RISKS and REWARDS

The Newsletter of the Investment Section of the Society of Actuaries

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50th Anniversary Update

by Cecilia Green

Registrations are already coming in for the SOA 50th Anniversary Celebration and Annual Meeting in San Francisco October 17-20. This meeting is expected to break past annual meeting attendance records and to cause early sell-out of hotel rooms. If you have not received your preliminary program, please call (847) 706-3545. Also, if you have not reserved your hotel room, do that now, even if you have not registered yet. The main hotel is the San Francisco Marriott (415) 896-1600 and the overflow hotel is the Palace (415) 512-1111. Be sure to say you're attending the SOA meeting to get the special rate.

The Actuarial Career Information Fair is going to be held on October 20 for area high school and college students and teachers, after the annual meeting adjourns at noon. If your company can be a lunch sponsor or wants a booth or an ad in the program, please call Linda Blatchford (847) 706-3564.

Revisiting the Portfolio Efficiency of Investment in High-Return Bank Loans

by Paul J. Donahue

In his definitive article, *Corporate Loans as an Asset Class*,[1] Elliot Asarnow presented the following findings about the years 1988 through 1994.

1. Floating rate U.S. corporate loans yielded risk-adjusted returns greater than those for more "traditional" asset classes.
2. There is a low correlation of corporate loan returns with those of other major asset classes.
3. Because of (1) and (2), corporate loans displaced Treasuries and high grade corporate bonds in low to medium risk multi-asset class portfolios modeled to be mean/variance efficient.
4. The higher returns generated by active management of corporate loan portfolios shows that the corporate loan market is inefficient.[2]

The continuing evolution of the product mix that incorporates bank loans[3] in the marketplace for investments makes it important to evaluate anew the answers to these foundational questions. The first part of this article will revisit the questions posed by Asarnow. Its concluding section will discuss new developments in the marketplace that give added relevance to a reevaluation of the contribution floating rate loans can make to the level of a portfolio's level and to the stability of the portfolio's return.

For those unfamiliar with the characteristics of the high-yielding bank loan asset class, Appendix 1 provides an introduction.

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Editor's Column

by Tony Dardis

Welcome to a real mixed bag of an edition of *Risks and Rewards.* The Investment Section newsletter is well-known for its diversity of subject matter and opinion. I hope you agree that in this edition we keep up the tradition. I think we have a number of cutting-edge articles that focus on some of the really hot topics currently being discussed around the actuarial community.

One hot subject that Investment Section members are keenly following is that of "capital management." I thought the membership might be interested to hear that the Society's Finance Practice Area is planning to put on a major seminar a little later in the year, with the tentative title of "Capital Management for Life Insurers," so keep an eye and an ear out for further details.

Capital management is one of the major issues facing the life insurance industry. Capital efficiency drives company value. In a consolidating industry, companies that achieve a high value have a strategic advantage, while low value means vulnerability. Achieving high value is important even for mutual companies since it gives them potential access to capital market financing and provides opportunities for affiliations/mergers and demutualization.

With the importance of successful capital management in mind, the Finance Practice Area is hoping that the seminar will help attendees get a grip on the subject matter. As I say, further details will be coming soon. In the meantime, as ever, we are delighted to hear your thoughts on emerging issues here on the pages of *Risks and Rewards.* Any articles, or simply a letter to the editor, on our members' experiences in the capital management area are most welcome!

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Revisiting the Portfolio Efficiency of Investment in High-Return Bank Loans
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Data

Asarnow

The data central to Asarnow's analysis was the Citibank Loan Index and the data that underlay the Index. The Citibank Loan Index contained data only for companies with public debt ratings. Asarnow's study considered the term-loan segment of the bank loan asset class. On average, the term loan subset of the Citibank Loan Index included 174 facilities representing $39 billion in outstanding loans. The study dropped loans for which key data items were missing or of doubtful validity.[4] The Euromoney/ Loanware[5] database supplied the key descriptive data used in the calculation of historical total returns.[6]

Since the Citibank Loan Index contained data only for companies with public debt ratings, Asarnow could identify matches with lists of defaulted companies published by Moody's or by Standard & Poor's.

Our Analysis

The demise in 1996 of the Citibank Loan Index makes unavailable the simple expedient of extending Asarnow's analysis. The only currently available surrogates for the performance of bank loans as an asset class are the Goldman Sachs/Loan Pricing Corporation Liquid Leveraged Loan Index ("the Index") and the results of bank loan mutual funds. In August 1993, the Index included 19 loans from 19 issuers with an aggregate market value of $9.2 billion.[7] As of November 6, 1998, the Index included 16 loans with an aggregate outstanding market value of $5.1 billion.

The Index is undeniably thin. The designers of the Index believed that the advantages of increased accuracy and replicability outweighed the disadvantage of a lack of comprehensiveness. The Index intends to reflect the characteristics of the most liquid performing loans in the "leveraged" (high-yielding) loan market.[8] To be eligible, an issue must be a syndicated term, dollar-denominated, SEC-registered, commercial/industrial loan, with a minimum stated maturity of one year and a maximum maturity of twelve years and with a minimum initial size of $100 million and a minimum size of $25 million during the term of the loan. To distinguish "leveraged" loans from investment grade loans, a loan eligible for the Index must have a minimum initial spread over LIBOR of 150 basis points. To remain in the Index, a loan must maintain a minimum price of $80, a surrogate for performing. A defaulting loan is removed from the Index at its then current market price, which reflects the effect of default.[9]

The Index appeared monthly beginning June 30, 1992, until December 31, 1992, and weekly thereafter.[10] Index returns are a market-value weighted average of the returns for the individual securities. Total return for each security includes price change, interest accrued and principal repaid.[11]

An alternative approach to examining results for a diversified portfolio of bank loans is to look to the results of a mutual fund or funds that invest in bank loans. In order to make valid risk/ return comparisons to asset classes for which true market prices are used, the pricing for the bank loan fund or funds should strive to reflect the current market value of the underlying loans to the extent possible. As with all financial instruments with limited liquidity, there will inevitably be an element of judgment in setting market value for bank loans. However, if the fund's management does not even attempt to price to market, but relies to a greater or lesser extent on amortized cost plus accrued interest ("book value') to strike a unit value for the fund, comparisons to financial instruments will be distorted, especially with respect to risk. Book values will be smoother than market values, and so will "book" returns, and particularly, "book" standard deviations.

Methodology

Asarnow

Asarnow made the following assumptions in order to be able to use the data available to measure bank loan performance.

1. Loans are reset every three months.

2. Since the Euromoney/Loanware database does not provide rate change data, assume the borrower chooses the lowest rate available (a "rational borrower" hypothesis.)

3. Prices used for calculation of total return are estimates based on new issue comparables.

Our Analysis

We have chosen to use the Merrill Lynch Senior Floating Rate Fund as a base on which to construct a surrogate for the performance of bank loans as an asset class. As of August 31, 1998, the Senior Floating Rate Fund was invested in 219 bank loans, compared to the 16 for the index as of November, 1998. Based on the description of the pricing practices of the mutual funds listed as bank loans funds in the *Wall Street Journal*, the Senior Floating Rate Fund is the only bank loan fund for which data is available from January 1990 onward that

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strives to "mark to market." We noted above the thinness of the Index. That reason alone would be sufficient to reject the Index as a surrogate for performance of bank loans as an asset class.[14]

Use of the Merrill Lynch Fund as the base for a bank loan performance surrogate allows us to dispense with the simplifying assumptions Asarnow needed. Accrued interest reflects actual rates as determined by borrower as permitted by the contractual reset provisions. The chief benefit of use of the Senior Floating Rate Fund is that price return can be calculated based on actual prices in the secondary market rather than on hypothetical prices determined by comparison to new issues.

To move from the returns on the Merrill Lynch Senior Floating Rate Fund to returns on the underlying assets which would be more directly comparable to index yields, we have added actual management fees, as disclosed in financial statements, to the Merrill Lynch returns. We shall refer to these augmented returns as the returns on "Bank Loans," to guard against any possible confusion between these augmented returns and the returns an investor in the Merrill Lynch Senior Floating Rate Fund would actually have earned.

Results

Correlation of Returns

A useful rule of thumb drawn from Modern Portfolio Theory is that the addition to a portfolio of an asset with low correlation to the assets already in the portfolio reduces the volatility of that portfolio.[15] If the addition of the new asset does not reduce yield, the expanded portfolio is an absolute improvement on the original portfolio (more technically, it is *pareto superior*). Additionally, given the risk/return preferences of some investors, a given reduction in volatility might be more valuable than the yield sacrificed to obtain the reduction in volatility.

Asarnow found that the correlation of total return on bank loans, as represented by the BBB-B segments of the Citibank Loan Index, with Treasuries of various maturities, with both high-grade and high-yield corporate bonds, and with the Standard and Poor's 500 Index, ranged from a high of .19 to a low of -.07.[16] These low correlations meant that bank loans had met the first condition for qualification for addition to a broad range of portfolios.

The table below updates Asarnow's analysis by replacing the Citibank Index by the Merrill Lynch Senior Floating Rate Fund. The period for which returns are correlated is from January 1990 to September 1998.

The correlations to Bank Loans range from highs of .44, to three-month LIBOR, and .39, to one-year Treasury notes, to a low of -.02, to the S&P 500. The correlations are relatively low even where we expect correlation, and there is essentially no correlation to stock returns.

These correlations show that the result established by Asarnow remains valid; the low correlation of bank loans to other asset classes makes them a plausible candidate for inclusion in portfolios in order to improve the risk/return efficiency of those portfolios. The next stage of the analysis requires that we consider yields.

Monthly Return Correlations

	Bank Loans	1 Yr T-Bond	5 Yr T-Bond	10 Yr T-Bond	30 Yr T-Bond	Corp. Bonds	High Yield Bonds	S&P Index	3 Month T-bill	3 Month LIBOR
Bank Loans	1.00	0.39	0.16	0. 14	0.04	0.09	0.02	-0.02	0. 36	0.44
1 Year	0.39	1.00	0.74	0.66	0.56	0.66	0.22	0.32	0.72	0.60
5 Year	0.16	0.74	1.00	0.96	0.90	0.94	0.30	0.41	0.29	0.13
10 Year	0.14	0.66	0.96	1.00	0.96	0.95	0.24	0.38	0.23	0.11
30 Year	0.04	0.56	0.90	0.96	1.00	0.93	0.23	0.41	0.19	0.09
Corp	0.09	0.66	0.94	0.95	0.93	1.00	0.43	0.51	0.28	0.16
High Yield	0.02	0.22	0.30	0.24	0.23	0.43	1.00	0.54	0.03	-0.03
S&P	-0.02	0.32	0.41	0.38	0.41	0.51	0.54	1.00	0.08	0.06
3 M T-bill	0.36	0.72	0.29	0.23	0.19	0.28	0.03	0.08	1.00	0.86
3 M Libor	0.44	0.60	0.13	0.11	0.09	0.16	-0.03	0.06	0.86	1.00

