NONPARTICIPATING GUARANTEED LIFE INSURANCE SEGMENT MODEL

MR. MICHEL GIGUERE: I am going to talk about the nonparticipating guaranteed life insurance segment but not much about the details of the results produced by the different scenarios. Instead I am going to highlight some of the specific characteristics of the model I have used.

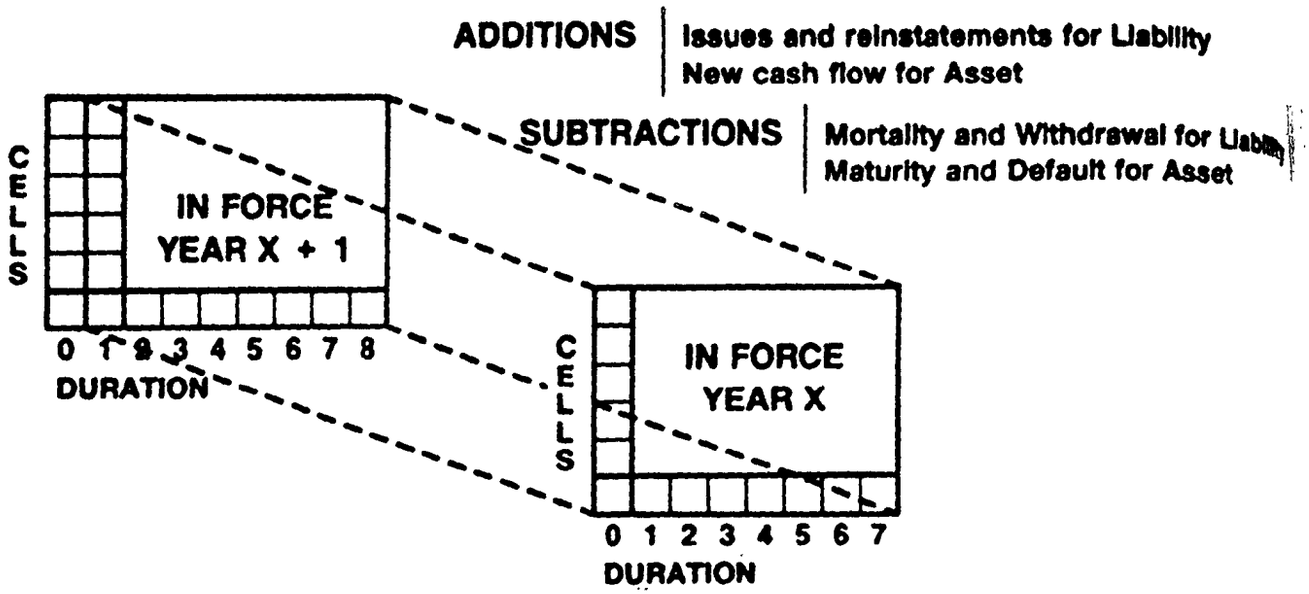
The model (Slide 1) may be thought of as an amalgamation of cells (some cells for the liability side and other cells for the asset side). Cells at duration 0 in year X have moved to duration 1 in year $X + 1$. A fraction has been applied to those cells to take into account mortality or withdrawal on the liability side or maturity or default on the asset side.

At duration 0, new issues for the liability side and new cash flow for the asset side are added. Reinstatements are also introduced at their appropriate durations.

This may seem a little simple, but this what modeling is all about: you have liability and asset cells, and you move them from one year to the next.

SLIDE 1

VISUALIZATION OF IN FORCE



Each move accompanied by: **Shift in duration**
Fraction applied to the cell

To generate the values (Slide 2), we decided we would produce a balance sheet, an income statement, and a schedule of changes in financial position.

The way to create the balance sheet is obvious. You only have to value your in-force business.

