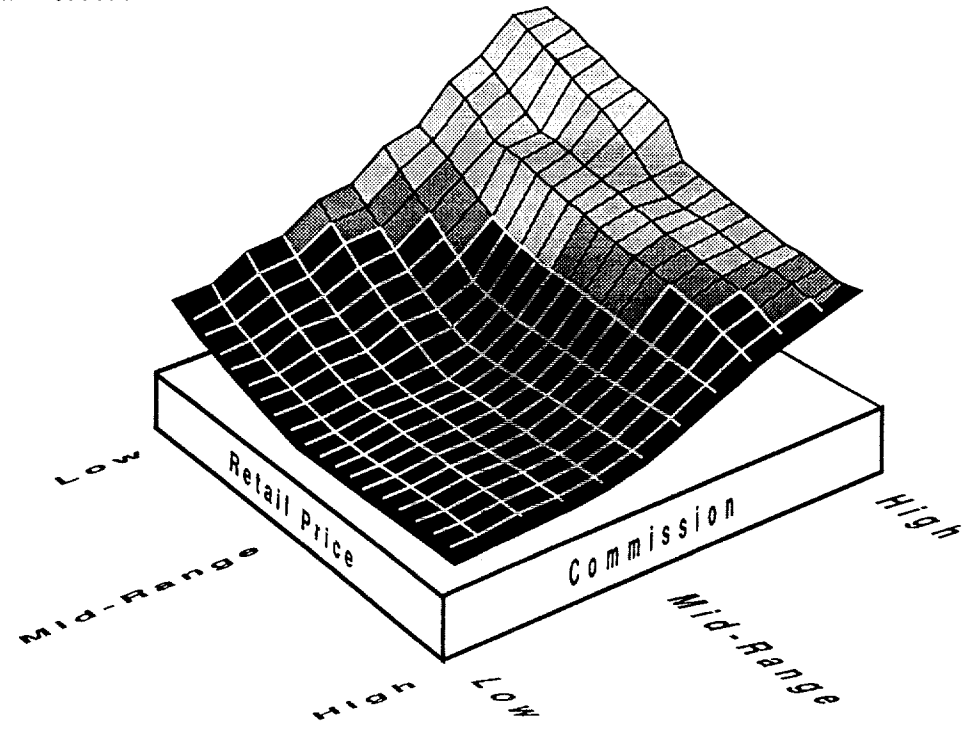
MR. SHANE A. CHALKE: It's kind of mind boggling to me to realize that I was standing up here five or six years ago in front of a very hostile crowd, trying to defend myself as best I could on these ideas, and now we're talking about the traditional macropricing grid.

I'm going to talk about macropricing. I'm still in the mode of trying to defend myself, but maybe I don't have to do that so much anymore. What's happened in the past few years? Well, what has happened is that macropricing is starting to gain some acceptance, not nearly as widespread as you might be led to believe by this panel so far, but it's gaining a certain amount of acceptance. I won't dwell on it, but I do want to mention just a couple things. The most important thing about macropricing is that we want to recognize the law of demand, price elasticity. In the macropricing process, we've embodied this idea by developing a new set of fundamental techniques for pricing. Looking at things on a project basis, optimization of profit is really the key. But, still even today, this idea about marginal expenses is rather controversial. And, as I mentioned, there may come a day when those final actuaries realize that, yes indeed, life is truly marginal.

People in their personal decisions tend to make marginal decisions. I mean, can you imagine if you were sitting in your home with your husband or wife, and you're just getting home from work. You're trying to decide what to do for the evening, and maybe the wife says, "Well, let's just stay home this evening." Well, do you go through this kind of analytical process? Do you take your monthly mortgage payment and divide by 29 or 30, then take the price of your college education and divide by life expectancy, develop a unit cost for living, and you say, "Well, that cost is about \$272 a day. We can't afford to stay home, we'd better go out to dinner, because that only costs a hundred bucks." That's the kind of decision that gets made when you take into account this ugly little animal called overhead.