	Annualized Total Return	Standard Deviation 1/90 - 9/98 (if available; otherwise as available)	Sharpe Measure
	1/90 - 9/98	Monthly / Annually	
Lehman Corporate	9.61%	1.400/4.83	0.90
Lehman High Yield	11.77%	2.140/7.41	0.88
1 YearTreasury	5.92%	0.270/0.93	0.73
5 Year Treasury	8.21%	1.240/4.30	0.69
10 Year Treasury	9.18%	1.920/6.65	0.59
30 Year Treasury	10.79%	2.760/9.54	0.58
3 Month LIBOR	5.63%	0.120/0.42	0.94
3 Month T-Bill	5.24%	0.140/0.50	0.00
S&P 500 Index	15.85%	3.85/13.34	0.80
Bank Loans	8.45%	0.180/0.61	5.27

Comparative Yields

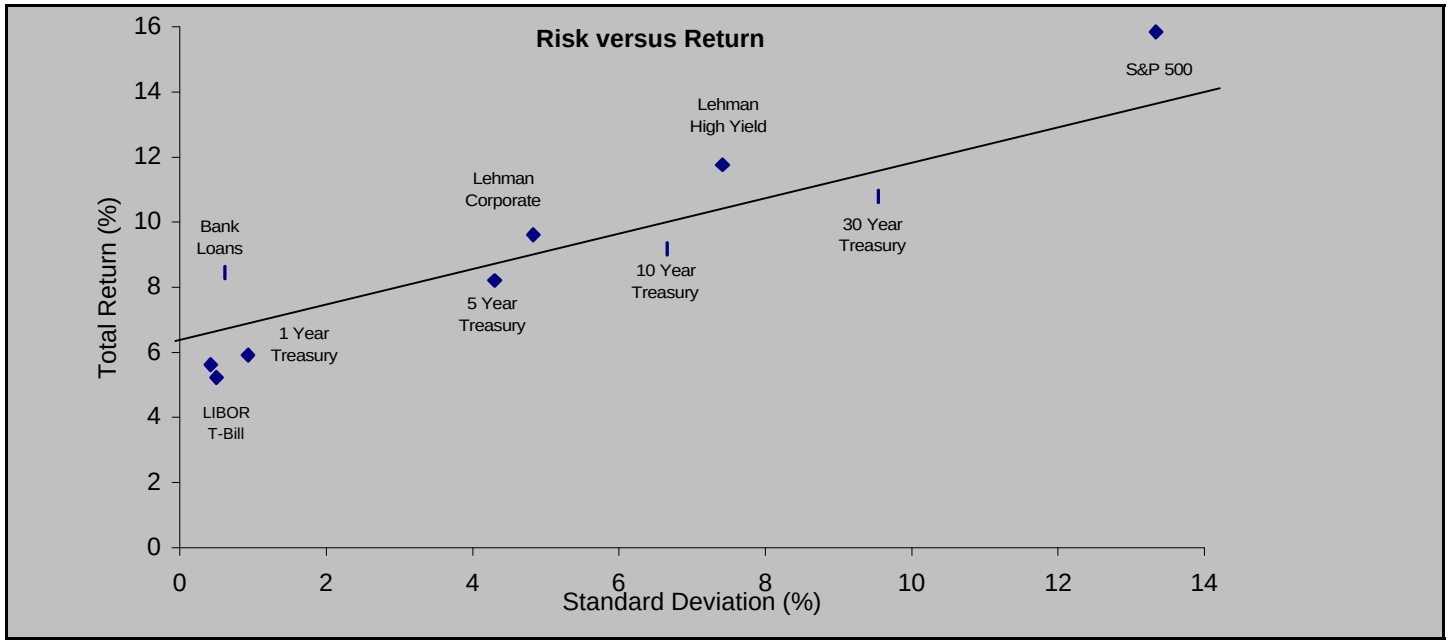
The table above presents the annualized total returns, the standard deviations and the Sharpe ratios for the same categories for which we examined correlations of returns on page 4.

The Sharpe Measure, which for Asset A equals (mean return for Asset A - mean return for the risk free asset)/ (standard deviation for Asset A), is a widely used measure of return per unit of risk. also reflect the risk/return characteristics of bank loans. The Sharpe ratio for Bank Loans is more than five times higher than that for the asset class with the next highest ratio, three-month LIBOR.

Over the period 1/90 to 6/98, Bank Loans' absolute return ranks above those for LIBOR, 3 month T-bills, and 1 and 5 year Treasuries, and below those for high-grade and high-yield bonds, 10 and 30 year Treasuries and the S&P 500 Index. Making a reasonable adjustment for management fees would reduce Bank Loans' return below those for the 5 year Treasuries. Restricting the comparison to the yields considered by Asarnow, the place of bank loans in the hierarchy of returns has changed very little, the only change being that bank loan returns have dropped below those for 10 year Treasuries.

The graph below plots total return against standard deviation of total return and includes the regression line determined by the data points. In this graph, to be below the regression line indicates that total return is greater per unit of risk than the regression line would determine. Here again, Bank Loans outperforms all other asset classes; for the degree of risk, the return exceeds that predicted by the regression line by 2%.

The graph, which makes no adjustment for management fees, shows, for example, that Bank Loans increases return while decreasing risk compared to 1 and 5 Year Treasuries, and that it offers considerable reduction of risk compared to the Lehman Corporate and 10 and 30 Year Treasuries with only a modest sacrifice of return. If we made a adjustment



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for management fees, the relationship of Bank Loans to the 5 Year Treasuries would change from one of absolute, to one of relative, advantage, for investors with even a slight degree of risk aversion.

Benefits of Active Management
Our analysis so far clearly establishes the advantages of investment in bank loans for improving the efficiency of low to moderate risk portfolios. Unfortunately, the data available does not allow us independently to weigh the advantages of active management. All recent data reflects active management.

The only reliable indication of the possible advantage of active management comes from a comparison of the return on Citibank index from 1/90 to its end in 12/96 to that of Bank Loans. The Citibank index earned 7.14%; Bank Loans 8.58%. If we were to reduce Bank Loans return by 130 basis points to approximate the difference in costs between active management and managing an index fund, Bank Loans would still have outperformed the Citibank Index by 13 basis points per year.

Investment Opportunities

Currently, retail mutual funds are a dominant force in the market for leveraged bank loans marketed to institutional investors. However, the analysis we have presented above should recommend bank loans as an asset class not only to retail investors, but to a broader range of institutions as well. Structures will certainly evolve to enable institutions to enjoy the superior return investment in bank loans offers, while accepting only the level of risk appropriate to their different situations, and with lower expenses than those incurred by mutual funds.

Collateralized Loan Obligations
A pool of bank loans can be used to support a variety of securities. One structure for which bank loans can serve as the underlying assets are Collateralized Loan Obligations (CLOs). CLOs are typically issued by offshore Special Purpose Vehicles (SPVs) meant to isolate the operation of the structure to the extent possible from United States taxes. Buyers of the equity are often hedge funds attracted by potential returns in excess of 20% per year. A relatively small equity participation in a CLO can raise the credit quality of the fixed-income securities issued by the SPV to a level as high as AAA, while still offering returns superior to other AAA investments. Multiplying the number of tranches offers the opportunity to tailor risk/return to the needs of nearly any institutional investor.

Defined Benefit Pension Funds
Elements of different tranches of bank loan structures, or indeed investment in a pool of loans managed by a bank loan specialist, would be an appropriate investment for a defined benefit pension plan. Investment in the equity element of a structure offers the opportunity for superior returns with lower downside risk.

Insurance Companies
The risk/return characteristics of a diversified portfolio of bank loans, especially as they can be tailored though structured securities, make bank loans and bank loan structures attractive investments for insurance companies. Investment in bank loan structures' equity would be an attractive risk-reducing alternative to stocks in insurance company surplus and general accounts. An insurance company separate account might offer direct participation in a pool of diversified bank loans managed by a bank loan specialist. A separate account offering a lower level of risk could invest in senior notes in a number of bank loan structures.

Capital Accumulation Plans
A pool of bank loans could itself be the basis for an option for participant-directed capital accumulation plans. Even direct participation offers superior return with risk characteristics appealing to the conservative investor. The senior or even the mezzanine levels of notes in a structure would be excellent investments for Stable Value Options, offering improved returns with a lower level of market value risk.

As the volume of bank loans grows, and with it the experience of the market in dealing with them and in constructing structures with elements that appeal to a wide array of investors, competition and increased administrative efficiency will make them an ever more versatile and appealing part of the capital market.

Appendix 1: High-Yielding Bank Loans

The asset class analyzed by Asarnow and reevaluated here consists largely of syndicated loans to large and mid-sized corporations. The interest rates on these loans change at periodic reset dates, most frequently quarterly, to maintain a fixed spread with respect to a reference interest rate, usually three-month LIBOR, but sometimes the prime rate, rates on certificates of deposit, or other reference rates. Spreads over the reference interest rate vary for many reasons: These loans are almost always senior obligations, and, in the case of loans with lower than investment-grade ratings, are secured.

Loans in this asset class can be either term loans or revolver loans. Term loans are fixed in amount and have fixed repayment schedules. Revolver loans are draws against a line of credit guaranteed available until maturity. An investor earns the reference interest rate plus the fixed spread and possibly other fees on the amount of outstanding term loans and draws. On revolvers, the lender also receives a fee on any amount guaranteed available not yet drawn down.

Loans in this class generally have

stated maturities of from three to five years and an average life of three and one-half years.

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Bibliography

1) Elliot Asarnow, *Corporate Loans as an Asset Class,* 22:4 The Journal of Portfolio Management (Summer, 1996), 92 [hereinafter "Asarnow"]. Consecutive citations to material appearing on the same page of the same source have been omitted except for the last of what would otherwise have been a series.

2) Asarnow, 93.

3) The asset class which Asarnow studied, and which we are reexamining in this article, consisted of bank loans rated BBB-B in the Citibank Loan Index. In this article, we refer to that asset class simply as "bank loans."

4) Unfortunately, Asarnow does not provide the number of loans dropped for these reasons.

5) Loanware is a proprietary database covering the global loan market, including syndicated loans and related banking instruments. It is a product of Capital Data, a member of the Computasoft Group, which has a website describing the database at *www.capitaldata.com*.

6) Asarnow, 94. Supplementary data came from additional source documents, e.g. loan agreements and terms sheets; unspecified published information sources provided checks "when required." *Ibid.* Historical LIBOR, prime and CD rates, as well as average all-in required spreads, were also factors in the calculation of total return. *Ibid.*

7) Thomas Iben, Steven C. Miller and John E. Urban, Fixed Income Research: Introducing the Goldman Sachs/Loan Pricing Corporation Liquid Leveraged Loan Index (Goldman Sachs, September, 1993) [hereinafter "Iben *et al.*"], 2.

8) Iben *et al.*, 10.

9) Iben *et al.*, 12.

10) Iben *et al.*, 13, Exhibit 4, note a.

11) *Ibid.* The Index assumes intra-week cash flows are received at the end of the period. It incorporates prepayments as soon as they are available. It does not include additional loan fees paid to investors. *Ibid.*, note 7.

12) Asarnow, 94.

13) As we shall discuss, *see below* footnote 18.

14) The general formula for the standard deviation of a portfolio as derived by Harry Markowitz is:

$$\sigma_{port} = \sqrt{\left(\sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j Cov_{ij, i \neq j}\right)}$$

See Frank K. Reilly and Keith C. Brown, *Investment Analysis and Portfolio Management* (5th ed., 1997), p. 261. In a portfolio with numerous assets, the contribution of an individual asset's covariance with other portfolio assets generally dominates the contribution of its own variance. *Ibid.*, p. 262. Transformation of the covariance into coefficients of correlation using the definition $r_{ij} = ov_{ij}/o_i o_j$ standardizes covariance into a statistic which can vary only from -1 to 1, which makes comparison simpler. *Ibid.*, pp. 259-261.

