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Setting Retention Limits for Individual Life and Disability Income Reinsurance

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Summary: This session discusses the significant considerations of setting retention limits for individual life and disability income (DI) reinsurance. Areas covered are industry practices, statistical considerations, and management issues.

Mr. James L. Sweeney: Bob Beal has over 20 years of experience in managing all facets of individual income. He is currently with Milliman and Robertson in Portland, Maine. He will be speaking about some of the theoretical and practical aspects of setting a retention level for individual disability income.

The second speaker is Richard Letarte. He is vice president and actuary from the Munich Re Organization here in Montreal. He services customers in Quebec and in the remainder of Canada. Richard will speak about what companies are actually doing in Canada.

I work with Munich American in Atlanta. We service the U.S. market, and I will talk about current U.S. practice and how that has changed over the last couple of years.

I will begin by speaking about a recent reinsurance survey that Munich American conducted. It is our fourth survey on retention limits. The third survey was done

five years ago in 1992. We finished the compilation of the survey and will be publishing it shortly.

Munich American sent a survey form to about 300 companies in the U.S., and 120 companies responded to that survey. That's roughly the same number that responded in 1992. We asked a number of questions. It was a fairly extensive questionnaire for each line of business. We'll talk about ordinary life and disability income. If we have a little bit of time, we may look at the accidental death benefit and AD&D lines.

For ordinary life, we compared the retention that companies have set with their assets, their in-force business, and their capital and surplus. We will compare the 1997 results with the results in 1992. I remind you that this is an empirical survey of actual retention limits the companies have set. I don't offer any theoretical background as to why companies are setting that kind of retention, although I will make some observations. Individual companies may have done their own theoretical analysis similar to what Bob will speak about.

Let's discuss the distribution of the 120 respondents by their capital and surplus. There are a small number of companies who did not report their capital and surplus, and it wasn't in our database, so it's considered unknown. As compared with the 1992 survey, more companies have capital and surplus of more than $200 million. The largest single group of companies, of course, are the companies with $10–50 million of capital and surplus. This mix of companies is a little bit different from the 1992 survey, and I think this fact reflects the consolidation that has taken place in the insurance marketplace over the last five years. The bigger companies are getting bigger and the smaller companies are remaining small.

We also studied the same respondents in a distribution by total assets of the company. There are many more companies that have assets greater than $5 billion represented in this survey than in the earlier one. There are also a greater number of companies who had assets less than $500 million, but in the range between $500 million and $5 billion, there are fewer companies in the survey. Again, I would assert that this might be a result of the consolidation in the industry.

I wanted to mention an interesting fact concerning ordinary life. We know from the American Council of Life Insurance (ACLI) that ordinary life sales have been relatively flat the last five years. The ACLI figures show roughly a trillion dollars being sold in 1992, and $1.1 trillion in 1996. That's the current estimate that I have from the ACLI for 1996. That is very small growth in the last five years. On the other hand, the reinsurance section of the Society has sponsored a survey measuring recurring reinsurance production for ordinary life. The production has gone from

$150 billion to slightly over $350 billion in 1996, according to our estimates. This shows that despite the fact that companies are getting larger, there is more business being reinsured.

I studied the percentage of ordinary life sales that are reinsured. I graphed reinsurance sales as reported by the SOA and as a percentage of the ACLIs ordinary life sales. I'll only discuss the last five years for demonstration purposes. In 1992–93, roughly 15% of the new sales are reinsured. Roughly one-third of the business is currently being reinsured. That's a big increase in the sales. I went back, although I did not graph it, and looked at the 1988–92 period and found out that roughly 15% was a good historical benchmark up until 1992. After 1992, the percentage of new business reinsured grew rapidly, despite the fact that companies are larger in size.

I would guess that the reason for the growth in reinsurance might have something to do with the price of reinsurance. We asked in our survey, for the first time in 1996, whether your company has a quota share type of retention. We found out that 34 of the 105 companies in the life insurance marketplace, used quota share. Many of these 34 companies are some of the very largest companies in the industry and they are producing a great deal of business; therefore they are generating a great deal of the reinsurance. Of the 34 companies that did quota share, 33 of them did it on term business and some did it on permanent-type products. Only one company kept their full retention on term and reinsured their permanent product on a quota share basis.