In essence, the crux of the method is to try to bring into play the demand surface of life insurance at the wholesale and retail level. When I began developing these ideas, maybe 10 or 11 years ago, I thought that I'd start with this picture (Chart 5). All you have to do is push this little forward button on the slide projector and you can convert it to a total profitability graph (Chart 6). We can easily choose the optimal price. As time told, that technique worked very poorly. There's an imaginative aspect to macropricing. By changing the actuary's role to analyze a complete range of prices, throw the decision into marketing's lap by showing them the cost involved in any particular price selection decision. These days the process looks a little bit more like this (Chart 7). We'd begin by coming up with a graph which shows what it's really worth to the company, for various production scenarios and various price structures. Next (Chart 8) we convert it to a graph like this, which we then show to the marketing department. This shows retail and

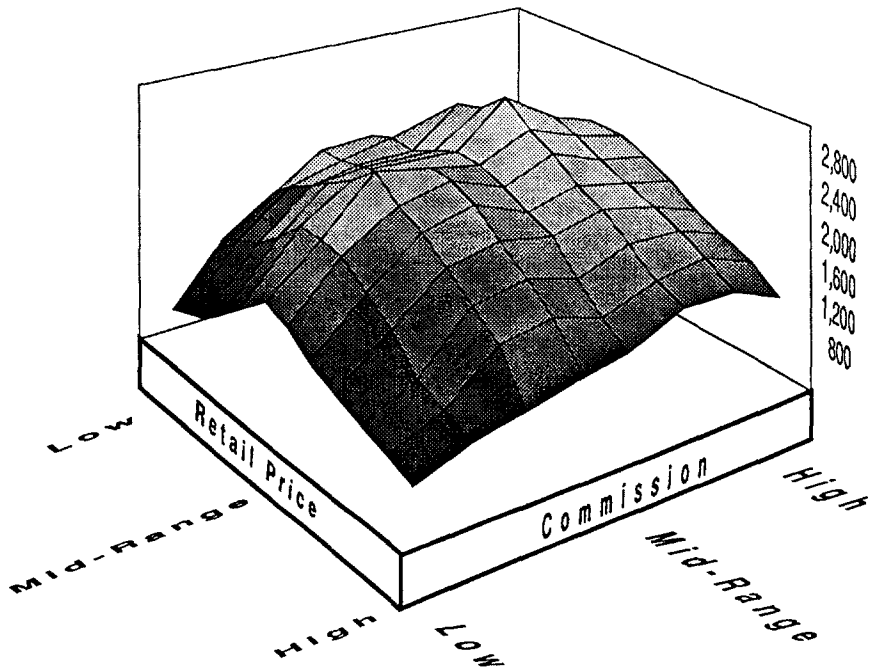
LIFE PRODUCT DEMAND SURFACE
Premium Production