15) Asarnow, 98.

16) The yields used in the tables and graph below are from indices with the exception of those for Bank Loans. As noted above, actual management fees, as disclosed in financial statements, have been added to returns for the Merrill Lynch Senior Floating Rate Fund results to create a bank loan surrogate comparable, that is to say gross of management fees, to those for the indices. Funds which consist of these different asset classes would charge very different fees. As examples, the median fee for high-yield bond funds is 145 basis points. The charges for the Merrill Lynch Senior Floating Rate Fund approximate 130 basis points. Fees for money market funds approximate 50 basis points, and for an S&P Index fund, between 50 and 60 basis points.

17) Indeed, the Sharpe ratio is so high that it casts doubt on the accuracy of the standard deviation of returns. We noted above that we were choosing the Merrill Lynch Fund as a base to construct a surrogate for the bank loan asset class primarily because it espoused "mark-to-market" pricing. The extent of the discontinuity between the Sharpe ratio for Bank Loans and those for other asset classes suggests above all that Merrill's attempt to mark to market has been less than totally successful. However, even doubling the standard deviation would leave unchanged the analysis which follows.

18) As we noted above, as an index, the Leverage Liquid Loan Index must be adjudged a failure. The Index correlates negatively to LIBOR and to Bank Loans, an intuitively unacceptable result. It has only a low positive correlation, over a brief period of commonality, to the Citibank Loan Index, which was much thicker, consisting of over 170 loans.

Nevertheless, even though a failure as an index, the Index is outstanding testimony to the skill of its constructors as active managers of bank loans. The results the Index has achieved over its life compared to other fixed-income investments are extraordinary. It outperforms every other fixed-income class by substantial margins, and is close to the S&P 500.

Scenario Generation: Valuation versus Strategy Development

by Mark Tenney and Luke Girard

More and more, we are seeing Monte Carlo methods being used for interest rate scenario generation. The scenarios are then used for valuation or strategy development with respect to life and annuity blocks of insurance liabilities. These methods are also being used generally in the investment community and with respect to pension funding. In applying their technology, practitioners need to create a set of scenarios that are appropriate for the application being considered. In generating such scenarios, one must make the choice of whether to use the true probability distribution or the risk-neutral distribution. The true distribution reflects the modeler's subjective views about the type and likelihood of future scenarios and history is usually a starting point for this. For the risk-neutral probability distribution, the true scenario probabilities are adjusted in order to reflect the market's pricing for risk.

We should not use the true distribution for valuation since it does not incorporate the market's pricing for risk, but it is appropriate to use this distribution for strategy development since it reflects the practioner's hopefully realistic view of the likelihood of future events. Conversely, we should not use the risk-neutral distribution for strategy development, but it is appropriate to use this distribution for valuation. Furthermore, assuming that cash flows are correctly modeled under a set of risk-neutral scenarios, the valuation can proceed by simply discounting the future cash flows by the one-period risk-free interest rates and then by weighting the pathwise values by the risk-neutral probabilities. This relatively simple procedure is referred to as risk-neutral valuation and is a consequence of the Fundamental Theorem of Asset Pricing.

The linkage between the risk-neutral distribution and the true asset return distribution is often lost sight of. We emphasize this linkage in this article. Risk-neutral valuation and thus risk-neutral scenarios are a calculational tool to answer the following question. Given a set of base assets, and the true return distribution of returns for these assets, what is the amount of assets that needs to be held to defease a liability, given that any dynamic strategy, including short selling, of the assets is allowed?

We can attempt to answer this question by first describing the following process to defease the liability. Given an asset return distribution, we define the strategy contingent cost of a liability to be the market value of the starting assets which will meet all the obligations of the liability under any scenario for the given dynamic investment strategy. We restrict the dynamic investment strategies to be ones that do not look ahead, i.e., for a given scenario, only information up to the current time in the scenario can be used to determine the investment strategy. We define the dynamic immunization value (DIV) to be the minimum of the strategy contingent costs over the set of all possible dynamic investment strategies.

If the model is not arbitrage free, then it may be possible to create portfolios of assets and liabilities that are riskless but earn a return in excess of the risk-free rate. In the most bizarre situation, the DIV can be as low as zero, or even negative. If the model is arbitrage free and there are no transaction costs or taxes, then the DIV equals the cost calculated using risk-neutral valuation. In fact, risk-neutral valuation is simply the calculational tool used to determine the DIV when the assumptions in the model allow us to do this (i.e., arbitrage free with no transaction costs or taxes). An example is the Black-Scholes option pricing formula which gives the dynamic immunization price under the assumptions of their model. Furthermore, the notion of dynamic immunization value generalizes the concept of arbitrage free pricing to the case involving market imperfections such as transaction costs. It is well defined with taxes.

For arbitrage free models, the dynamic immunization value is the same for different asset return distributions which have the same risk-neutral asset return distribution. In particular, the dynamic immunization value for the risk-neutral asset return distribution is the same as the dynamic immunization value for the original true asset return distribution. This is true because these distributions differ only by the probabilities assigned to the scenarios in the universe of all possible scenarios.

Much of the finance literature emphasizes the cases where different true asset return distributions lead to the same risk-neutral distribution, and therefore the same price and portfolio holdings for the immunizing portfolio. While this is of practical importance in many cases, what remains critical is the dynamic immunization value implied by the true asset return distribution. No matter how many true asset return distributions different imply a given risk-neutral distribution, this is irrelevant if the one true asset return distribution that is used for strategy development is inconsistent with the risk-neutral scenarios used in pricing.

For an insurance liability, the dynamic immunization value is one possible approach to determining the market value of liabilities. This is the cost of purchasing a portfolio of assets that dynamically defease the liability. If the allowed investments include below investment grade bonds, we can subtract out a default cost for each quality level. In principle we should model the spreads for default, quality and sector as stochastic. If we do not, we can use a blended yield curve, with appropriate charges for the market's pricing for default risk subtracted out.

Adjustments to the risk-neutral pricing algorithm, or the assumptions that go into it, are determined by the true asset return distribution, and conversely their

validity is judged by the asset return distribution that they imply. For example, calibration to initial market prices is important in obtaining the correct answer in calculating the DIP that is used for valuation. However, if an interest rate model is calibrated to market prices by altering its deep fundamental parameters, and this results in unrealistic distributions of the yield curve, under the realistic probability measure, then the calibration process is rendered suspect. If the true asset return distribution is affected by this calibration to make it unrealistic, then inappropriate strategies may be obtained if these scenarios are then used for this purpose.

"Adjustments to the risk-neutral pricing algorithm, or the assumptions that go into it, are determined by the true asset return distribution, and conversely their validity is judged by the asset return distribution that they imply."

Generalizing DIV to Reserves

We can also consider the dynamic immunization reserve where there is an allowed deviation in meeting the obligations, i.e., we relax the constraint that the hedging strategy defease the liability in all scenarios. This is a natural way of thinking about reserving that actuaries are already familiar with. Using the true distribution, suppose that we allow a percentage P of cases in which there is a shortfall in meeting the obligations, then we define the reserve to the P level. For arbitrary dynamic strategies, there does not exist an algorithm for calculating this reserve level (for example, a risk-neutral valuation type algorithm does not exist). If we parameterize the investment strategies allowed, we can use brute force methods to calculate an upper bound on this reserve. We can also consider restrictions in the investment strategy in setting this reserve level.

In a market with transaction costs, imperfect information, and a failure of transparency in information, a reserve may be more relevant than the price from an arbitrage free model. However, a dynamic immunization value that includes these imperfections can still be relevant. Unrealistic strategies can be pared by making appropriate assumptions concerning transaction costs, uncertainty in parameters, and institutional restrictions.

If we set the transaction costs to zero and assume no taxes, then the risk-neutral value from an arbitrage free model is a lower bound to the dynamic immunization value with transaction costs.

Simulation for Asset-Liability Management

Below is a general outline for creating true probability distributions of interest rates, stock, bond and other asset prices and other economic variables.

i) First, develop the stochastic process for the core state variables in the true probability measure.

ii) Then, assume a formula for risk premia and from this obtain the risk-neutral pricing measure for all asset returns.

iii) Generate scenarios in the true probability measure in the core state variables.

iv) Generate the prices at each scenario point given the core state variables at that point, and the risk premia formula, by generating risk-neutral scenarios from that new starting point, and using these to price securities. Do this by generating the cash flows of the securities in these risk-neutral scenarios and discounting them at the one-period risk-free rate in those scenarios and then averaging these prices over scenarios. Note that the set of all risk-neutral scenarios is the same as the set of all true scenarios, but the probabilities are different.

v) Perform a calibration process of the parameters of the core state variable process and the risk premia formula to fit the modeler's subjective view of the distribution which may be based on historical information. We also use the starting yield curve and other market information to determine the initial values of the core state variables. This can also be combined with the historical calibration. We may also introduce a residual process to achieve a final reconciliation with initial market prices. For example, small deviations in the model yields and treasury yields can be modeled as residuals that decay over the course of the next year.

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What Your Manager Won't Tell You about Investment Benchmarks

by Alton Cogert

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It's time for your quarterly meeting with your company's investment manager. It probably follows one of the following scripts:

Scenario 1: The manager has apparently beaten the benchmark.

The manager starts with a brief macroeconomic review, including typical comments about the Fed, spreads, and market trends. He/she spends some time highlighting your portfolio, and then emphasizes how your portfolio is doing terrifically well, easily beating the benchmark. The meeting ends with all shaking hands, and hoping for a similar performance next quarter.

Scenario 2: The manager has apparently not beaten the benchmark.

The manager starts with a very long macroeconomic review, showing how events largely outside of his/her control have caused temporary, unexpected market dislocations. He/she spends some time highlighting your portfolio, and then quickly shows that your portfolio did not beat the benchmark. However, you are told not to worry because either: (1) this was a very unusual quarter, and/or (2) the benchmark you use really isn't very relevant to your company's portfolio (it has so many Treasuries that would give you low yields that just wouldn't give you the income you need). The meeting ends with all shaking hands, and hoping for a return to "normalcy" and better performance next quarter.

You were probably treated to both scenarios last year. Scenario 1 probably applies to the results of the first, second and fourth quarter of 1998, while scenario 2 dovetails nicely with the 'flight to quality' seen in the third quarter of 1998.

No, we are not psychic, but we do know that, for many insurers, it is too easy to abdicate the difficult job of developing and following an appropriate investment benchmark to its investment manager. Though this is akin to letting the wolf watch the hen house, the business of the insurer is, after all, insurance, and investing is best left to the experts.

However, as a prominent investor in insurance companies once said: A company that doesn't focus on both sides of the balance sheet is asking for trouble—either through sub par investment results and profitability or hidden investment problems.

One of the best way to judge how your investment portfolio is performing is by comparing it to a relevant benchmark—after taxes and after fees.