Another question that we asked the companies was what is your normal ordinary life retention, notwithstanding a quota share arrangement? I graphed the distribution by retention levels. The most prevalent retention limit is somewhere between $250,000 and $500,000. The next most popular retention is between $100,000 and $250,000. These results have not changed too much over the last five years. So even if companies are not doing quota share reinsurance, they really have not, despite becoming larger, increased their retention significantly in the last five years.

Although the study shows that there is a large variation in the retention level of the 105 companies, we tried to make some sense out of the numbers that came in. We tried to ascertain some reason why companies may be more or less risk adverse. Obviously, the tolerance level at which the chief executive officer (CEO) can sleep at night is a big factor. The pricing assumptions, particularly with preferred underwriting, may be another factor. Other factors include whether the company considers ordinary life as being a core business or a profit center. Obviously, the

price of reinsurance must be considered as a factor in determining a company's retention.

We took each of the 105 companies' retention, and compared it with its capital and surplus, its assets and its ordinary in-force business. We rated the companies from the most risk adverse (that is, the companies that had the lowest ratios), to the wildest swingers in the marketplace. The median retention, which would put you at 50% level, is a retention of $300 per $100,000 of capital and surplus. I think that would be 0.3%. Another way of expressing it as a percentage of the assets is having a retention of $30 per $1 million of assets or $40 per $1 million of ordinary in-force business. Again, I mention that there are large variations among companies. There was one company that had a retention of $1 per $1 million of in-force business, and another company indicated that their retention was a million dollars per million dollars of in-force business. That is an unlimited retention. So these formulas will put your retention in the median percentile of all companies.

I tried to do some multiple linear regression on retention limits. I tried to make some sense of what companies are doing. We examined not only the capital and surplus and ordinary life premiums, but we also looked at other factors such as assets and ordinary in-force business. We did multiple regression and found that this formula gave us the best ratio and had an R-squared ratio of 0.9988. Retention is 0.085% of your capital and surplus plus 0.26% of your ordinary life premium.

Statistically speaking, it made sense. We then went back to the 105 companies, looked at their actual retention and compared it with the formula. For some companies, the formula predicted the retention within $500, and there were some companies whose ordinary life retention was off by $5.5 million from what the formula would predict. Those tended to be the larger companies. It is just a representative sample of what companies may be doing.

It has been our practice to ask companies whether they graded their retention by age, table rating, or by plan. Fifty-five percent of the companies did grade their retention by one or more of those factors. Thirty-two percent did not grade; that is, they had a single retention regardless of age or table rating. Thirteen percent of the companies did not answer the question. Half of those companies that graded their retention used a combination of age and table rating. That is, they may reduce their retention at age 60 or 70, and they may reduce their retention at a table rating of eight or higher. The others used either age or rating, but not both.

We also surveyed disability income retention practices. We found that of the 120 companies that we asked, only 26 companies (or about 20%) retained any individual disability income. There were 13 companies who indicated that they

wrote some disability income, but they did not retain any of it. They reinsured all of it. One of the reasons for this may be the marketing and distribution arrangements, that we've read about. It's also a possibility that the companies may have reinsured their existing disability insurance.

There has been a tremendous consolidation in the disability income business in the last five years. Nevertheless, we went ahead and measured those 39 companies. The most common retention for companies in the disability income business is zero. The number of companies who have a retention of less than $1,000 per month has significantly reduced in the last five years. The distribution has definitely changed because of the fact that there are fewer companies in the marketplace. There's only one company that reported keeping more than $10,000 a month in our survey.

The final question that we asked in the survey was about catastrophe reinsurance. About 62% of the companies said they had catastrophe coverage for their ordinary line of business, and 37.5% said they had catastrophe reinsurance coverage for their group business. However, both of those percentages are smaller than reported in 1992.

In conclusion, what we determined from our survey was that the life insurance industry in the U.S. is consolidating, which results in larger or smaller insurance companies. There are fewer and fewer companies in the middle. This would normally mean that retention limits would go up, and you would see much less reinsurance. Our survey and the numbers from the ACLI and the Society indicate just the opposite. There is much more quota share in the ordinary life marketplace. There's much more zero retention in disability income. Those companies who do keep a retention, in the aggregate, have not increased their retention limits over the last five years. It has been an interesting experience for us doing the survey. For us, it is a counterintuitive conclusion. I'll turn this discussion over to Richard Letarte, who will talk about the Canadian experience.