PANEL DISCUSSION
CHART 5

TOTAL PROFITABILITY

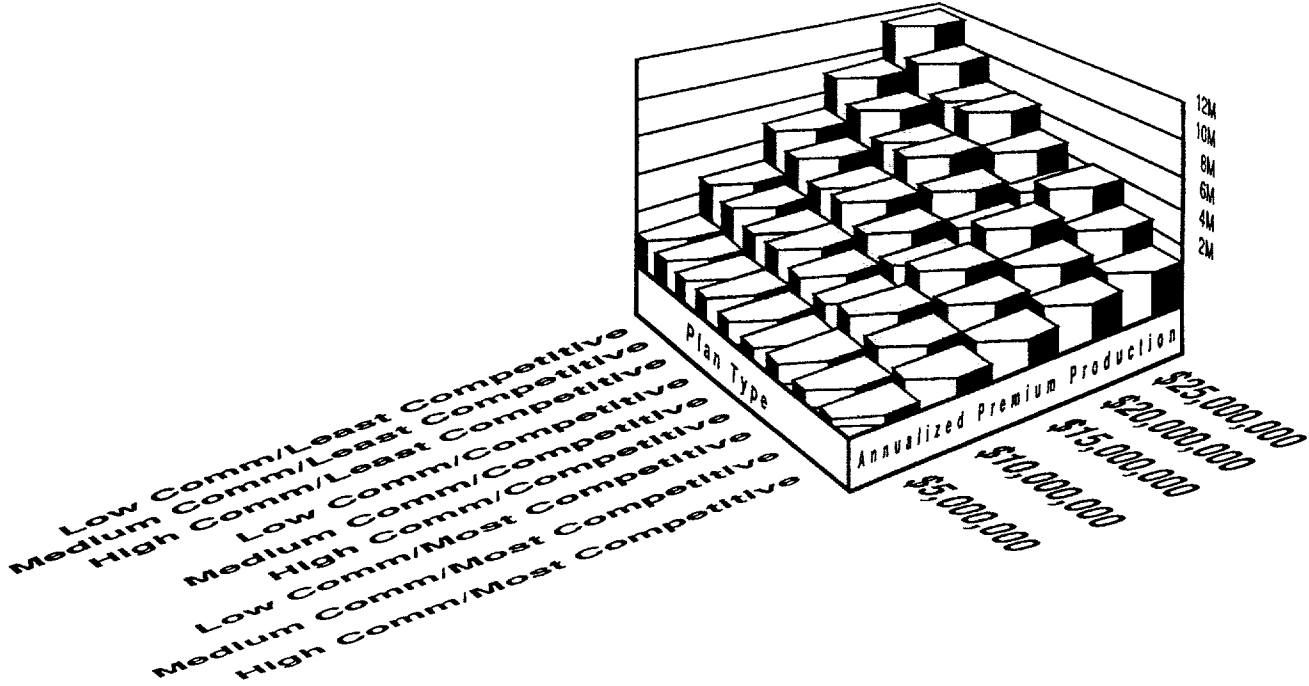
Profits



EVOLUTION OF THE PRODUCT DEVELOPMENT PROCESS
CHART 6

PROPOSED UL PRODUCT
Marginal Value Added

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PANEL DISCUSSION
 CHART 7

PROPOSED UL PRODUCT

Production Level to attain \$10 M Marginal Value Added

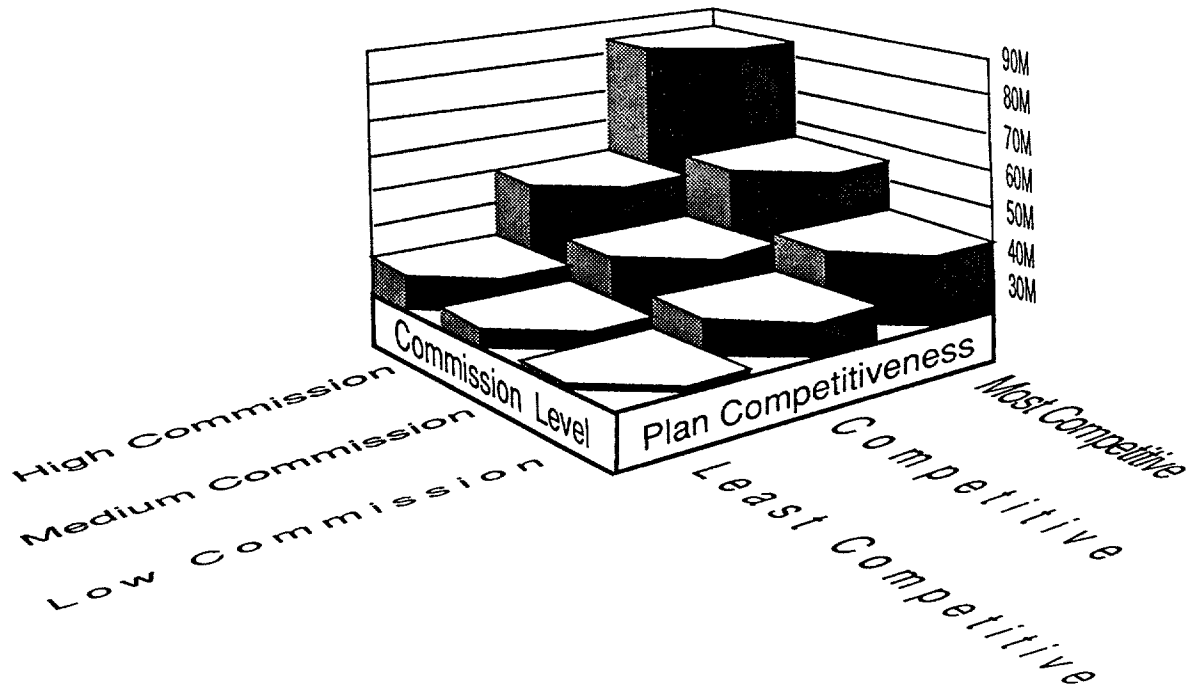


CHART 8

EVOLUTION OF THE PRODUCT DEVELOPMENT PROCESS

PANEL DISCUSSION

wholesale price, what their marketing goal will have to be in order to leave the company neutral between this and other price structures.

Here's what the algorithm looks like (Chart 9). This algorithm has many good algorithmic features. It has some nice boxes and arrows, and I think that's important for any algorithm.