AIMR Performance Presentation Standards recommend using after tax performance calculations for taxable clients. In essence, this means that accrued interest and dividends are tax affected by the company's highest effective marginal tax rate. Realized gains and losses are tax affected, while unrealized losses and gains are not tax affected. AIMR's logic here is clear. Unrealized gains and losses on a securities portfolio may never be realized. This is especially true for fixed income securities that may never be sold, just allowed to mature. Thus, tax affecting unrealized gains and losses is not allowed by the AIMR standards.

But how do you know if the benchmark is appropriate? This is fairly well spelled out in the literature for CFAs, where six basic characteristics are outlined.

The chart below outlines those six characteristics and applies them to companies that use a truly customized benchmark (TCB), a generic index (e.g. Shearson/Lehman Aggregate Index), and a mix of different generic indices. A TCB is a group of randomly selected fixed income securities with the duration, credit and asset category characteristics required by the insurer's asset allocation strategy. TCBs and other performance measurement issues are discussed in more detail at the SAAInteractive.com web site (*http://www.saai.com/performa1.htm*).

You probably use some kind of generic benchmark(s), or some slicing and dicing of those benchmark(s).

Characteristic	TCB	Generic	Generic Mix
Specified before investing begins	Yes	Yes	Yes
Understandable construction	Yes, specific securities are all known	Not really, specific securities are not known	Not really, specific securities are not known
Investable	Yes	Impossible, benchmark size is too large	Impossible, benchmark size is too large
Measurable and possible to track	Yes	Yes	Yes
Relevant, tied to the insurer's strategy	Yes	No	Only if mix is related to product strategies and capitalization
Realistic constraints (e.g. maximum loss)	Yes	No constraints	No constraints

But, did you know:

1. Generic benchmarks may include securities that are not allowed in your investment policy. For example, the popular Shearson/ Lehman Aggregate Index (SLAG) includes Yankee bonds—non-U.S. issuers in US$. Does your policy allow investment in foreign securities?

2. Generic benchmarks include more U.S. government bonds than you would ever want in your portfolio. Of course, too high an allocation to US government bonds is not desirable for yield reasons. Here's a chart showing the approximate asset allocation found in commonly used indices.

	Shearson/Lehman Aggregate Index	Shearson/Lehman Govt/Corp Index
Sector	%	%
Government	48	73
Corporate	21	27
Mortgage-Backed	30	0
Asset-Backed	1	0

3. Generic benchmarks should not be used as both return and yield bogeys. The yield for a generic benchmark is a simple weighted average of the yields of the underlying securities. Remember that yields need to be calculated in a non-linear fashion, not as a linear weighted average. An article in the *Journal of Financial Analysts*[1] has shown that this has produced up to 90 basis points in error.

"The benchmark you choose should be the right one for your company's liability and capitalization, despite 'unusual' market conditions."

4. Managers that want to use multiple benchmarks for a single portfolio are probably good at smoke and mirrors. The more benchmarks the merrier for the manager, since it gives him/her an added chance to beat something. Your benchmark should incorporate yield and return requirements, but it should be one benchmark.

5. The strategic asset allocation decision you make will provide 80%+ of the returns of your port folio. This has been shown in classic articles in the *Journal of Financial Analysts*[2]. Therefore, if you make this decision internally, your manager can only really provide value at the margin. Thus, it is very important to have an accurate, appropriate benchmark against which to measure performance.

6. The benchmark you choose should be the right one for your company's liability and capitalization, despite "unusual" market conditions (see Scenario 2 above).

With this information, you are now properly prepared for the next quarterly meeting with your investment manager. However, please be prepared for the most obvious howling about using a more appropriate benchmark: "It's too much work to use a truly customized benchmark!" To which the best reply may be, "It's too dangerous not to use the proper benchmark. We want to be involved in accurately managing both sides of the balance sheet, thank you."

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Financial Engineering

by Mark Bursinger

There has been increased discussion around finding new avenues for growth in the actuarial profession. In the investment community, there is a relatively new profession called financial engineering that requires many of the same fundamental skills acquired by actuaries. But before we jump to the conclusion that financial engineering is a good fit for actuaries, we must first understand what it is.

The International Association of Financial Engineers (IAFE), which was formed in 1991, organizes the financial engineering profession. There are about 2,000 members representing academia, industry and regulatory communities worldwide. The IAFE defines financial engineering as, "The development and creative application of financial technology to solve financial problems and exploit financial opportunities…" If you put a reference to future contingent events in this definition, it sounds a lot like actuarial science. Though I can identify with this definition, it's difficult to understand exactly what financial engineers do. A simpler definition might go like this, "Financial engineers create financial products to change risk-reward tradeoffs." In many cases, financial products are derivative securities. The users of these products range from individual investors to major corporations.

The creation of this profession was likely caused by the increased complexity of financial products and capital markets. The IAFE conducted a survey that showed that financial institutions are becoming more dependent on quantitative professionals and techniques. We can see this in our own profession as actuaries get involved in the design and pricing of guaranteed minimum benefits for variable annuities. These benefits are fundamentally options requiring the ability to understand and model financial markets.

Frederick Novomestky, Academic Director, Financial Engineering Program, Polytechnic University, Brooklyn, New York, gave a presentation at the 1998 IAFE Conference about training financial engineers. Core courses in financial engineering include financial accounting, fixed income markets, derivatives and probability and stochastic processes. Prerequisite coursework includes microeconomics, macroeconomics, calculus, probability and statistics, linear algebra, spreadsheet knowledge and exposure to computer programming. A quick glance at the actuarial syllabus reveals the similarities in educational requirements between our professions. Especially for those that pursue the investment track.

"The IAFE defines financial engineering as, 'The development and creative application of financial technology to solve financial problems and exploit financial opportunities...'"

Novomestky listed the following examples of what financial engineers do:

- Develop, price, trade, evaluate and apply new financial products
- Assess and manage risk
- Implement sophisticated investment and risk management strategies
- Design, develop, and implement the IT infrastructure for modern financial services firms

He also cited the following employers of financial engineers:

- Investment advisory firms
- Consulting firms
- Investment banks
- Banks
- Insurance companies
- Regulators and exchanges
- IT product development firms
- Energy marketing firms

At the current time, there is not a specific accreditation program for financial engineers. But don't get too excited about escaping exams. Like any other profession, employers like to have a way to evaluate the qualifications of candidates. The IAFE is planning to establish a certification program. It is anticipated that the program would include a written exam or series of exams. In addition to examination, the program would include ethical standards, standards of conduct and experience requirements. It's not clear when the certification program would start.

Based on what I've learned about financial engineering, I believe there will be opportunities for actuaries wishing to pursue this field. In fact, I'd suggest there are actuaries working at insurance companies or investment banks doing financial engineering type work although they may not be calling it that. More information about financial engineering can be found at the IAFE website, *http://www.iafe.org.*

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The Use of Transfer Pricing in Asset Liability Management

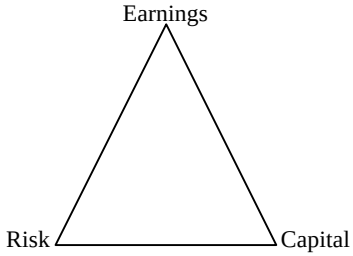
by Nancy Bennett & Mike Murphy

The scene takes place in the executive conference room. You are having a conversation with the CEO and CFO about the financial health of your organization. The conversation starts with some questions about company earnings. Perhaps your company is considering investments in alternative asset classes or introducing a new product. Before long, the questions get tougher and tougher. Your heart starts beating faster as you realize you are not able to answer many of these questions.

CEO: What are the company's primary sources of earnings and how can we reduce the volatility of earnings?
CFO: What are appropriate product pricing targets and how are results evaluated to determine if pricing targets are being met?
CEO: What is the value of the company and how should value be measured? Are the financial objectives for earnings, growth, and capital appropriately defined?
CEO: What are the sources and possible uses of the company's capital?
CFO: How much capital should be retained in the company?
CEO: Are the company's reserves adequate to cover benefits?
CFO: What is the company's tolerance for liquidity, quality, and other investment risk?
CEO: How can our general account investment strategy be modified to increase return? What tradeoff are we making between earnings and appreciation?
CFO: How much interest rate risk can the company withstand? How is interest rate risk monitored? What types of actions would the company take, or need to take, if interest rates spiked?
CEO: How can we evaluate the performance of the product, asset, and corporate managers?

Answering these questions is critical for any insurance organization to achieve financial success. For many of us whose job is to answer these questions, we know it is not simple.

Although there are many questions involved with managing the financial condition of an insurance company, the questions usually fall into one of three categories: earnings management, capital management, and risk management. As illustrated in the following diagram, these three categories are interrelated. Directly or indirectly, intentionally or unintentionally, the actions taken to achieve financial objectives have a domino effect due to the integrated nature of financial management.



Earnings are equal to the change in capital.
Risk materializes as variability in income.
Capital represents the funds needed to cover risk and fund new ventures.

While various organizational structures are used in financial management, every company needs to perform similar tasks. To make these tasks tractable, responsibilities for financial management are divided among many functional areas. This segregation of responsibilities promotes specialization, but often overlooks the integrated nature of financial management. Who is accountable for the development and execution of company strategies? How are the costs and benefits of the strategies measured and evaluated? How are the rewards of implementing these strategies passed on to policyholders, shareholders, and company managers?

More sophisticated financial management involves the development and/or revision of product, asset, and corporate strategies in the context of integrated financial management. The task of managing the financial condition of an insurance organization is quite complex. Too often, company managers hide behind this complexity and cite many barriers as reasons to stay the course with a segregated approach to financial management. Of course, this "Rip Van Winkle" approach to financial management can work for awhile if you are lucky or if the market is strong.

The remainder of this article describes a new paradigm for managing the financial condition of a life insurance company. We designed this paradigm with many years of experience as ALM practitioners, both with direct responsibility as a company's corporate actuary and as consultants to many life insurance companies. As such, we put ourselves back into these face-to-face conversations in describing this new financial management paradigm. Having worked in financial management for many years, I could see great potential in ALM and integrated financial management. The difficulty was in convincing other senior managers that ALM could help manage the company better.

Discussions with management were interesting, but often dismissed as too theoretical. Financial resources were tapped out dealing with the demands of regulators, rating agencies, and stock analysts, often leaving little time to analyze the underlying financial economics. More sophisticated financial management would necessitate more sophisticated tools and rigorous analysis. However, progress in using these tools was slow due to inadequate technology and a distrust of a model's ability to capture all dimensions of the business. Furthermore, some managers within the organization were wary of formula-driven management since financial objectives were not sufficiently articulated to explain results and recommend strategic changes.

I needed to show management that an integrated approach to managing the financial condition of the organization would result in better decisions and a stronger, and ultimately more competitive, company. But how?

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The Use of Transfer Pricing in Asset Liability Management

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My conviction was strong enough to persevere in the face of many obstacles and the competing demands on my time. Eventually, I was successful in attracting the attention of many asset, product, and corporate managers by piquing their curiosity as I posed many of the probing questions mentioned earlier. I had convinced enough people that we could increase the value of the company through more sophisticated and integrated financial management. But, what exactly needed to be done?

Most importantly, a new financial management infrastructure had to be useful in practice. This new infrastructure should provide a basis for evaluating alternative investment, product, or capital strategies, but continue to support the requirements of regulators, auditors, stock analysts, rating agencies, and other constituencies. I needed a tool that would enhance the decision-making process; but I knew this tool was only a means to the end. No ALM paradigm, regardless of design, could directly produce the answers. I needed a basis for measuring investment risk and return, establishing profit expectations, and evaluating financial performance and institutionalizing risk management.