Mr. Richard Letarte: My part of the presentation relates to a study of the retention level of insurance companies in Canada. As opposed to what Jim has done in the U.S., we haven't done a survey because there are fewer companies in Canada. It was easier for us to take the information that we have on file for most of the companies and compile the results.

First, I would like to present to you the results of our study on different retention levels for each of the major lines of business, which would be individual life, individual disability insurance, group life, and group long-term disability (LTD). For the last three lines of business, however, we only have information on a few

companies, so we'll just give you whatever we have. There is more detail on individual life retention, and we compared it, as Jim did, with assets and surplus. Also, we wanted to note the differences between Canada and the U.S. in setting the retention.

However, when we started comparing our results, we found that there are many more similarities than differences between the two countries. First of all, we looked at the distribution of companies by surplus. Most companies either have a surplus between $50 million and $100 million or between $100 million and $200 million. If we compare it to what Jim presented, we would find that, overall, the surplus position of companies in the U.S. is a little bit higher than it is in Canada.

The distribution of companies by assets shows a big difference. We see that companies have assets of either $200 million or less; or they have assets of over $1 billion. There is also quite a large difference between the U.S. and Canada in the size of companies as measured by assets. There are more companies with higher assets in the U.S. than in Canada. For example, in Jim's presentation we heard that one-third of the companies had assets in excess of $5 billion, which is not the case in Canada.

We have information for 53 companies in Canada. We see that there is a smooth distribution of the level of retention. At a retention level of $100,000–200,000 there is a spike. We will see later that a retention of $100,000 is a real trigger point for many companies' retention. I also compared this distribution with the U.S. distribution, and the level is a little bit lower in Canada than it is in the U.S.

We wanted to get information about the average retention. In Canada the average is $763,000. However, it seems this is not a very representative figure by itself, especially when we look at the median retention of $250,000. The mode is the retention level that we see most often in the distribution, and, in this case, it is $100,000. The median is the 50% point where 50% of the respondents have a retention level that is below this median point, and 50% have a retention that is higher. We see a huge difference between the median and the mean. What this means is that a company with a large retention distorts the overall mean.

This is why I wanted to present the results, separated by the different surplus levels that we discussed earlier. Here we see that the mean and median are much closer to each other. If we take the group of companies with a $50–100 million range of surplus, the mean retention is $235,000, and the median retention is $250,000.

As expected, we see that companies keep a higher retention when their surplus is higher. I added the last column in Table 1, which is labeled the mean ratio. The

mean ratio is a ratio of the mean retention over the mean of surplus for each surplus range. For example, for a company with a surplus of less than $10 million, on average, their retention level is set at 1.43% of their surplus. We see that this ratio decreases quite rapidly with the increase of surplus. I tried to find a reason why this ratio decreases as the surplus increases. An answer that came to mind is that maybe larger face amounts are not as prevalent in Canada. A larger company may prefer to keep lower retention to protect themselves from aggregate fluctuations rather than from a single claim. There can be other reasons as well. When we look at the total for the industry, we see that the mean ratio is the same number Jim had for the U.S., which is 0.3%. On average, a company in Canada keeps a retention of 0.3% of their surplus. This shows you what is actually happening in Canada.

TABLE 1
DISTRIBUTION OF INDIVIDUAL LIFE RETENTION BY SURPLUS

RANGE	MEAN	MODE	MEDIAN	MEAN RATIO
0-9,999	69	–	58	1.43%
10,000-19,999	122	100	100	0.81
20,000-49,999	125	200	100	0.44
50,000-99,999	235	250	250	0.32
100,000-199,999	825	500	375	0.58
200,000-999,999	786	500	500	0.21
1,000,000+	4,400	3,000	4,000	0.26
Total	763.49	100	250	0.30

All amounts are expressed per thousand dollars
Mean ratio=mean of retention/mean of surplus

Table 2 is similar to Table 1 except that it shows the distribution of retention by assets. For example, a company with assets from $1 billion to $10 billion has a mean retention of $552,000, and a median retention of $500,000. Again we see that within an asset range there is much more consistency with the level of retention, and the difference between the mean and median is much closer. The last column again is the mean ratio, which is the mean retention divided by the mean of assets. We calculate the mean ratio for each asset range. For example, companies with assets of under $100 million set an average retention of 0.22% of their assets. Like the mean ratio for surplus, the mean ratio for assets goes down with an increase in asset size. There is a 0.03% in total for all companies, which again, is exactly the same number that Jim found in his study. We see that this number is very much influenced by larger companies. Although this is an average, I don't think it's a representative figure for the overall industry. But it was very interesting that we came back to the exact same figure as the U.S.