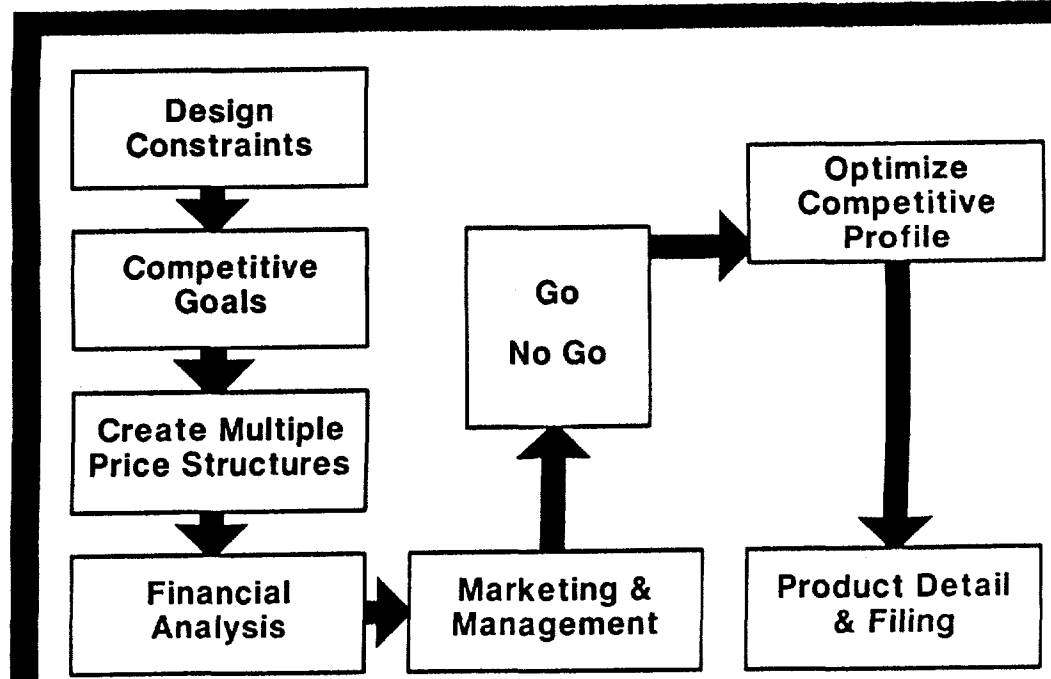
Now I want to talk about what I wish would happen. Hopefully, I can be a little controversial, and maybe get a whole group of people disagreeing with me again. That'll spur me on for another five years. What we find exciting at the moment is the application of financial technologies to the insurance product development process, or the pricing process. Amongst the financial technologies that we can apply, of particular interest to the actuary standing in front of you is the application of option pricing techniques to product development. I'll start by showing you a little bit of option pricing application that is perhaps more typical in this day and age. We'll begin in asset liability work, just to set the stage for how we then convert that to integration into the product development process.

What does option pricing seek to do? Many of you are familiar with the technology, because it is of great interest to actuaries at this time. What option pricing seeks to do is really to explain market prices. Option pricing models are designed to develop a simulated market price for a group of cash flows, in relation to observable prices of other securities.

These pricing models are quite useful. When you expand the option pricing concept to look at not only the value of a set of cash flows, but how that value changes with changing interest rates, things get interesting. A technique that has been used to a fair degree in asset/liability management is that which is known as a price behavior curve. You might see something that looks like this (Chart 10). This is what a price behavior curve for a callable bond might look like. The little "i" might be the interest rate today. The value of the security is, as we assume an instantaneous shift in interest rates up and down, how the price and value of that security changes.

This kind of a graph, right from the shape of the graph, option adjusted duration and convexity, with durations just the negative of the slope of that curve divided by price and convexity, needs no explanation to an actuary. In asset/liability management, typically, this is not the end of the story. We'll take the price curve for a single asset (Chart 11), a group of assets or whole portfolio, and we'll compare that with the price curve of a liability stream which, by the way, is far more difficult to get, but very interesting. If we go the extra step of overlaying the two (Chart 12), we can look at that shaded area in the center, which is actually sort of our economic value or economic surplus. See what happens to that economic surplus as interest rates shift up and down. The way that this is generally applied in asset/liability management is that we've used this as a tool to begin to recognize what forms of insurance might be appropriate to purchase for the insurance company themselves to insure against interest rate risk. In general, techniques might use interest rate derivatives, caps, floors, swaps or IOs (Interest Only Pieces), to reform the shape of the asset price behavior curve (Chart 13).