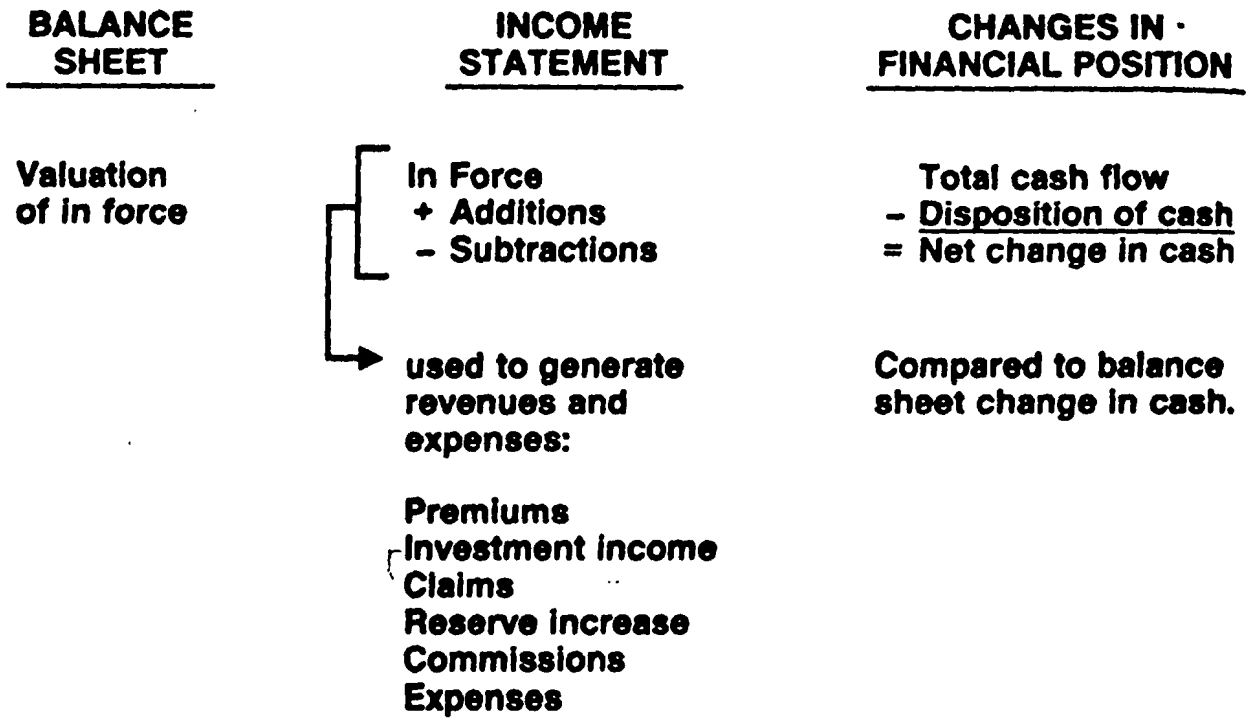
For the income statement, the in force plus additions minus substractions is used to generate all the elements of revenue and expense. For example, premiums, claims, reserve increase, commissions, and expenses all flow from the liability in force, while the investment income is derived from the asset in force.

Finally, the analysis of the changes in financial position is the ultimate check of accuracy of your model. The total cash flow produced minus dispositions of cash must reconcile with your balance-sheet change in cash.

Slide 3 presents the products modeled. The segment is made of two products: a Whole Life and a Term-to-100. Their respective amounts of insurance and risk classes are $30,000, smoker, and $100,000, nonsmoker. The Term-to-100 does not provide cash surrender values (CSVs). We have modeled only two ages for each: 25 and 35. The premiums per thousand are indicated, and we have assumed the Whole Life experienced no growth while the Term-to-100 sales were increasing by 15 percent each year.

SLIDE 2

GENERATING THE VALUES



SLIDE 3

PRODUCTS MODELED

		Whole Life	Term to 100
Amount of Insurance		$30,000	$100,000
Risk Class		Smoker	Non-Smoker
Sex		Male	Male
CSVs		Yes	No
Ages		25, 35	25, 35
Premium/$1,000		$8.30, $14.30	$2.30, $4.00
Policy Fee		$50	$50
Sales Growth		0%	15%
Premiums 1988:	1st year	4.1 million	2.2 million
	Renewal	29.4 million	5.1 million

Finally, the volume of premiums is a little over $6 million in the first year and $34 million in renewal. The volume of premiums is much larger for the Whole Life product because this product is older than the Term-to-100 and has been sold for many years.