TABLE 2
DISTRIBUTION OF INDIVIDUAL LIFE RETENTION BY ASSETS

RANGE	MEAN	MODE	MEDIAN	MEAN RATIO
0-99,999	90	100	88	0.22%
100,000-199,999	172	100	100	0.12
200,000-499,999	156	–	150	0.05
500,000-999,999	643	250	275	0.09
1,000,000-9,999,999	552	500	500	0.02
10,000,000+	4,000	3,000	3,500	0.03
Total	763.49	100	250	0.03

All amounts are expressed per thousand dollars
Mean ratio=mean of retention/mean of surplus

Every year, however, we do a Munich Re Individual Life Insurance Pricing Survey. In a recent survey we asked companies if they normally use reduced retention for different products. We found that 46% of the respondents did say that they sometimes use reduced retention. Normally, the reduced retention is on a term plan, such as T-10 or T-100 product. For those who use reduced retention, normally it is on a first-dollar quota share basis. I understand that it's quite similar to what is done in the U.S. also. The reasons that we find for this type of reinsurance are for risk sharing, in particular, the lapse risk for the T-100 product. Obviously, the available reinsurance terms are an important factor. The last factor is surplus strain, or minimum continuing capital and surplus requirements (MCCSR), if there is a need for that.

The next part of my presentation deals with individual disability income retention. As I said, we have information on only 11 companies, so we were not able to look at the distribution of retention levels because it wasn't relevant. So the only thing we want to tell you here is that of those 11 companies, seven companies are reinsuring on an excess basis with a retention ranging from $1,000 to $8,000 per month. Four companies are reinsuring on a quota share basis ranging from 10% to 50%. Let’s discuss group life retention, although we did not have many companies. The most prevalent retention limit is in excess of $225,000. If I recall, the average retention for that group of companies would be $500,000. The other popular retention limit is $75,000–150,000; within that group, most companies would be at $100,000.

We had information about group long-term disability retention for 18 companies. Nine companies are using quota share reinsurance ranging from 10% to 75% of retention. Seven are on an excess basis ranging from $600 to $5,000 per month

retention, which is much lower than individual disability insurance. Finally, two companies were using an extended wait form of reinsurance. For example, there is no reinsurance for the first three years of claim and then 60% of the claim amount is reinsured thereafter.

Mr. Robert W. Beal: My assignment is to discuss the financial considerations and issues pertaining to setting individual disability income (IDI) and reinsurance retention limits. I will be presenting an example of a type of analysis that may be useful in determining the appropriate retention limit for your company. I will be specifically focusing on excess risk reinsurance where the primary objective is to limit the upper end risk exposure to the company. In this regard, I will not be considering any form of financial reinsurance where objectives, such as surplus relief, may be the consideration. I will also not be considering quota share.

I see three reasons for purchasing excess risk reinsurance. The first is simply to reduce the risk of a significant impairment on your company's surplus. For example, your company may need to have an issue limit in the marketplace of $20,000 of monthly indemnity per person. That's for competitive reasons. As a result, a single large claim could have a multimillion dollar liability associated with it. Just a handful of such claims in a given year may take a significant chunk out of your surplus.

The second reason for purchasing excess risk reinsurance is to reduce the risk of significant adverse fluctuations in your company's financial results, more specifically, it's the bottom line. Although your company's surplus may be so large that the threat of significant impairment from large IDI claims is relatively small, the occurrence of large claims can contribute to wide swings in your company's or your IDI line's financial results. Managing an IDI line of business can be unnerving enough without having to explain and interpret the threat of an occasional mega claim. By the way, in the recent discussion draft of the General Principles of Actuarial Science prepared by the SOA and the Casualty Actuarial Society (CAS), this specific risk is referred to as the process risk. It's nice to have a name for it anyway.