MACRO PRICING ALGORITHM



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EVOLUTION OF THE PRODUCT DEVELOPMENT PROCESS
CHART 9

PANEL DISCUSSION

CHART 10

PRICE CURVE CALLABLE BOND

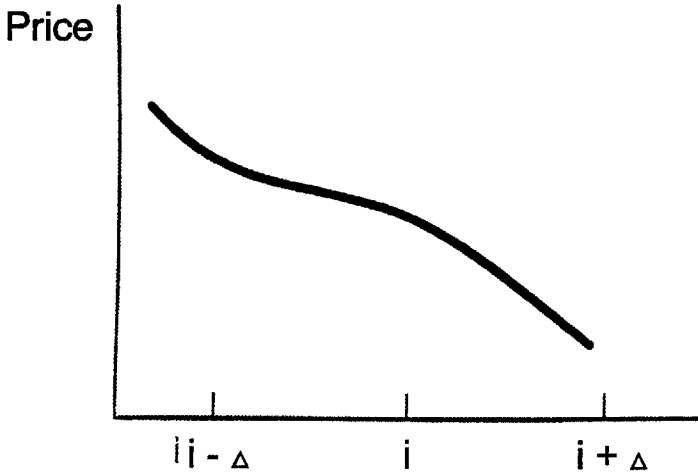
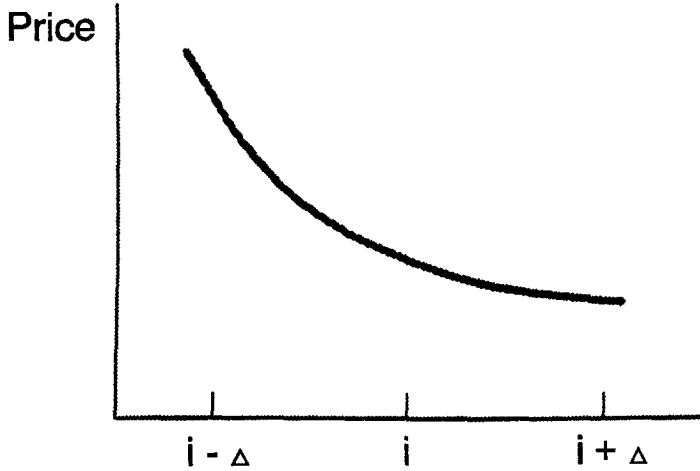