The in force was created by running the model over three years for Term-to-100 and thirteen years for Whole Life (see Slide 4). We then valued the liabilities and prorated them to the amount agreed upon as our starting liabilities. The surplus was chosen to be $18 million. The assets were then created to be consistent with those figures. We ended up with $131 million of assets split between $10 million of policy loans and $121 million of bonds.

The investment policy of this segment is simply to invest in bonds: half government and half industrial; half ten years and half twenty years. We could have chosen to use a larger number of investment vehicles, but we decided to keep it simple for practical reasons.

The model works with two in force: one on July 1, and one on December 31 (see Slide 5). All issues and all expenses are assumed to occur on July 1, and all withdrawals and deaths occur on December 31. The net cash flow on July 1 (premiums - expenses - commissions) is carried to December 31 with the ninety-one-day rate. The death claims and CSVs are then deducted.

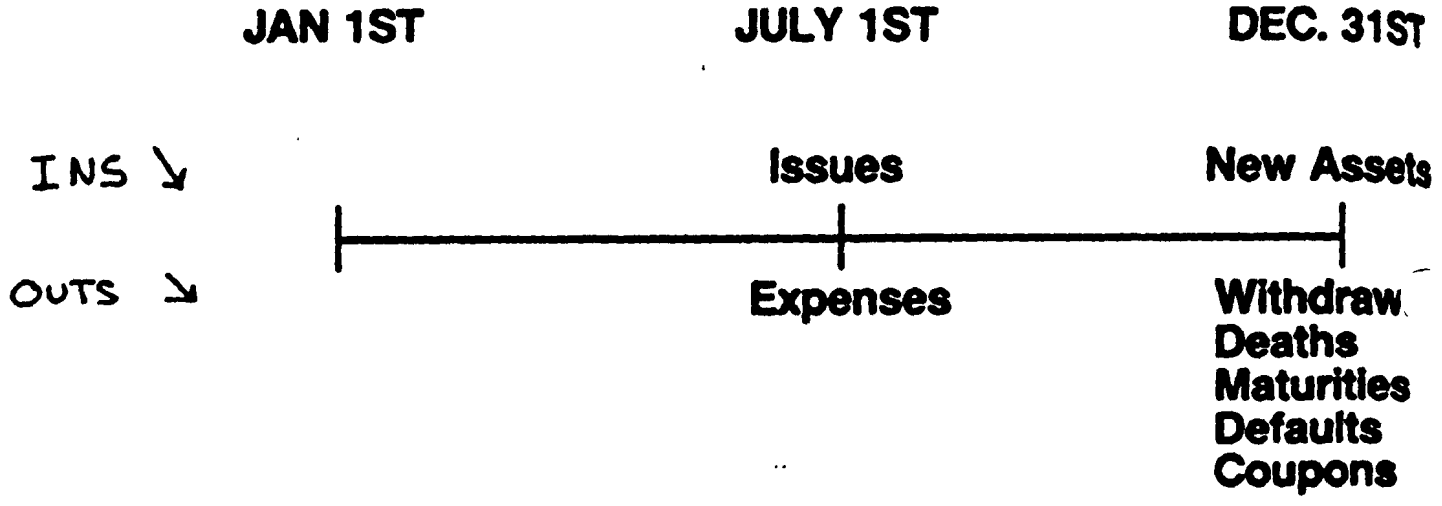
SLIDE 4

CREATION OF THE MODEL

		Whole Life	Term-to-100
1.	Running the model for:	13 years	3 years
2.	Valuing the liabilities		
3.	Prorating the liabilities to the preselected amount		
4.	Setting the surplus to the preselected amount		
5.	Creating a credible in force of assets		

SLIDE 5

INS AND OUTS



All asset transactions occur on December 31 (cash is invested, maturities and defaults occur, coupons are paid, etc.).