While cognizant of regulatory demands, this new ALM paradigm had to be designed around leading-edge risk management concepts. The company's financial management capabilities needed to be enhanced by bridging the existing tools with newer risk management concepts through the translation of current financial performance measures into financial measures based on these leading-edge concepts.

I have never forgotten a conversation with a senior actuary when asked how I could defend my budget requests for more sophisticated financial management. "I can measure the value of adding an underwriter. I can compare the future mortality savings to the cost of the underwriter and measure the value of stricter underwriting controls. How can I measure your value?" It would take me years to answer this question.

The answer to this question was the genesis of transfer pricing. In its purest form, transfer pricing involves assigning a "price" for the use of funds that are transferred within the company. Through this transfer process, the company can better manage risk and profitability. In application, transfer pricing represents the intra-company reinsurance of the interest rate risk. The asset and product managers cede or transfer the interest rate risk to a corporate risk manager allowing them to focus on the performance of the assets or products, respectively.

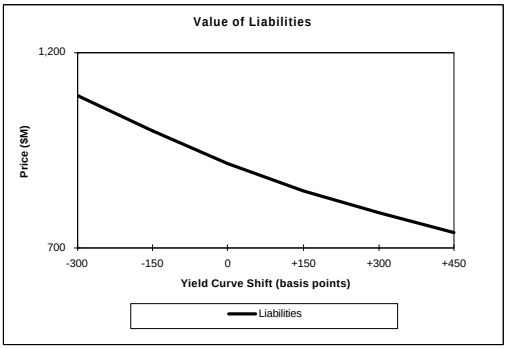
Consider the classic asset-liability question. A life insurance company issues products with guarantees and product options, producing contingent liability cash flows. What types of assets should be purchased to support this product liability?

"The answer to this question was the genesis of transfer pricing."

The timing, amount, and probability of these contingent events are primarily stochastic, and should be quantified by means of option pricing theory and policyholder behavior studies. Option pricing is a technique of determining the economic value or price of a stream of contingent cash flows. Price Behavior Curves (PBCs) are a tool for identifying interest rate risk using option pricing techniques. Prices are calculated as the present value of expected cash flows, discounted over various shifts in the yield curve.

The following is an illustration of the PBC for a block of deferred annuities. As you can see, the economic value or price of the product changes as interest rates change.

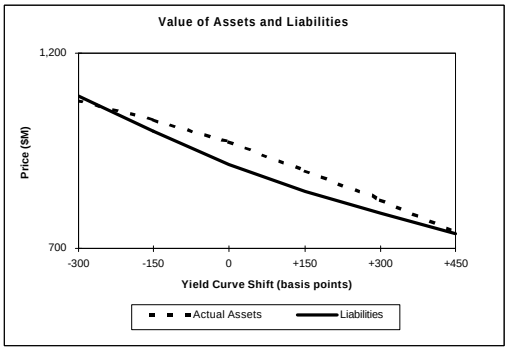
PBC of an SPDA



Let's get back to the classic asset-liability question. Given this PBC information, how do we determine the types of assets to be purchased for this product? Designing investment strategies for different products and allocating those results within the financial statements is not a new issue. Even before the regulatory requirements of cash flow testing, many companies recognized the interplay of the product options, crediting strategies, and investment strategies. Eventually, most companies designed some type of product line asset allocation system that attempts to manage the ALM position by matching certain types of liabilities with assets.

The most common method of asset allocation is to simply segment or prorate a portion of all inforce assets to the various liability product lines. A typical segmented ALM paradigm looks like this:

ALM Approach Based on Segmented Asset Allocation



As you can see, the assets and liabilities contain different degrees of price volatility, commonly referred to as

interest rate risk. Economic surplus is defined as the difference between the price or value of the assets and liabilities. Various measures, including the durations and convexities of assets and liabilities, are calculated and used in managing the company's surplus. However, this type of ALM paradigm presents some challenges in evaluating investment and product strategies.

While a company may be comfortable assuming some level of interest rate risk, how much risk is appropriate? Who is responsible for deciding how much interest rate risk is appropriate? Are the actions of the product or asset managers increasing or decreasing the interest rate risk? Determining how value is added is a difficult task.

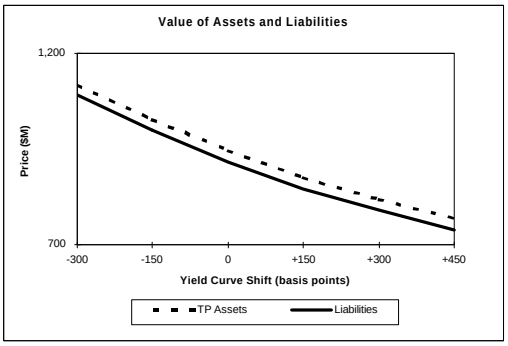
Many ALM systems use information obtained from the accounting systems used in cash flow testing and in the preparation of statutory and GAAP financial statements. A major problem in leveraging ALM systems is that current financial reporting techniques for allocating investment results to the product lines commingle the contributions of the product, asset, and corporate managers. Investment allocation to the product lines needs to be reconfigured to facilitate the management of the interest rate risk and ultimately provide a practical ALM paradigm.

The ALM paradigm based on transfer pricing is characterized by the following:

- Creation of a centralized corporate risk function
- Transference of the interest rate risk from the product lines to corporate
- Intra-product line investment allocation based on synthetic asset portfolios (SAPs)
- Direct recognition of writing options in the products

With transfer pricing, the ALM paradigm looks like this:

ALM using Synthetic Asset Portfolios



In transfer pricing, synthetic asset portfolios are constructed with the same interest rate risk profile as the product liabilities. SAPs are constructed to emulate the cash flow characteristics of the product liabilities. Using linear programming tools, SAPs are constructed from a universe of noncallable bonds and interest rate derivatives.

As illustrated, the transfer pricing approach produces an immunized surplus position as the values of assets and liabilities move in tandem with changes in interest rates. The SAPs are monitored and updated as the characteristics of the liabilities change. These SAPs form the basis for allocating investment results to the product lines. By allocating investment results to the product lines based on the synthetic assets, the product lines receive investment cash flows consistent with the risks inherent in the products. The SAPs supporting the products will provide the necessary cash flows to fund product guarantees and options over a wide range of interest rate scenarios.

In transfer pricing, the actual investment return of the company's assets is essentially bifurcated into fixed and residual components. The SAP for a given product line represents the fixed component and its investment results are allocated to that product line. The investment return attributed to the residual component is allocated to the corporate risk line. Residual returns include investment returns from assuming quality risk, liquidity risk, option risk, duration and convexity risk, and the selection of asset types and securities.

The bifurcation of investment results into the fixed and residual components simplifies the analysis of investment and product performance because the managers' contributions to financial performance are delineated. It is easier for a company to evaluate the performance of the asset manager since the impact of product actions is isolated in the maintenance and evaluation of the synthetic portfolios. It is easier for a company to evaluate the performance of the product manager since the impact of the investment actions is isolated in the maintenance and evaluation of the corporate risk line.

The SAPs represent a matched investment strategy. However, it is important to distinguish between the "synthetic" asset strategy and the "actual" investment strategy. Transfer pricing neither requires nor endorses a matched actual investment strategy for products. In order to earn a competitive rate of return, a company will continue to invest in callable bonds, CMOs, equities, and other asset classes. The actual asset portfolio can be evaluated relative to the residual returns earned in excess of the synthetic portfolio's returns. Because the SAPs emulate the cash flows and risk characteristics of the liabilities, the SAPs form a basis for establishing investment strategies and customized benchmarks for evaluating investment performance.

Transfer pricing does not provide free reign for the asset or product managers. The transfer pricing paradigm is a valuable tool for the corporate risk manager to evaluate and establish risk parameters and financial constraints for the asset and product managers. The transfer pricing paradigm supports an enterprise-wide risk management process and facilitates the evaluation of financial performance within the context of the guarantees made to its policyholders.

Also, transfer pricing does not endorse an ALM approach based on economic surplus. The SAPs are designed to provide the necessary cash flows to the product lines under a wide range of economic conditions. By matching the durations and convexities of the SAPs to the durations and convexities of the product liabilities along the entire price curve, the product lines are assured the cash flow needed to fund product obligations. While this matching of the asset and liability risk profiles results in immunized economic surplus at the product line level, transfer pricing is neither endorsing nor requiring an immunized economic surplus position for the total company.

Alternative investment and product strategies will be analyzed in the context of the obligations made to policyholders and the impact on the total company's financial objectives. Insurance companies use a variety of financial performance measures, including earnings per share, earnings volatility, capital ratios, economic surplus, and distributable

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The Use of Transfer Pricing in Asset Liability Management

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earnings. While some of these measures are better grounded in financial economics, a company can use transfer pricing to consolidate product and investment strategies at the enterprise level. The consolidated strategies are analyzed relative to the company's chosen financial performance measures.

Implementing a transfer pricing approach can be a significant endeavor for a company, with implementation being a multi-phase project. The all-important first step involves getting senior management buy-in for the project. Since ALM crosses into many functional areas (product management, asset management, and corporate management), company-wide acceptance for the project is critical.

The next implementation steps involve the reconfiguration of the product line balance statements as assets and capital are reallocated between the product lines and the corporate line. In the final steps, the product line income statements are reconfigured to be consistent with the reallocation of assets and capital. Product line investment income, capital gains, expenses, and taxes are allocated to be consistent with transfer pricing principles.

While the implementation of transfer pricing may seem an overwhelming task, the effort is worthwhile. Since transfer pricing impacts product line earnings, it is important to review pricing targets and overall line of business financial objectives. Transfer pricing creates a forum for discussing financial objectives in a new light. Furthermore, transfer pricing creates a forum for discussing the various financial responsibilities for achieving the stated objectives. Who is responsible for managing the interest rate or the credit risk? Who is accountable for achieving the priced-for crediting margins? Answering these questions is one of the biggest byproducts of transfer pricing. Transfer pricing provides an opportunity to take a fresh look at the company's financial objectives and determine if appropriate charges are being made for the cost of capital, investment risk, and product guarantees and options.

With a transfer pricing infrastructure, the impact of alternative investment, product, or capital strategies can be measured and evaluated. The contributions of the asset, product, and corporate managers are reported separately, allowing the value added by their actions to be evaluated. With transfer pricing, ALM becomes institutionalized as the impact of interest rate risk is moved directly into the accounting statements. As the company gains confidence in the transfer pricing results, incentive compensation for asset, product, and corporate managers can be linked to transfer pricing results.

"The contributions of the asset, product, and corporate managers are reported separately, allowing the value added by their actions to be evaluated."