CHART 11

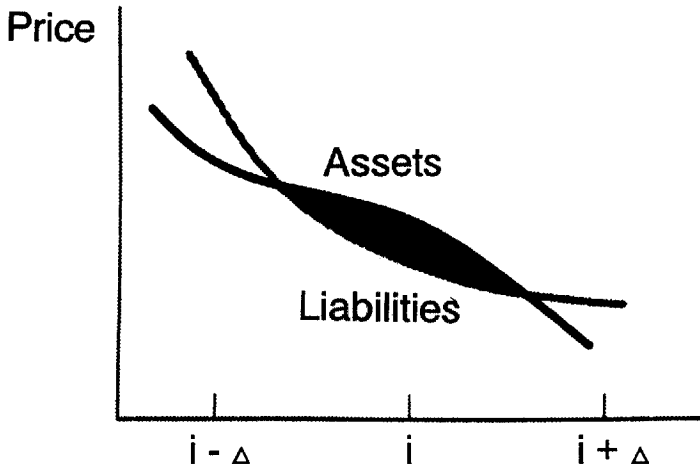
PRICE CURVE SPDA



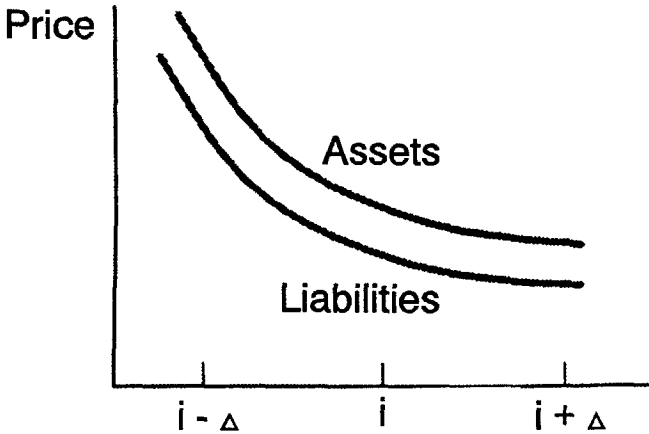
PANEL DISCUSSION

CHART 12

PRICE CURVE ASSET/LIABILITY



PRICE CURVE ASSET/LIABILITY WITH CAPS/FLOORS



PANEL DISCUSSION

That's where the emphasis has been with asset/liability management and the application of option pricing techniques. I think that there are many more exciting applications of this technology, and if we shift our interest from reformation of the asset price behavior curve to reformation of the liability price behavior curve, we find ourselves squarely in the product development actuaries' camp. There's a lot of things that we can do that have very dramatic effects on the types of risks that the company assumes. There are many factors that affect liability price behavior. This is just a very short list. Things like bailouts and the form of crediting interest, how much interest you credit, withdrawal provisions, loan provision. Anything that is optional in nature to the policyholder has quite an effect on the shape of this liability price behavior curve. I have a couple examples as to how the shape of these curves might change with the addition or deletion of certain options.

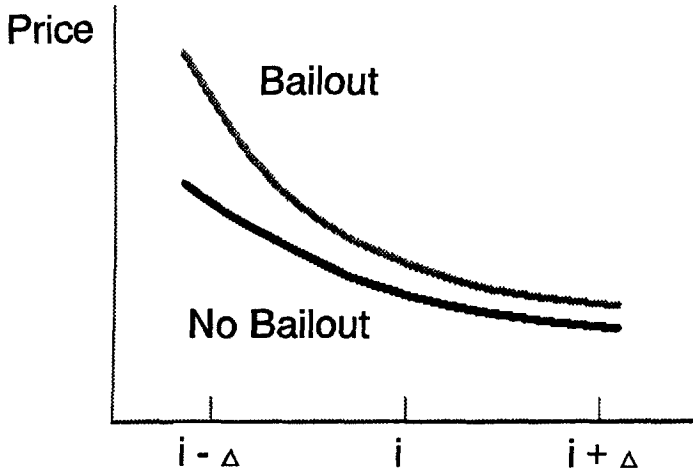
I'll start with the bailout provision on an annuity (Chart 14). With the bailout, we find a couple effects. We find that the liability stream as a whole gets more costly. Because we're applying option pricing techniques, an option, even when it's distant from the money, will result in some nonzero values.

We find that the curve is generally higher overall, and as interest rates drop, the distance between the curves expands. If we were to look at a preferred partial surrender provision, we find that has an impact on the opposite side of the curve. You can experience large changes in the behavior of the economic cost of liabilities. Now, what does this have to do with product pricing? These graphs are generally portrayed in terms of after issue type analysis. This SPD (Summary Plan Description) has already been issued, which is why it's a net liability to us. It's very interesting to look at price curves for liability stream prior to issue, and this now comes in under the realm of pricing decision. Next, we transform this into what the identical product looked like the second before we issued it. And I'm also going to swap the sign of the graph to look at it in terms of an asset instead of as a liability. And I end up with this. Kind of interesting. It's really something like the mirror image of the graph adjusted for premium, in a certain sense. Now I have something that I can work with in the pricing realm. I'm faced with a decision as to whether I should have a preferred partial withdrawal provision or not? I can begin by looking at the relationship between these two curves (Chart 15). At first glance, I might say I'd rather not have the withdrawal, because not only is the product as a whole worth more to me, it retains value for a wider interest rate swing. However, life is, again, not that simple because we have that niggly little thing called the law of demand which states that as you raise the price, you sell less. In fact, removing an option from a product is the same thing as raising the price, if you think of price as the whole collection of value that you're providing to your wholesale intermediary or to your consumer.