In summary, on the liability side we have two in-force files each year, but on the asset side we have only one in-force file on December 31.

Let's talk about some shortcuts that have been made to simplify the modeling. In the model, the total amount of policy loans stay level over the years. It is assumed that repayments of loans on one side is compensated by new loans on the other side. This is more or less the situation my company has been experiencing over the last few years. We could have been more theoretical, but we estimated that the impact would not have been material as compared to other dangerous threats.

Another characteristic of the model is that the company is operating with no cash. On each December 31, the net cash flow is completely invested in bonds according to the investment policy of the segment.

As a final example of simplification, all the premiums are assumed to be annual. This permits the use of mean reserves with no deferred premiums.

All our figures have been split between first-year and renewal results (Slide 6), enabling us to analyze profitability between first-year strain and renewal profit. This refinement is not complicated to introduce. In fact, you only need to be able to allocate investment income between first year and renewal. All other items come directly from our model.

The Whole Life product shows a first-year strain of 95 percent of premium with a renewal profit of 30 percent, while the Term-to-100 shows a strain of approximately 220 percent with a renewal profit of roughly 10 percent. Thus, the Term-to-100 does not prove very profitable on a statutory basis.

We have made no change in our products or pricing under any of the scenarios in order to show the full effect on a guaranteed product. The reserve basis has been changed, when appropriate, only at the end of the fifth year. Of course, this is not what the valuation actuary is expected to do in real life. This has the advantage of avoiding many revaluations and of showing the full effect of the modification at one point in time.

Only one set of reserves is used for all durations. For example, in 1992, the reserves are calculated with assumptions appropriate to the circumstances prevailing at that time. So the policy issued in 1987 is valued with a factor calculated with assumptions of 1992 at duration 5 and not with its historical experience.

SLIDE 6

FIRST YEAR vs RENEWAL SPLIT

Advantages: Possibility to analyze profitability (First-year strain vs. Renewal profit)

Difficulty: Allocating investment income

One Solution:

1. Determine interest charged on first year cash flow
2. Interest on renewal is the residual

Examples:

	Year 1988 in % of premium	
	Whole Life	Term to 100
1st Year Strain	(95%)	(217%)
Renewal Profit*	30%	8%

* before tax and excluding interest on surplus

The Canadian 1978 method has been used, but for reasons of simplicity, we have not tested the adequacy of the margins included in the assumptions.

In terms of equipment, the model is run on an IBM personal computer using APL language.

The net income is negative for all five years of the projection (Slide 7). Income before tax, however, is positive throughout the period. The main reason for this anomaly is that the increase in tax reserve is lower than the increase in statutory reserve.

The difference in the two reserves amounts to $3.2 million (mostly concentrated in the first year due to deficiency reserves on Term-to-100). So although the statutory earnings amount to $2.6 million, the tax earnings amount to $5.8 million with a resulting income tax of $2.9 million. The end result is a statutory deficit.

Slide 8 illustrates the choice of the interest rate valuation assumptions under various scenarios. Our valuation policy was to take a first rate a little lower than the portfolio rate and to decrease it over fifteen years to an ultimate rate determined according to the Valuation Technique Paper No. 3 (August 1987 version).