With a more rigorous ALM infrastructure based on transfer pricing, companies can:

- Strengthen existing financial management infrastructure (systems and processes) for analysis of current operations and alternatives and increase quantitative focus on results relative to a financial objective
- Increase the awareness of the interest rate risk within the organization; formally create a forum for discussing the financial impact of asset and liability decisions on the value of the firm
- Demonstrate financial results to various audiences, including the measurement of actual results relative to performance targets with due consideration for risk and the cost of capital
- Develop modeling capabilities to analyze alternative strategies and determine optimal solutions that maximize the value of the firm
- Produce product line income statements with reasonably predictable investment income based on investment decisions within the product line's control
- Analyze the cost of embedded product options and guarantees
- Produce better information to develop and monitor crediting strategies and the pricing of interest sensitive products
- Develop performance benchmarks for investment and product operations
- Produce better information to understand the risk/reward tradeoff of certain asset classes and assist in the development of investment strategy
- More clearly articulate the roles and responsibilities for asset, product, and corporate managers
- Better correlate asset, product, and corporate managers' compensation with performance commensurate with their responsibilities

With more rigorous and sophisticated ALM practices, a company is better positioned to respond to changes in its risk profile and to the changing marketplace. At its core, transfer pricing is a foundation for managing a firm's financial condition based on financial economic principles. An ALM approach based on transfer pricing can provide answers to complex business issues or provide peace of mind that current strategies are operating effectively.

Transfer pricing is the elusive answer the insurance industry has been seeking to develop a rigorous ALM process for managing profitability and risk, and move beyond regulatory cash flow testing.

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All That Glitters Has Not Been Gold

by Nino Boezio

Gold has been one of the worst performing investment assets of the last two decades, and it is not too puzzling as to the reasons why.

Inflation has been steady to low, and hence gold as a store of value or purchasing power was not required by most investors. Its industrial and commercial value tends to be fixed by a somewhat static demand, and its monetary value as an instrument for transactions is non-consequential. Overall, with the low levels of inflation the past number of years, gold is just not a vehicle to reckon with.

Central banks have had a definite bias to reduce their gold holdings. It seems that the only central banks that may buy gold are those in the developing economies—perhaps for the prestige that gold once afforded a country, or in response to concerns that the home currency may not be always stable. Whatever the case, gold has had only limited use for most financial organizations and economies today.

The Case for Inflation

Annual money supply growth has often approached double-digits in the past two decades, especially in times of crisis. Yet this rapid increase in money supply by most Western central banks has not produced inflation as measured by the Consumer's Price Index (CPI) or commodity indexes. Why? Some would point to the rise in financial assets as the answer. Rather than spending on goods and services, investors have put the excess cash into financial assets. In turn, the rise in financial assets has had an increasing influence on economic growth, otherwise termed the wealth effect. In essence, easy monetary conditions has produced inflation, but in financial assets, not consumer products and services. If there is ever a sense that financial assets will no longer deliver attractive investment returns, then we could find that the money leaving financial markets could finally be spent on products and services producing inflation (that is, a latent danger of heavy consumer demand at some point).

The rise in financial asset inflation has been often noted by officials such as Alan Greenspan, Chairman of the U.S. Federal Reserve, but for the most part it is often ignored by most monetary officials, or the rise in asset values has been explained to have occurred due to excellent economic fundamentals. However, when one looks at equity valuation measures of very large blue-chip organizations, one can see that virtually all traditional overvaluation benchmarks have been broken. Financial asset inflation is just not a factor in economic decision making, and has not been perceived by many to have apocalyptic overtones.

Low Inflation Leads to Currency Stability

As consumer inflation and increases in producer prices have remained low, it is difficult to shun assets such as U.S. bonds that pay an attractive yield, and where the underlying currency is very stable. The U.S. dollar has taken on a "rock-hard" reputation which rivals the traditional view of gold, and U.S. assets also provide an attractive return. Gold on the other hand really provides no return unless one loans or leases gold, or engages in the futures market. What gold needs in order to attain renewed appeal, is to no longer have a rival "currency" or "store of value" to compete against it. Now with the advent of the euro, we can anticipate two strong currencies. However, what is needed to topple these two major currencies is a return of inflation which no longer preserves their purchasing power, and thereby maintains the attractive return of their underlying investments. In fact, the world as a group has been so negative toward gold and has for the most part sold its holdings beyond reason, that we can expect very buoyant demand for gold once the tables turn. To date, gold has had only appeal to the struggling economies of Asia, where the strength of the underlying currencies has always been questionable.

The Gold Standard Did Have Benefits

The old gold standard restricted the ability of participating central banks to print money at will. Any increase in currency supply had to be tied to the increase in gold reserves. The advantage of this system was that inflation could or should not be induced. Unfortunately however, in terms of economic thought that developed this century, the gold standard also prevented the central bank and the government from stimulating the economy (when it was depressed) through aggressive monetary policy. By tinkering with the monetary variables, it was believed that one should be able to achieve better economic results than if one's economy was strictly tied to gold, tightening when the economy was strong, and loosening when the economy was weak. This approach was not always practically possible under a gold standard, without the borrowing and lending of gold reserves. Of course, tinkering with economic variables does now incorporate a more human element of subjectivity, so one would witness more instability at various times.

Greenspan has been noted to like the idea of the return to the gold standard. Its return, of course, is now a major fantasy, but it could certainly curtail the rise in asset inflation which I believe has been largely induced by aggressive monetary policy. The rapid rise in asset inflation whether it be in a country (e.g. 1980s Japan) or globally (the 1920s) tends to end badly. It cannot be unwound as gradually as it occurred without some major pain. The issue becomes whether one believes things are different this time, and hence asset inflation is not a threat yet, or whether the fact that many small and midcap indexes are not as inflated as the popular indexes, so that in aggregate we do not have a problem with asset inflation (hence we should not tar the entire equity market with the same brush of "inflated"). One concern that

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also always haunts many economists, is that if investors suddenly come to the realization that financial assets will no longer rise as they have in the past, or that asset values will even possibly decline, that they may begin to liquidate their financial assets which were a form of saving, and begin to spend, driving up inflation dramatically. Hence all the inflation that central bankers were expecting all these years that never came (because the inflation occurred in financial assets and was in a sense stored up as future spending) could suddenly be unleashed in a big flurry all at once. Such a big burst of inflation will be very hard to control, and gold would explode upwards.

Whatever the case, gold's day should come, as there is always an up and down for any investment. Its day will likely be tied to the time when currencies are no longer perceived as stable, which has certainly not been the case since the early 1980s. It is interesting to note that the U.S. currency has grown in popularity and acceptance in direct reverse correlation to gold since that time. In the future, if the U.S. economic environment takes a turn for the worst or inflation reemerges with a vengeance, and the euro cannot fill the U.S. dollar's shoes as a world currency of choice, then gold will once again shine. Until then however, the gold price appears to be atagnant to slightly down. Jewelry demand and mine shutdowns have helped to support the price, while central bank sales has depressed it.

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Stochastic Modeling for Segregated Fund/Variable Annuity Products

by Craig Fowler

The Canadian Institute of Actuaries (CIA), The Actuarial Foundation and the Society of Actuaries is sponsoring a symposium on stochastic modeling for segregated fund/variable annuity investment guarantees, September 13-14, 1999, at the Toronto Airport Hilton Hotel. The goal of the symposium will be to advance education and research in the area of stochastic modeling of investment returns in respect of the maturity and mortality guarantees offered on segregated fund and variable annuity products. While this conference is not intended to produce a 'silver bullet' with respect to reserving and capital for these products, it is hoped that this symposium helps move the profession towards a more consistent methodology in terms of model properties and assumptions.

Working groups in both Canada and the United States were commissioned by the CIA and American Academy of Actuaries to study the investment guarantees offered on the segregated fund and variable annuity products offered in their respective countries. Because of the similarities of the guarantees, there have been discussions between the two working groups. Last fall, the CIA working group published a research paper on "Financial Consider-ations of Segregated Fund Investment Guarantees." The paper stopped short of attempting to specify a stochastic approach given the wide array of stochastic models. The working group advocated the completion of more intensive research activity aimed at building professional consensus on one or more stochastic approaches to modeling these features that can be widely used for risk management and valuation, and will produce consistent results for similar circumstances.

A subcommittee with representatives from the CIA, the Actuarial Foundation and the SOA has recently been formed. This subcommittee is interested in work that has been done throughout the industry in the area of stochastic modeling and would like to have different models that are currently in use presented at the symposium. Also, this subcommittee has recently issued a call for papers asking for work to be submitted on the following three main topics: the distribution of long-term market returns, investment returns for individual funds and policyholder behavior/product features.

Cash Prizes To Be Awarded for Research Efforts

The response to the call for papers has been extremely positive and several industry experts on the subject have come forward to share their research and help advance this field within the profession. In recognition of the importance of this research effort, the Investment Section Council has approved the provision of up to three prizes of $2,000 (Can) each for the authors of the best papers at the symposium.

The program for the symposium is being mailed this month. Please contact Charles Hill at *chill@ymg.ca* for more information.

Craig Fowler, FSA, is vice-president and chief actuary at ING Institutional Markets in Denver, Colorado.

Editor's Note: The symposium is an opportunity for actuaries to integrate the traditional work of actuarial modeling and long-term risk management with the financial engineering used in short-term derivative trading. We urge all actuaries practicing in this field to attend this symposium to share their knowledge and experience.

The Investment Models of a Finnish Pension Company

by Antero Ranne

Editor's Note: This article is reprinted by permission of the British APL Association. It last appeared in the April 1999 edition of Vector, the association's quarterly publication. It also appeared in the Transactions of the 26th International Congress of Actuaries, Vol.7, Birmingham, 1998.

The Mutual Pension Insurance Company Ilmarinen is one of the companies managing the statutory employment pension in Finland. The investment models for actuarial use have been developed in Ilmarinen starting from the year 1993. The main parts are:

- financial time series data management
- time series analysis programs
- investment simulation models
- portfolio optimization models.

The models have been used for the following purposes:

- Developing the statutory solvency requirements for the Finnish pension companies and other insurance companies
- Developing new rules for determining the technical interest rate of Finnish pension companies
- Analyzing the risks connected with the investment strategy of the company.

Financial Time Series Data

The models are based on financial time series from 12 countries. These include inflation, GNP growth rate, interest rates, share price indices, and dividend yields. The longest of the series start from the year 1950. The data are saved in an three-dimensional APL array. There are programs for adding new data and for output as tables or figures.

Time Series Analysis Programs

Various time series equations are defined for the variables in the investment model. Programs exist in APL to estimate the parameters of these equations. Although commercial statistical programs can be used for more thorough analyzes, it is convenient to be able to make calculations in the same environment where the data are.