So, if you take this chart and apply a little bit of macropricing theory to it, you'll have less production than if I have the withdrawal (Chart 16). I would now analyze or develop a price curve without the withdrawal for a different amount of production than I would with the withdrawal. My picture gets a little stickier and a little bit more difficult to interpret when I do that, because I might end up in a situation like Chart 17. Now I've increased the difficulty in trying to assess which curve I prefer, because although without the withdrawal I continue to preserve a positive value along a wider array of

CHART 14

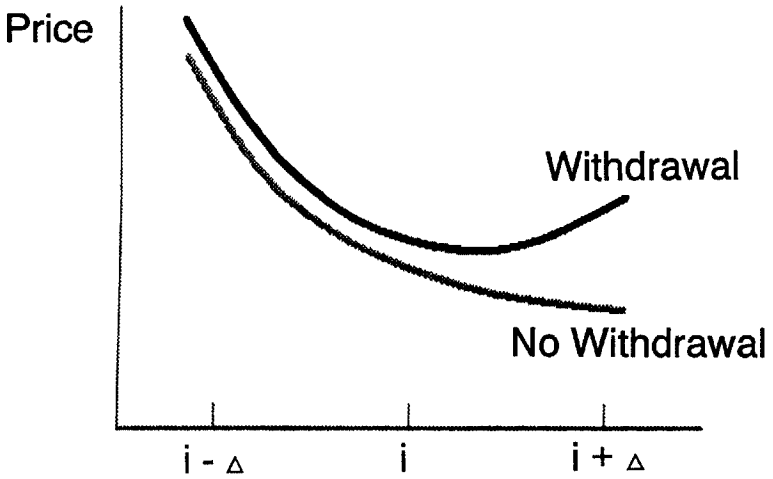
PRICE CURVE SPDA



PANEL DISCUSSION

CHART 15

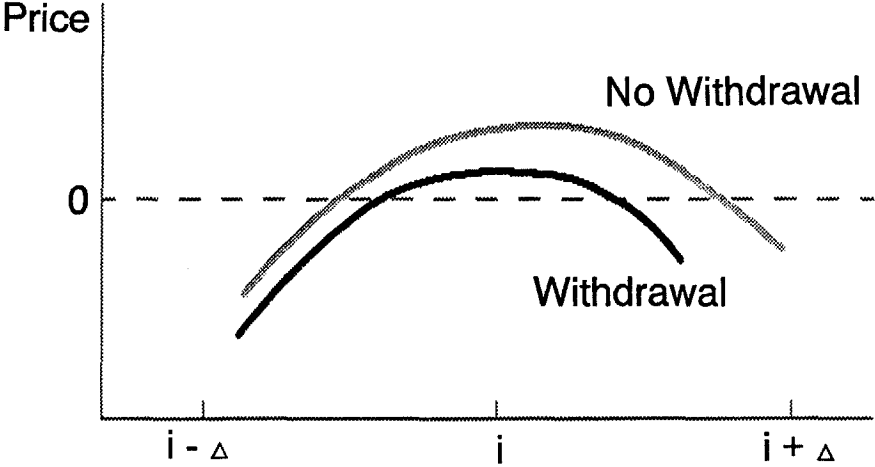
PRICE CURVE SPDA



EVOLUTION OF THE PRODUCT DEVELOPMENT PROCESS

CHART 16

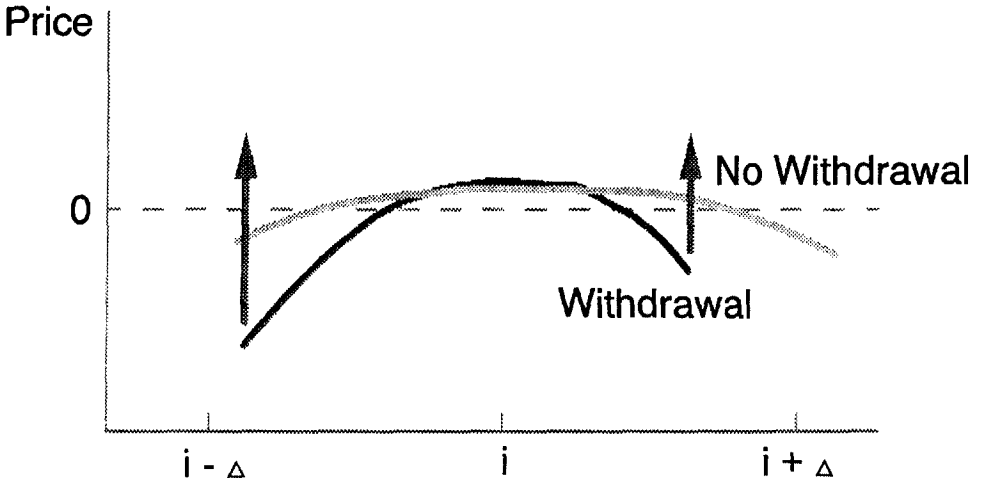
PRICE CURVE SPDA



PANEL DISCUSSION

CHART 17

PRICE CURVE SPDA



EVOLUTION OF THE PRODUCT DEVELOPMENT PROCESS

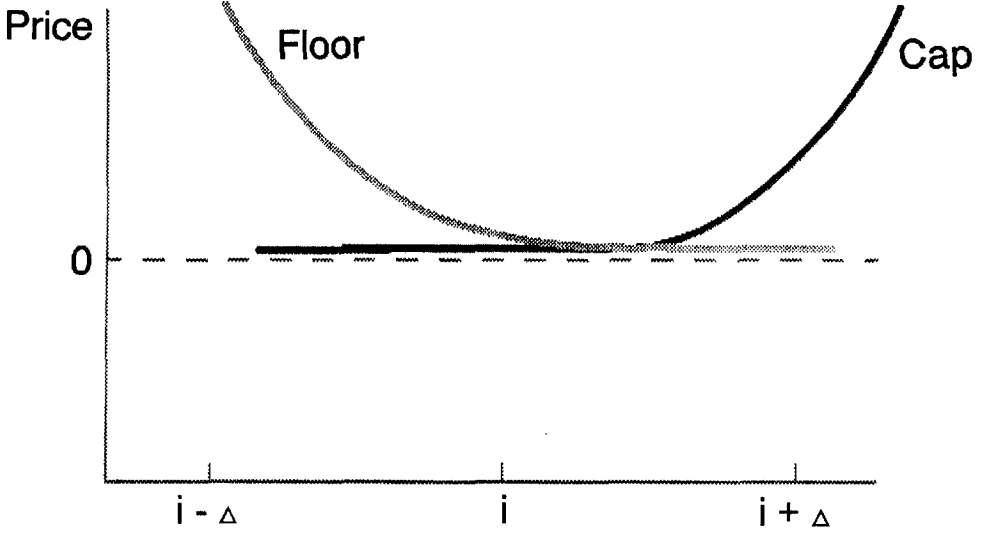
economic conditions, at the central point I don't have as much value. If nothing changes, I don't have as much economic value at the central point. So how do I proceed to make such a comparison to decide whether I want this feature in my product or not? I would move that it's very difficult to compare distributions of things. What I would seek to do is to create a situation where these two curves are of the same shape. Once they're of the same shape, then I can determine which curve it is that I prefer. A way that I can do this is by putting little arrows in the slide and pulling those lines up. The way to actually do this economically is to look at various asset forms that might counteract the shape of that curve with withdrawals, and see what it takes in terms of asset vehicles in order to reform the shape of that liability curve with the withdrawals so that it parallels the one without the withdrawals. In this particular case (Chart 18), I used interest rate caps and floors because they have opposite price behavior to the