SLIDE 7

INCOME TAX

1992 results (in $ millions)

	1st year	Renewal	Total
Stat. reserve increase	3.0	31.1	34.1
Tax reserve increase	0.5	30.4	30.9
Difference			3.2
Stat. earnings before Tax			2.6
Tax earnings			5.8
Income tax (at 50%)			2.9
Stat. earnings after tax			(0.3)

SLIDE 8

CHOICE OF INTEREST RATE ASSUMPTION IN VALUATION

Scenario	Description	Net rate of return 1992	½ Bonds 3 yr. average	Average term to maturity	VALUATION RATE First	Ultimate	Years
0	Base Case	10.5%	5.0%	11.9	10.0%	4.5%	15
4	i ↑	12.0	6.21	1.8	11.25	5.0	15
5	i ↓	9.4	3.8	11.9	9.0	4.0	15
13	i ↑ w ↑	12.2	6.2	11.2	11.25	5.0	15
14	i ↓ w ↓	9.3	3.8	12.0	9.0	4.0	15
15	Short l i ↑	11.8	6.2	5.5	11.25	5.0	10
16	Short l i →	10.3	5.0	5.5	10.0	4.5	10
17	Short l i ↓	9.0	3.8	5.5	9.0	4.0	10

For the base case, the return of 10.5 percent leads us to a first rate of 10 percent. For the ultimate rate, we had to blend half of the three-year average on bonds with 4 percent (remember we used the August 1987 version of Technique Paper No. 3; under the current version, July 1988, the 4 percent would be 5 percent), thus leading to 4.5 percent.

In scenario 4, where the interest rates are increasing, we ended up with a portfolio rate of 12 percent and chose to use 11.25 percent. For the ultimate rate, the blend of 6.2 with 4 percent produced a rate of 5 percent.

In scenario 5, where the interest rates are falling, the portfolio rate of 9.4 percent leads us to a first rate of 9 percent and an ultimate rate of 4 percent (blend between 3.8 and 4 percent).

Scenario 15 calls for a short investment policy with interest rates increasing. We may see that the valuation rates (11.25%, 5%) are the same as for scenario 4. However, the big difference is in the number of years before reaching the ultimate rate. Since the average term to maturity of the portfolio was only five and a half years, we felt we could not use the former fifteen-year period. We decided to use a shorter period of ten years.

Slide 9 illustrates some of the results under scenario 10, which calls for an additional 3 percent in inflation of unit expenses each year. Earnings before unusual items are a little worse than for the base case (deficit $1.2 million instead of $0.6 million).

However, the revaluation of reserves brings the income after unusual items to a deficit of $27 million because of strengthened reserves due to increased administrative costs. Thus the surplus ends up to ($14 million) instead of $14 million under the base scenario. This compares to the Canadian Life and Health Insurance Association (CLHIA) requirement of $25 million to $26 million. So we can conclude that a steady increase in the unit costs is a dangerous threat to this segment.

Slide 10 shows the premium deficiencies under all the scenarios where a revaluation has been done in 1992. We show the ratio of the theoretical valuation premium (that is, the valuation premium before it has to be reduced to the gross premium) to the gross premium.

For the Whole Life product, the premium does not become deficient under any scenario. For the Term-to-100 product, the premium is deficient by 20 percent according to the valuation assumptions under the base case. Under scenario 1, where mortality rates are increasing by 15 percent, the ratio comes up to 130 percent. For scenario 3, where the lapse rates are assumed to be half of the expected experience, the

SLIDE 9

ILLUSTRATION OF SENSITIVITY: INFLATION IN EXPENSES

(in $millions)

Scenario 10: additional 3% in inflation of unit expenses each year

	1992 Earnings				
	Before Unusual	After Unusual	1992 Surplus	CLHIA Require.	Ratio Eligible Surp. to CLHIA require.
Base Case:	($0.6)	($0.6)	14.0	24.8	53%
Scenario 10:	($1.2)	($27.0)	(13.7)	25.8	(56%)

SLIDE 10
PREMIUM DEFICIENCIES

Scenario	Description	Ratio of theoretical valuation premium to gross premium	
		Term-to-100	Whole Life
0	Base	120%	68%
1	q_x ↑	130	71
3	↓ w ↑	158	63
4	i ↑	110	65
5	i ↓	138	80
10	exp. ↑	127	71
13	i ↑ w ↑	110	63
14	i ↓ w ↓	179	80
15	Short l i ↑	115	67
16	Short l i →	126	69
17	Short l i ↓	144	81

ratio is 158 percent. Under scenario 4, where new-money rates are going up by 300 basis points, the situation is improving, and the ratio goes down to 110 percent. For scenario 5, falling new-money rates, the ratio is 138 percent. In scenario 10, with additional 3 percent in inflation of unit expenses, the ratio is 127 percent. In scenario 14, which combines two problems: falling interest with lower withdrawals, the ratio comes as high as 179 percent.