As an example it is shown how the parameters of the inflation model are estimated. The inflation rate may be influenced by external shocks which in the model are represented by oil price movements. The inflation $i(t)$ in year t may be modeled by the equation

$$i(t) = m + a_1\,[i(t-1) - m] + a_2\,[i(t-2) - m] + b_0\,o(t) + b_1\,o(t-1) + e(t)$$

where $o(t)$ is the oil price inflation and $e(t)$ are the residuals or the stochastic part of the model. The parameter values are obtained by iteration. For the intermediate parameter values m, a_1, a_2, b_1 and b_2 we calculate the residuals $e(t)$, as well as the partial derivatives

$$\frac{\partial e(t)}{\partial m} = -1 + a_1 + a_2\,, \quad \frac{\partial e(t)}{\partial a_1} = -x(t-1) + m \quad \text{, etc.}$$

By ordinary linear regression we find the coefficients d1, ... d5 in the equation

$$e(t) = d_1 \frac{\partial e(t)}{\partial m} + d_2 \frac{\partial e(t)}{\partial a_1} + d_3 \frac{\partial e(t)}{\partial a_2} + d_4 \frac{\partial e(t)}{\partial b_0} + d_5 \frac{\partial e(t)}{\partial b_1}$$

The new parameter values are calculated by subtracting the d-coefficients:

$$m' = m - d_1\,, \ldots\,, b_2' = b_2 - d_5\,.$$

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The solution is easy in APL because the linear regression part can be calculated directly using Ž, as is shown in the following programs. The variable *"inf"* is the inflation and *"oil"* the oil price inflation.

```
par„Infparam;p2;e;d;c
p2„1+par„5½0
 :while 1E¯3<-/|par-p2
   Œ„p2„par
   e„p2 Resid inf,[1.1]oil
   d„p2 Deriv inf,[1.1]oil
   c„eŽd
   par„p2-c
:endwhile
e„par Resid vars;x;y;m;a1;a2;b0;b1;i
(x y)„›[1]vars
(m a1 a2 b0 b1)„par
x„0 0,x-m ª y„0 0,y ª e„(½x)½0
:for i :in 2‡¼½e
  e[i]„x[i]+(-a1×x[i-1]) +(-a2×x[i-2])+(-b0×y[i])+(-b1×y[i-1])
:endfor
e„2‡e

d„par Deriv vars;x;y;m; a1;a2;b0;b1
(x y)„›[1]vars
(m a1 a2 b0 b1)„par
d„((½x),1)½¯1+a1+a2
d„d,-¯1‡0,x-m
d„d,-¯2‡0 0,x-m
d„d,-y
d„d,-¯1‡0,y
```

The calculation takes only a few steps. The same principles can be used for other quite complicated equations.

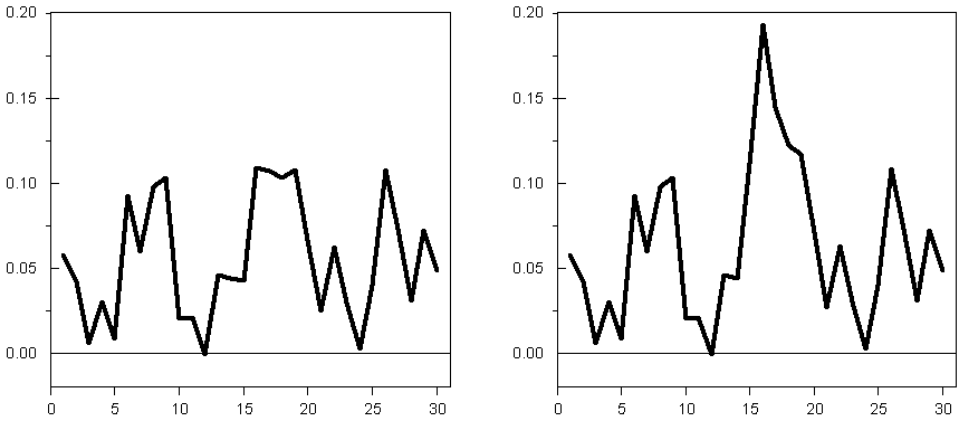
Investment Simulation Models

When the parameter values have been established, the time series equations can be used to simulate the variables. The residuals are then generated as random numbers using the Wilson-Hilferty algorithm (see Daykin et al., 1994). The numbers are calculated using the following program:

```
 Z„V Random N;M;S;A;B;C
© N random numbers from distribution with
© mean = 0, std deviation =  1 and skewness = V
© first numbers from normal distribution
 S„(÷1+M)×?(N,2)½M„2147483646
 Z„(2±±2×S[;2])×(¯2×µS[;1])*0.5
 …(0=V)/0
© skewness is added by Wilson-Hilferty-algorithm
 (A B C)„((V*2)÷108),((V÷6)-6÷V),2÷V
 Z„(A×(Z-B)*3)-C
```

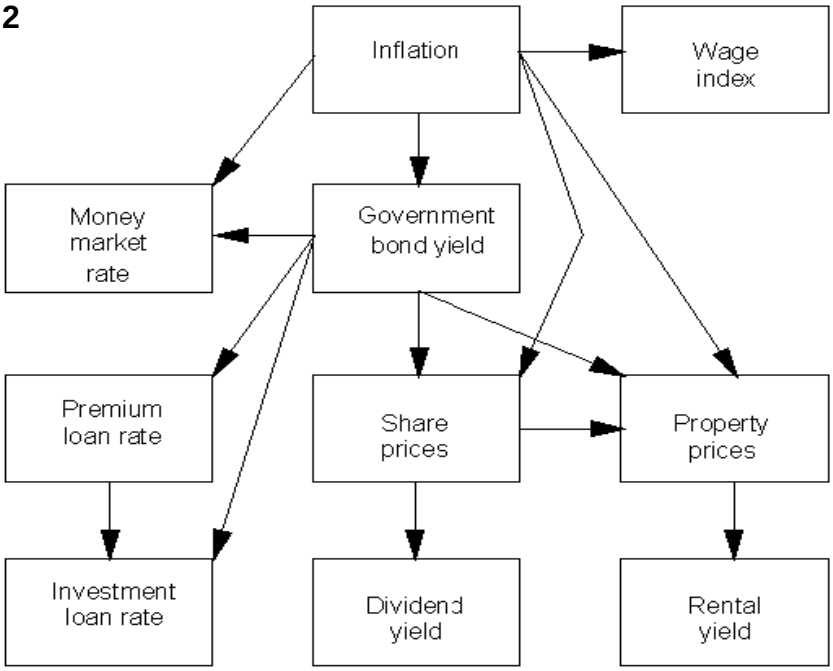
Figure 1 shows an example of simulated inflation numbers using the parameters obtained by the programs shown above. The second version contains in year 15 an inflation shock generated by the oil price variable.

Figure 1



The structure of the whole investment model is shown in Figure 2. A detailed description can be found in Ranne (1998).

Figure 2



The purpose of the model is to generate investment yields that have realistic means, standard deviations and correlations in the long term. These are used to estimate the investment risks of a company.

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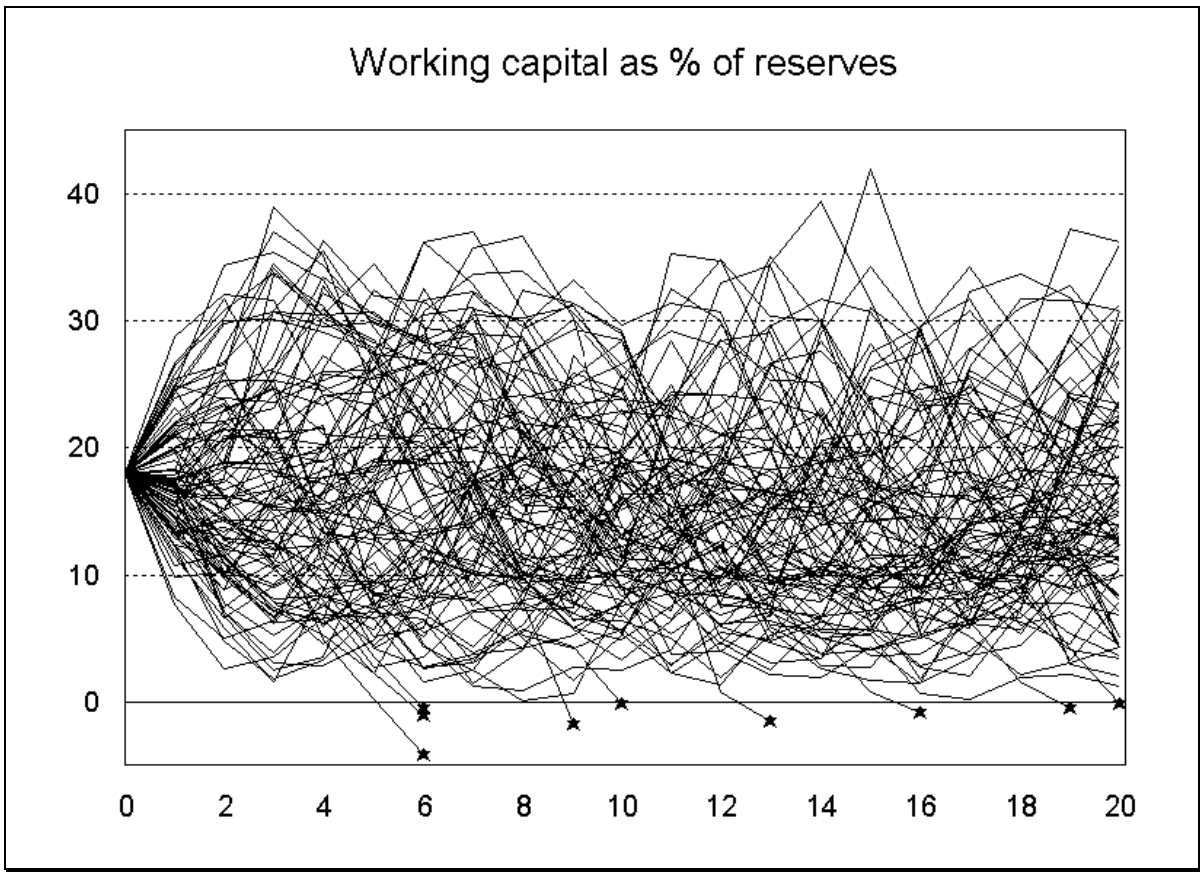
The investment variables are combined with a forecast describing the development of the whole pension insurance company and various output variables are calculated (e.g. premiums, pension expenditure, reserves, bonuses, profits or losses). The most important output variable is the working capital, which is the difference between the total assets and the liabilities of the company and which acts as a buffer against variations in the investment results. The following picture below shows an example of simulated working capital as per cent of the reserves.



A thousand simulations for 20 years takes about 2 minutes 40 seconds on the present computer (300 MHz Pentium, 128MB memory).

Optimization Models

In the optimization problem there are different investment categories (e.g. bonds, shares, property, cash). The investment returns have means μi , standard deviations σ_i and correlation coefficients ρ_{ij} . Standard deviation is used to measure the risk level of the investments.

The proportion invested in category i is x_i ($\Sigma_i x_i = 1$). The mean μ and standard deviation σ of the whole portfolio is

$$\mu = \sum_i \mu_i x_i$$

$$\sigma = \sqrt{\sum_{i,j} c_{ij} x_i x_j}$$

where c_{ij} is the covariance $c_{ij} = \sigma_i \sigma_j \rho_{ij}$.

The problem is to find the portfolio with the lowest risk σ corresponding to a given mean return μ. (Alternatively one could find the maximum return corresponding to a given risk.) In practice there are often also minimum and maximum proportions for different investment categories.

Mathematically the problem is therefore formulated as minimize the function $\Sigma_{i,j}\, c_{ij}\, x_i\, x_j$
using conditions $\Sigma_i\, x_i = 1$
$\Sigma_i\, \mu_i\, x_i = \mu$
$m_k \le x_k \le M_k,\ \ k = 1,...,n$.

By standard mathematical methods it can be shown that the solution may be found by solving the following group of equations:

$2\,\Sigma_i\, c_{ik}\, x_i + a + b\, m_k = \lambda_k,\ \ k = 1,...,n$
$\Sigma_i\, x_i - 1 = 0$
$\Sigma_i\, \mu_i\, x_i - m = 0$

where in each investment category i one of the following conditions is true:

a) $x_i = m_k$
b) $x_i = M_i$
c) $\lambda_i = 0$.