The third reason for purchasing excess risk reinsurance is the risk that the expected claim cost is significantly different than assumed in your premium rates, your reserves, or simply your financial projections. In the General Principles of Actuarial Science, this risk is referred to as the parameter risk. Excess risk reinsurance is probably less effective than say quota share reinsurance in controlling this process risk. For typical retention limits, the amount of reinsurance involved actually may be only 5–10% of the total risk, so a substantial share of the expected risk is

retained by the direct company. Regardless, you are still trading a portion of that parameter risk for the certainty of the reinsurance premium.

Let's look at some factors that are often considered in choosing the appropriate retention limit for a company. The first is the redundancy in statutory reserves, and the second is redundancy in statutory surplus. These first two considerations address the overall financial soundness of your company, and its ability to absorb significant adverse fluctuations. A company with large statutory margins relative to the total IDI risk may feel that the excess risk reinsurance is an unnecessary expense. Therefore, they may choose to set a very high retention limit or simply take the whole risk itself. On the other hand, a company with a minimum statutory reserve and surplus that may be under the watchful eye of the regulators may choose to cede out most of the IDI risk.

The third consideration is the other types of risks assumed by the company. The mix of other types of products sold by the company might affect the level of the IDI risk that a company chooses to retain. For example, if the other lines are such that large, generally stable profits emerge, then a company may feel comfortable assuming a much larger share of the IDI risk. This comfort level may be greater when the other risks appear to be negatively correlated with the IDI risk. One risk, which may be negatively correlated, is annuities.

The fourth consideration is the nature of the IDI business. Given that all other factors are comparable, two companies may need significantly different IDI retention limits if they are in different IDI markets with different types of products. For example, a company competing in the professional market with so-called "state of the art" products for the last ten years may feel a much greater need to have a lower retention than a company that sells more limited products to the blue or gray collar market.

The fifth consideration is risk tolerance of management. You can generally assess the mood of management regarding risk tolerance. A conservative management with a strong dislike for surprises may need a lower retention limit than a management that views any risk-sharing as a threat to realizing the full potential profitability of its business. This type of company looks at reinsurance as a necessary evil. Unfortunately, the risk tolerance of management may shift quickly, particularly when experience is going south over an extended period of time, which for some in management may mean two calendar quarters.

A company may compare its IDI retention with the retention limits for its other lines of business. If a company has a $100,000 retention limit for its individual life insurance business, then there is probably a good chance they would not be

comfortable with an IDI retention limit greater than $1,500 or $2,000 of monthly indemnity per insured. They kind of go hand in hand.

To determine the most appropriate retention limit for one's IDI business, there are a number of approaches that may be used. Let me just mention two extreme methodologies. First, there is one that uses a comprehensive corporate model that incorporates and balances the risks associated with all lines of business within the company, the co-variances among those risks, the margins in the statutory reserves, the target surplus levels, and whatever else you can think of. I've never seen one of those models, but I think they're out there. This actually is a type of dynamic solvency testing. Everything goes in, you do some kind of balance, and you come up with the most ideal appropriate retention limit.

However, the other extreme is simply a gut feeling. Something we all know about. This approach avoids the complex modeling associated with the first approach, and is often used when either there is a of lack of resources or there is a certain level of skepticism. In either case, the gut feeling approach incorporates most of the considerations I mentioned earlier that one must use to arrive at a retention limit at which management will be comfortable.

I'd like to illustrate a middle approach. It is one that avoids the complex modeling of the first extreme, but may shed more light on the IDI risk and the impact of possible retentions on that risk. This approach uses the stochastic modeling of the IDI financial results to help determine an appropriate retention limit.

There are three steps involved. First, test the inherent variability of volatility in the IDI financial results assuming no reinsurance. Next, evaluate the impact on the variability of the financial results from assuming different retention limits. Third, settle on a retention limit that most comfortably balances low expected profits with lower variability. If you're really sophisticated, you may have a sophisticated index to compare the different results, or you can rely on your gut feeling.

I've been in this business of actuarial science for a few years, and I realize that no matter how scientific you get, you still have to, at some point, fall back on some level of gut feel. This modeling approach isolates the IDI business from all other lines within the company. So it does not necessarily incorporate the potential co-variances between the lines of business that may increase or decrease the overall risk. However, it does address that potential impact of both the parameter risk and the process risk, which I mentioned earlier, for the IDI business. This approach can also give the actuary and management some idea about the potential threat to the company's statutory surplus arising from the IDI business. As you will see, this approach does mix statistical analysis and gut feelings.