Slide 11 is an overview of some important numbers produced by the ten prescribed scenarios. For the base case, we end up in 1992 with a surplus of $14 million versus a requirement of $25 million. With increasing mortality rates the surplus turns out negative at ($13 million). With the withdrawal rates at half the expected experience on the Term-to-100 product, the results are a disaster with a negative surplus of ($83 million). Scenario 4, rising interest rates, turns out to be our best with surplus going up to $33 million. No growth scenario 6 is the only other scenario which is favorable. Falling interest rates and increasing expenses (scenarios 5 and 10, respectively) produce a negative surplus at the end of 1992.

In summary, the main threats to solvency for this segment have proven to be reduced lapse rates on Term-to-100, increase in mortality, inflation in unit costs, and falling interest rates.

SLIDE 11

OVERVIEW OF RESULTS. PRESCRIBED SCENARIOS

Scenario	Description	1992 Earnings	1992 Surplus	CLHIA Require.	Ratio Eligible Surp. to CLHIA Require.
0	Base	(0.6)	14.0	24.8	53%
1	q_x ↑	(26.5)	(13.0)	25.8	(54%)
2	Morb ↑	(0.6)	14.0	24.8	53%
3	↓ w ↑	(101.0)	(82.7)	26.3	(318%)
4	i ↑	35.0	33.4	23.5	139%
5	i ↓	(20.2)	(7.1)	25.5	(35%)
6	0 Growth	2.5	22.4	21.9	98%
7	2 x Growth	(6.4)	1.0	28.9	0%
8	95th Perc.	(0.6)	13.6	24.8	52%
9	2 x Default	(0.9)	12.7	24.8	48%
10	exp. ↑	(27.0)	(13.7)	25.8	(56%)

An interesting parallel may be drawn between scenarios 1 and 10 which had similar results. Scenario 1 calls for a 15 percent deterioration in mortality, while scenario 10 calls for an additional 15 percent in inflation. However, this is only by chance that the numbers are so similar. For the mortality scenario, we have revalued the liabilities with mortality assumptions 15 percent higher than in the base case. But, for scenario 10, we have assumed a continuous future additional inflation of 3 percent each year. Thus, we have interpreted the mortality scenario as being a one-shot deterioration, while we have assumed that the additional inflation in scenario 10 represented a trend that would continue in the future.

Slide 12 presents the results of the additional scenarios we have tested. The worst additional scenarios have proven to be those in which we were assuming a decline in the interest rates (scenarios 14 and 17).

SLIDE 12

OVERVIEW OF RESULTS. ADDITIONAL SCENARIOS

Scenario	Description	1992 Earnings	1992 Surplus	CLHIA Require.	Ratio Eligible Surp. to CLHIA Require.
0	Base	(0.6)	14.0	24.8	53%
11	> Default	(0.8)	10.3	24.8	38
12	Mort.& Morb.	(26.5)	(13.0)	25.8	(54)
13	i ↑ w ↑	44.7	42.6	19.2	217
14	i ↓ w ↓	(165.9)	(155.1)	32.5	(483)
15	Short l i ↑	21.5	26.3	24.0	106
16	Short l i →	(15.0)	(1.0)	25.3	(7)
17	Short l i ↓	(37.9)	(25.5)	26.2	(105)
18	No Sales	5.6	28.7	14.3	201
19	No W.L.	0.3	18.2	22.1	82
20	No T100	4.8	26.3	17.0	149

GROUP LIFE AND HEALTH OPERATIONS SEGMENT MODEL

MR. PHILIP J. POTHIER: I want to talk about the projection methodology I used in doing the modeling of the group life and health operations of a Canadian company within the modeling subcommittee of the Canadian Institute of Actuaries. My methodology differs fundamentally from that used by the rest of the subcommittee and any other financial projection that I've seen. Before you launch "full steam ahead" into the projection process, I wanted to give you my alternate perspective on projections.