withdrawal feature in my SPDA (Single Premium Deferred Annuity). So, if I look at something which is surprising at all, price behavior curves for interest rate caps and interest rate floors, I can see that these are tools that control the price of that liability curve, after applying them at the right strike prices for the right durations and in the right amounts. By applying these in judicious amounts, I can change the shape of the curve so it's parallel to the other. Then, I want to subtract from that curve the price of the asset forms necessary to make the curves parallel. The end result is that I end up with a picture that looks something like Chart 19. What I've done is supplemented the withdrawal curve with judicious amounts of interest rate caps and interest rate floors, and then I looked in the market and got a rough idea as to what these caps and floors cost, and subtracted the cost from that curve with the withdrawal. I have two curves that are parallel, and now I have something which is mentally comparable. I can look at these two and say that I'm pretty sure that I have a greater degree of comfort with the no withdrawal curve. This is just an illustrative example.

I do believe that this is a fairly powerful technique of dealing with the cost of options and products that we sell, as well as things that we may not even consider as direct options. Things like do you credit interest on investment generation basis or portfolio basis, or some kind of a new money marginal rate to the whole bucket of money? The different ways of dealing with features on liability streams have enormous impact on how the value or the worth of this liability stream will change in changing environments. As I compare the behavior of the liability value, with and without various features, I can begin to compare integrating this into macropricing process, and determining things like the way of managing the business and what features will actually result in optimal value to the company.

PANEL DISCUSSION

CHART 18

PRICE CURVE CAP/FLOOR



PRICE CURVE SPDA