To illustrate the stochastic modeling approach, I've used a real IDI policy in-force file in order to reflect a realistic spread of the IDI risk. Around this policy in-force file, I've developed a hypothetical IDI line of business with rather idealistic financial expectations. The hypothetical IDI line consists of an annualized premium before reinsurance of $18.1 million with over 33,000 policies in force. The distribution of these policies by monthly indemnity is shown in Table 3. I've made the assumption that there's only one policy per insured. In reality, you would need to account for multiple policies per insured in your file. The IDI contracts in this file consist of a great majority of the policies having to age 65 or longer benefit periods. My sense of the policy file is that the average policy size is about $1,500 of monthly indemnity or less. This may be somewhat smaller than many of the IDI lines of businesses today.

TABLE 3
MODEL OF HYPOTHETICAL IDI LINE

Premium	$18,120,000 (Direct)
Number of Policies	33,257

DISTRIBUTION OF IN-FORCE BUSINESS BY SIZE:		
MONTHLY INDEMNITY	**NUMBER OF POLICIES**	**PERCENTAGE**
Under $1,000	20,184	60.7%
$1,000-1,999	7,267	21.9
$2,000-2,999	2,892	8.7
$3,000-$3,999	1,231	3.7
$4,000-4,999	612	1.8
$5,000-6,999	636	1.9
$7,000-$9,999	229	0.7
$10,000 and Over	206	0.6
Total	33,257	100.0

To do a stochastic analysis of the IDI risk, I've modeled the two risks (Table 4). The parameter risk, the risk that the expected claim cost is different than assumed, and the process risk, the variability of actual results around the expected claim cost. My model looks at the potential variability in the financial results of the business in one year. You may want to expand your perspective to cover multiple years, but I wanted to keep my model relatively simple. The main variable that I use in this model is the interest-adjusted claim cost, which is the present value of all benefits arising from the new claims in this specific year. That is, the present value for the

full benefit period for claims incurred in a calendar year. I chose not to model the variability of the run out of prior years incurred claim, since in my opinion, the greatest variability in any year comes from the cost of new incurred claims. As long as you're doing this yourself, you would want to factor all of these things in. However, by offsetting this, I've included the variability in the future run out of the new claim costs beyond the year of incurral rather than determine the probability of setting up an additional reserve at the end of the year for existing claims. I have reflected the probability of the payment going all the way to the end of the benefit period. There is some variability in this model due to the run out of claims, although it's claims that would be incurred now going off into the future.

TABLE 4
PARAMETER RISK—PROBABILITY DISTRIBUTION

Parameter Risk = $\frac{\text{True Expected} - \text{Estimated Expected}}{\text{Estimated Expected}}$

PARAMETER RISK	PROBABILITY DISTRIBUTION
-20%	10%
-15	20
-10	40
0	50
10	60
15	80
20	90

The parameter risk can be measured by the following ratio:
Parameter Risk = (True Expected – Estimated Expected)/(Estimated Expected)

The parameter risk is the risk that the expected claim costs are wrong. In this formula, you model the true expected and subtract your estimated expected and divide by the estimated expected. This estimated expected may be based on pricing assumptions, reserving assumptions, or historical experience. You are not sure that this estimated expected will actually become the true experience.

So to express your discomfort, you may choose a probability distribution around the extent your estimated expected may be off from that true expected or vice versa. I came up with a hypothetical probability distribution for the parameter risk using a gut feeling. I suspect you would need to rely on gut feel, as well. However, your

choice of probability distribution here may be affected by your feelings regarding how well you have studied your line of business.

Modeling the process risk relies a lot less on gut feeling. My approach involves a stochastic analysis of the policy in-force file using a risk simulator tool developed by Milliman and Robertson. This tool performs Monte Carlo testing on the in-force file by going through the in-force file 10,000 times. At each iteration or pass through the in-force file, a random number determines whether each policy will go on claim and determines the duration of the that claim by comparing a random number with the probability distribution derived from the expected claim incidence and claim termination rates.

For each complete pass-through the in-force file, the risk simulator then adds the resulting interest adjusted claim costs for each policy to obtain the total interest adjusted claim costs for the whole in-force file arising from the new claims in that specific year.