I'm going to start with an analogy using an area of projection that everyone is familiar with -- weather forecasting. In Canada, weather data are fed into computers at the Canadian Weather Central in Montreal. The computers then churn away, eventually producing future weather maps. These maps are transmitted to local forecasting centers like Halifax on Canada's eastern seaboard. At these local centers, forecasts are prepared on regularly scheduled intervals. But if it's 4:00 P.M. and you are trying to decide whether or not to play golf, how good is the forecast produced at 11:00 A.M. using the giant computer produced projections? Not good enough for me.

Bridgewater, Nova Scotia, is about seventy miles southwest of Halifax. Now weather systems generally move northeast along the Atlantic coast of Canada at about 35 mph.

That means Bridgewater is about two weather hours away from Halifax. The 4:00 P.M. Bridgewater weather is an excellent predictor of 6:00 P.M. Halifax weather and infinitely better than the 11:00 A.M. forecast.

What does this have to do with life insurance company financial projections? The most important factor in doing financial projections is the latest actual result. In itself the latest result is an excellent estimator for future statements. Understanding recent financial results is critical.

Now if I was asked to project net income after taxes for the next few years (see Slide 1) I would start with $18 million for 1988 and ask - WHY NOT? Of course there are potentially many reasons, but I would make sure that my projection was referenced against the $18 million "straight extrapolation." I believe to do anything else is daring (perhaps better termed as foolhardy)!

These observations are intended to apply no matter what projection system is used. Now given that there is a limited range of plausible/believable numbers to be produced in a projection, I question how detailed the projection process should be. Furthermore, no matter how accurate the theoretical model is, it is only as good as its assumptions.

SLIDE 1

SAMPLE FINANCIAL HISTORY

(millions)

YEAR	REVENUE PREMIUM	NEW ANNUALIZED PREMIUM	NET INCOME AFTER TAX
Actual 1985	$300	$35	$15
Actual 1986	313	40	16
Actual 1987	329	45	17
Projected 1988	348?	50?	18?

The uncertainty of the future environment of the company, the competition and the tax laws will surely overwhelm any perceived accuracy gained through a complex projection system. Think back over the past five years. How well did or would you have done in projecting the changes that impacted your company? In the case of Canadian companies, no one would have done very well at predicting the dramatic changes to corporate taxes that we face in 1988. I'm sure that many companies have also seen significant changes in marketing direction and growth over the past five years.

Let me now briefly outline my approach. In a manner similar to other modeling techniques, I chose a limited number of model cells to represent the company; in my case, I would limit this to only five to ten distinct cells or blocks. In the case of Group insurance for the subcommittee's work, I had two blocks each for life and health. Each block is intended to represent a major segment of business -- almost treated as a separate company within the company. Within the block I deal with new sales and inforce business and can vary lapse and sales rates. But I do not use a specific product issued at a specific age to represent a cell, nor do I attempt to recreate a true financial statement.

A normal (but simplified) income statement might look something like that in Slide 2. In projecting all these numbers, you must be accurate and consistent in the handling of assets, reserve liabilities and investment income -- especially when it comes to the timing

GROUP LIFE AND HEALTH OPERATIONS SEGMENT MODEL

SLIDE 2

TYPICAL INCOME STATEMENT

(Simplified)

Premium	100
Investment Income	50
Total Income	150
Paid Claims	41
Expenses	15
Changes in Reserves	90
Total Outgo	146
Net Income	4

of transactions. The reserve increase must be consistent with the investment income generated by the notional assets that back the liabilities. This is the typical approach to modeling financial results. Now let me show you my version of the income statement which is the basic notion behind my projection methodology (see Slide 3).