The total interest adjusted claim costs for each pass, or iteration, is then compared to the average interest-adjusted claim costs (IACC) for each of the 10,000 iterations. A distribution of results is developed and the mean of the distribution is close to the expected. As a result of this, I can develop a probability distribution for the process risk by using the following ratio:

$$\frac{\text{(Actual Interest Adjusted Claim Cost} - \text{Average Interest Adjusted ClaimCost)}}{\text{(Average Interest Adjusted Claim Cost)}}$$

We repeated this Monte Carlo simulation using four different reinsurance scenarios. One assumed no reinsurance and the others assumed retention limits of $5,000, $3,000, and $1,500, respectively. As the reinsurance amounts increased, the probability distributions tightened. We would expect this result since excess risk reinsurance does reduce the severity portion of the risk. To be honest with you, I was hoping for differences in probability distributions that were just a little more dramatic than this. I'll talk about that a little bit later.

In order to use these probability distributions, I then developed a model that could generate the annual proforma financial statements for the hypothetical line of business. This model is a Lotus spreadsheet (Table 5). The proforma, or the annual financial budget, shows, among other things, the expected premium income statutory after-tax profits, return on equity, and interest adjusted claim costs ratio. As you can see by the direct column, my hypothetical line shows a quite healthy financial return of almost 15%. We always price our products to give a 15% return.

TABLE 5
ANNUAL PROFORMA FINANCIAL STATEMENT

	DIRECT	$5,000 RETENTION	$3,000 RETENTION	$1,500 RETENTION
Premium	$18,127	$17,808	$17,306	$16,006
Statutory Profits*	($ 569)	($ 611)	($ 666)	($ 810)
GAAP Profits*	$1,793	$1,722	$1,617	$1,345
R.O.E.*	14.96%	14.60%	13.90%	12.00%
IACC Percentage	38.70%	38.10%	37.10%	34.10%

*After tax

The impact of the three possible retention limits is also shown in Table 5. I have assumed that the reinsurer's yearly renewable term premium rates reflect the company's expected claim costs, but include a 35% load for expenses and profits above that morbidity charge. To be honest, I don't know that the load is at all typical, but I wanted to reflect a significant cost of reinsurance. As you would expect, premiums, profits, and return equity decrease with the decreasing retention limits. Consequently, the company needs to determine where there is a sufficient reduction in variability of the financial results to justify the cost of reinsurance since there's a drop in profitability. If you go to $1,500 retention, your return has gone from 15% down to 12%. So there's a considerable charge there, and you should expect some reasonable pay back for giving up that much profit.

Table 6 shows results of applying the two probability distributions to the proforma financial model, that is the impact on the interest-adjusted claim cost percentages over 1,000 iterations. This Lotus model of the proforma statement will run through 1,000 iterations applying the probability distributions to the interest-adjusted claim cost. First, I apply the probability on that parameter risk. Once I have that, I apply the process risk to that. I run it through 1,000 times to develop a distribution for each of the various financial indicators. I'll show a few of them here, such as the interest-adjusted claim cost ratios. With no reinsurance, the interest-adjusted claim cost percentages were plus or minus 14% of premium around the expected ratio (38.7%) 90% of the time. There is a 5% probability that claims will exceed 52.5% of premium, which is 13.8% of premium, and there is a 5% probability that claims are lower than 26.8% of premium, or 12% lower than expected.

TABLE 6
STOCHASTIC MODEL RESULTS
INTEREST-ADJUSTED CLAIM COST RATIOS (% PREMIUM)

		RETENTION		
PROBABILITY	DIRECT	$5,000	$3,000	$1,500
5%	52.5%	50.7%	49.2%	44.1%
10	48.6	47.3	46.3	41.9
25	42.6	41.9	41.0	37.6
50	37.2	35.9	35.4	32.5
75	32.2	31.2	30.7	28.4
90	28.5	27.7	27.3	25.8
95	26.8	26.4	26.0	24.5
Proforma	38.7	38.1	37.1	34.1

On the other hand, with a $1,500 retention limit, the range around the proforma expected claim cost of 34.1% is + or –10%. There's an obvious reduction in the variability of the claim cost, but the question is whether this reduction is worth the cost of the reinsurance.

Table 7 shows the distribution of the after-tax statutory profits over 1,000 iterations of the stochastic model. These results suggest that reinsurance may not be significantly reducing the potentially large swings in the after-tax statutory profits. The most extreme case, the 5% case, which was the worst result assuming no reinsurance, was a negative $2.6 million, which is a considerable deviation relative to the proforma. With the $1,500 retention, you still have a negative $2.1 million potential. My opinion is that reinsurance has not had a big effect.

This is only one example of possible outcomes from this stochastic modeling. We should not draw too many conclusions from it because it's just one example based upon one policy file, and it may not be characteristic of what you have to work with, although there are a few implications one can derive from this analysis. First of all, excess reinsurance, in this case, did not significantly reduce volatility. This may be the result of having 60% of the policies with monthly indemnities under $1,000. As I mentioned before, it's a low average policy size. Because of that low policy size, maybe excess reinsurance is not that necessary to control variability anyway. Another portfolio, with a large percentage of policyholders having larger size policies, may have a greater volatility that could be controlled through reinsurance.

TABLE 7
STOCHASTIC MODEL RESULTS
STATUTORY PROFITS (AFTER TAX)

		RETENTION LIMIT		
PROBABILITY	**DIRECT**	**$5,000**	**$3,000**	**$1,500**
5%	(2,625)	(2,460)	(2,404)	(2,135)
10	(2,039)	(1,959)	(1,993)	(1,841)
25	(1,152)	(1,172)	(1,233)	(1,281)
50	(332)	(279)	(422)	(605)
75	409	410	239	(57)
90	964	921	734	283
95	1,216	1,110	914	456
Proforma	(569)	(611)	(666)	(810)

The use of a model with a projection period longer than one year also may have shown a greater impact of reinsurance. By only looking at one year, I'm only analyzing one piece of the whole risk. Regardless of the small impact that the excess risk reinsurance may have had in this hypothetical case, the management still may want to purchase reinsurance on its large policy sizes. This is because they simply aren't comfortable with the fact that large claims may occur some day. Essentially, in this situation, you're back to management relying on a gut feeling rather than the stochastic results.

Finally, again, it's important to emphasize that another block of IDI business with different characteristics could have materially different stochastic results and implications. Regardless of the outcomes and conclusions you may reach with your own block of IDI business, it is worth the exercise to understand the stochastic risk inherent in your business. Explaining the potential variability to management is a great learning exercise for you and your management.

Mr. John E. Hewitt: Bob, you mentioned a 35% load for the reinsurer for expenses and profit. Did I understand what you said?

Mr. Beal: I used 35%, but it is hypothetical. I was trying to reflect a cost of reinsurance. My model is relatively simple, so I started with the same expected as the direct business.

Mr. Hewitt: Did you try something with a little more realistic reinsurance load?

Mr. Beal: Is the realistic higher or lower?

Mr. Hewitt: I would assume it's lower.

Mr. Beal: I didn't try it. I don't think it would have an impact on the variability issues. I think it may have an impact when you look at that comparison of direct proforma statement (no reinsurance), and those showing the various retention limits.

Mr. Sweeney: The 35% load for reinsurance premium was 35% of claim cost, not 35% of premium?

Mr. Beal: Right, it was 35% of the claim cost.

Mr. Anton A. Harper: Bob, this may not be a fair question, but do you think one can adjust that method for life retention?

Mr. Beal: Yes, I think so. I think it would follow very easily. I think the disability risk is just an extra dimension that you have to factor in.

Mr. Sweeney: We have similar models that we use for stop-loss calculations for life retention.

From the Floor: I'm just worried about my ability to do mental arithmetic. I keep working out what 0.3% is in terms of dollars per million, and I keep getting 300. Jim explained it as $30 per million. Is my mental arithmetic wrong, given that you said it was equivalent in the U.S. and Canada.

Mr. Sweeney: Are you talking about retention as a percentage of capital and surplus?

From the Floor: Yes, the ordinary life retention as compared to assets is $30 per million in the U.S. and 0.3% in Canada, but Mr. Letarte said they were exactly the same. But I think one is ten times the other.

Mr. Sweeney: I agree. Particularly in the United States, a lot of the assets back annuity business. To express an ordinary life retention as a percentage of your annuity assets may be somewhat misleading. There is no real easy way to split out your assets among the various lines. You could attempt to do it by reserves. We tried to do that, and it was very difficult. So that may account for one of the differences there.