I make no attempt to reproduce a typical income statement but focus solely on the sources of gain. The only basic statement numbers that I project are premium and reserve. I then express each of my profit sources as a percentage of premium and/or reserves. Now before you dismiss this approach as so simplistic that it is of no value, let me expand on it a bit more.

Remember that the premium and reserve numbers themselves reflect both sales and lapse effects in a fairly accurate manner. There are about four different sources of gain, each with 2 percent factors for a total of eight assumption factors. Note that each of my blocks acts independently so that my marginal-profits percentage assumption is unique for each block. Finally, in practice, my model is a little more complex than the foregoing indicates but the essential principles are followed.

Let me digress into one of the complexities to illustrate how the principle can be extended as desired. One of the more difficult areas to handle in my projection process is the gain or loss created because the reserve does not equal the cash surrender value

GROUP LIFE AND HEALTH OPERATIONS SEGMENT MODEL

SLIDE 3

SOURCE OF GAIN
APPROACH TO INCOME*

Investment Gain	4
Underwriting (Mortality) Gain	3
Loading Gain	(5)
Investment Income on Surplus	2
NET INCOME	4

* Each Profit Source is defined as a % of Premium and/or Reserves.

(CSV) paid on a lapse. In my modeling process I do not attempt to accurately project the reserve or the CSV. Instead, I use an estimate of the difference between the two by duration since issue.

For example, perhaps the difference is approximately one premium at issue decreasing linearly to zero over twenty years. To calculate the lapse gain or loss from this source I simply apply my assumed lapse rate to the difference.

How do you choose the assumptions? The process is one of trying to satisfy various constraints. Clearly the model should produce results consistent with the last year's actual results and the perception of the next year's results. Furthermore, detailed assumptions should be consistent with known characteristics of the business. For example an annuity block operating on an asset-liability spread of 1 percent should have a 1 percent reserve factor for investment gain.

If pricing is based on specific spreads, they can be used to guide assumptions. I have even used overall target rates of return on equity to control the setting of assumptions within a given block. The assumptions must be set within a good understanding of past financial results, but that is fundamental to any projection. You must also have an understanding of those changes currently happening, which will significantly influence future financial results.

My purpose is to point out that projecting financial results can be done in different ways. I like my approach because it is conceptually simple to follow and modify. It provides useful feedback and insight into key factors that dictate the true financial well-being of your business. It is relatively easy to find errors and do reasonability checks. I would stress the word *relatively*.

The actual system I use for my company is simple only in relation to the complex and detailed systems that can be created. The bigger and more complex the system, the more difficult it is to maintain. And you will have to maintain it. New products will be introduced, the environment will change and, perhaps just as importantly, people will change. Furthermore, these huge systems take on a life of their own, can be hard to control, and produce sometimes almost unbelievable results. How many projection systems are you aware of were developed, or perhaps attempted, but did not last? They collapse under the sheer weight of their own complexity. From my own personal experience I recall TAMIS (Total Actuarial Management Information System). It told you everything you wanted to know -- except no one believed it! It also ate up actuarial students attempting to develop and maintain it. Fortunately it died of indigestion.

More recently, during the 1980s when I took on a new job, my boss told me he wanted a good projection system. I'm sure if I told him all the wonderful things TAMIS could do, he would have been happy to let me create such a system. I didn't dare ask what he

meant exactly, but I know his time frame was measured in years. Instead, I spent a week on LOTUS creating a relatively simple system that could answer my boss' question. He was satisfied that I had come up with a quick temporary solution pending a grander system. Now over the past four years, the system has been improved but is essentially the same concept created in one week on LOTUS. Every year I project the financial information required, and my boss does not ask about the "grand projection system." Recently I decided it was time to face the issue squarely. I posed the question: Does my spreadsheet projection system satisfy your desire for a projection system? He paused a moment, then said, "Yes ... as long as it's right!"

In conclusion, whatever approach you choose, you must be comfortable that it will produce reasonable results.