For each combination of these conditions the resulting system of equations is linear, and so it can be solved in APL using the function Ž. One has to solve the equations for different combinations of the conditions a-c. The solution that fulfills all the conditions and has the smallest variance is finally chosen as the answer to the optimization problem. The part of the program solving the linear equations is shown in the following. The program uses the global variables:

Mu	vector	mean values for investment returns
Cov	matrix	covariances
Min	vector	minimum values
Max	vector	maximum values.

Since it is possible that a given system of equations has no solutions, there is a matrix division function that returns the empty vector instead of stopping in domain error:

```
Z„X MatDiv Y;Œelx
© Matrix division
© Result is empty, if no solution
Œelx„'Z„Ð ª …0'
Z„XŽY
```

The second function finds the distribution for a given mean return “mean” and conditions that are based on the argument “list”:

```
z„list Optimal mean;n;N;MAT;C;k;i
© Finds the optimal distribution for given mean return "mean"
© Investment return means in "Mu", covariances in "Cov",
© maximum and minimum proportions in "Max" and "Min"
© list[k]=0: no restriction in investment category k
© list[k]=1: use minimum for category k
© list[k]=2: use maximum for category k
  N„2+2×n„½Mu
  MAT„(2½N)½0
  MAT[¼n;¼n]„2×Cov
  MAT[¼n;n+1]„MAT[n+1;¼n]„1
  MAT[¼n;n+2]„MAT[n+2;¼n]„Mu
  MAT[¼n;n+2+¼n]„-(¼n)°.=¼n
  C„(n½0),1,mean,n½0
    :for k :in ¼n
    i„n+2+k
    :select list[k]
    :case 0
      MAT[i;]„i=¼N
```

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```
      C[i]„0
   :case 1
      MAT[i;]„k=¼N
      C[i]„Min[k]
   :case 2
      MAT[i;]„k=¼N
      C[i]„Max[k]
   :endselect
  :endfor
 z„n†C MatDiv MAT
```

One has to execute the program for different values of the variable "list" and find the solution that fulfils all the conditions and has the smallest variation. The part of the program doing this selection is not shown here.

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Letter to the Editor:

Inspect Those Asset / Liability Optimizer Projections

by Douglas C. Doll

I recently had an opportunity to review the results of an asset/liability optimization exercise. The objective was to choose a set of assets that would "perform" better than the existing assets, where performance was defined as profitability under each of a defined set of interest scenarios. At first glance, the results were quite impressive. The optimized assets provided higher profitability for every one of the scenarios, substantially higher for some of them.

Too good to be true? You bet! A closer review of the results showed that the initial rebalancing of the assets produced capital gains on the assets sold. These capital gains went into the IMR, but the IMR amortization was not used in calculating portfolio yield for crediting rate purposes. The increased profitability was coming from a reduced crediting rate. In fact, it appears that a simple strategy to keep the original assets and reduce the crediting rate would be superior to the "optimized" strategy.

Optimizers can be worthwhile tools, but their results need to be inspected for possible weaknesses and biases. It seems like a simplistic recommendation, but you should be wary of any optimizer result that show significant improvements until you have inspected the projections and figured out the "why" for the improvement.

Douglas C. Doll, FSA, MAAA, is a principal of Tillinghast-Towers Perrin in Atlanta, Georgia. He can be reached at dolld@tillinghast.com.

Review of Financial Risk Management of Insurance Enterprises Course

by Scott Martin

Are you a "traditional" actuary who says, "Here are my numbers, now go away and leave me alone?" Are you uncomfortable meeting with the investment side of the office, due to a knowledge level concern? Do you wish all the current investment actuarial exams were available when you were writing? Do you read the investment details in this newsletter, among others, feel it all sounds understandable and sensible, but wonder about putting it to practice? Are you comfortable with your investment knowledge level, but would like a nice overview?

"The course is excellent in terms of keeping up-to-date with the most recent developments, current theoretical and application papers, and illustrating where to find relevant information on the Internet and elsewhere."

If you answered "yes" to any or all of the above, the Financial Risk Management of Insurance Enterprises course would be well suited for you. It is a very useful four-month university course, offered over the Internet, by Stephen D'Arcy, professor of finance at the University of Illinois in Champaign, to off-campus students, covering a broad range of financial management material.

The course starts with an overview of financial risk management, discussing its benefits and the historic reasons why it has become more necessary and why an actuary should be involved. It studies various asset-pricing models, like the Capital Asset Pricing Model and the Option Pricing Model, and discusses all the risks facing an insurance enterprise and how to measure them. The course covers specific asset pricing, along with interest rate term structures and theories. All the derivative instruments are explained—from forwards, futures, swaps to options—and their uses for insurance are illustrated.

The basics from above are then applied to asset-liability management and valuation. The different ways to look at and calculate duration and convexity are illustrated. Static asset-liability management techniques, such as segmentation and cash flow matching, are discussed. Dynamic strategies are distinguished between value-driven and return-driven, with variations from passive immunization techniques to more active target strategies. Various techniques to value portfolios with embedded options are discussed, from the binomial method, to the Monte-Carlo method, working through several examples valuing all forms of derivatives, including collateralized mortgage obligations.

The last third of the course applies all that is learned above. Pension fund examples, risk-based-capital illustrations, and specific technical applications to both property and liability and life insurance companies are modeled. The Dynamic Financial Analysis process is analyzed in detail, including both stochastic and deterministic techniques. Modeling catastrophic risk is discussed and recent development in securitizing catastrophic risk and sample catastrophic bonds are discussed, such as Property Claim Service options on the Chicago Board of Trade.

The course is excellent in terms of keeping up-to-date with the most recent developments, current theoretical and application papers, and illustrating where to find relevant information on the Internet and elsewhere. Each week, you are provided with the slides of the on-campus presentation, along with various readings. The readings are separated into required, optional, and advanced to provide benefit to varying levels of students. There are assignments and exams. Off-campus students have much flexibility in timing and the pace of working through the material. It is clearly to your benefit to keep up with the discussion, but you can read the minimum or explore all the advanced areas as desired. There are private areas on the Internet to discuss problems with other students and the professor, along with chat rooms and possibly pre-arranged times for instant response.

The course brings together university students and practicing actuaries with varying levels of experience. Through the material, the course provides instant benefit to everybody, and helps graduates bring actuarial science to the next level, ready to succeed in the next millennium.

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Editor's Note: In a fast-moving environment, courses such as Professor D'Arcy's are going to become an increasingly important aid to our professional education and development. As the Society of Actuaries looks at alternative educational delivery methods, Professor D'Arcy's approach looks to have tremendous potential.

1999 Market Triathlon Update

by Frank Grossman

Twenty-nine intrepid Investment Section members submitted entries postmarked before the June 1 deadline to the 1999 Market Triathlon contest. While the majority of missives were received from the United States and Canada, far-flung actuarial outposts in Hong Kong and Malaysia also checked in. Hence, distance alone can't reasonably be held as an excuse by those Section members who failed to submit their picks.

Recall that the Market Triathlon simply challenged contestants to set out their best estimates for the 3-month Treasury bill rate, 30-year Treasury bond rate and Dow Jones Industrial Average index value at year-end 1999—seven months in advance (a mere blink of the eye to those well accustomed to setting pricing assumptions). E-a-s-y! Where better to invest one's unallocated surplus, given that the price of a postage stamp confers a 7.25:1 shot at one of the four $100 event prizes?

In the five months since last year-end, treasury yields have risen while the DJIA continued its ascent (Table 1). Thirty-year treasury yields, which plunged to 4.6% last September in the wake of Russia's default and the Long Term Capital bail-out, rose above 6% in early June.

Our triathletes' outlook for interest rates at year-end 1999 was, on average, roughly a 25 basis point increase in short rates and little change in long rates compared to yields in early June (Table 2). The average DJIA pick submitted by our triathletes exceeded even Abby Joseph Cohen's year-end target released in late March. Though some might typify Ms. Cohen as an outspoken booster of the longest bull market in history, her pick for the year-end DJIA was only 10,300, representing an annual gain of slightly more than 12%. Wimp.

Table 1

Recent Historical Data

	3-Month T-Bill Yield	30-Year T-Bond Yield	DJIA Index Close
December 31, 1998	4.44%	5.092%	9181.43
June 1, 1999	4.56%	5.936%	10596.26

Table 2

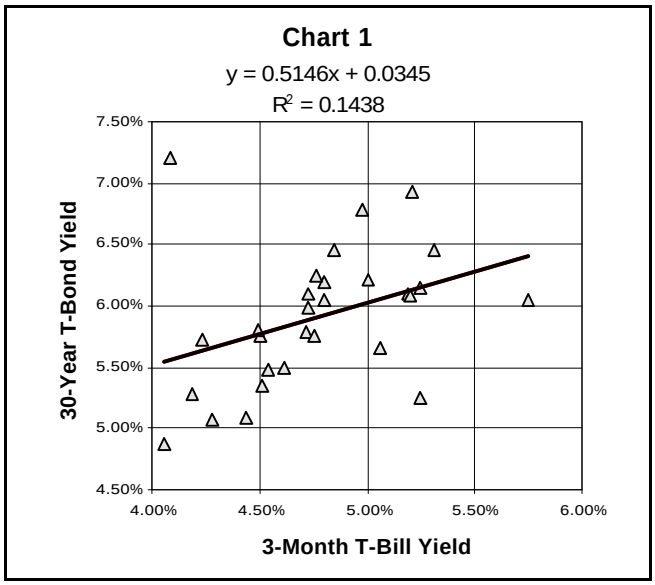
Key 1999 Market Triathlon Picks

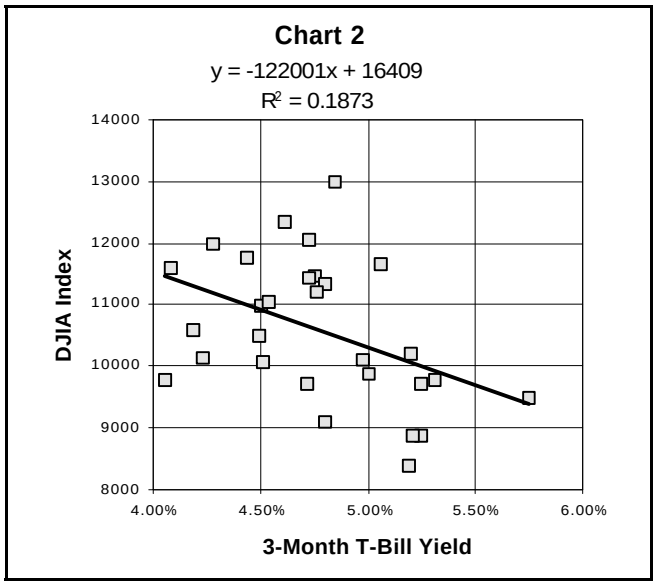
	3-Month T-Bill Yield	30-Year T-Bond Yield	DJIA Index Close
Maximum Pick	5.75%	7.208%	12980.00
Mean Pick	4.77%	5.908%	10591.00
Median Pick	4.75%	5.976%	10499.00
Minimum Pick	4.06%	4.868%	8375.00

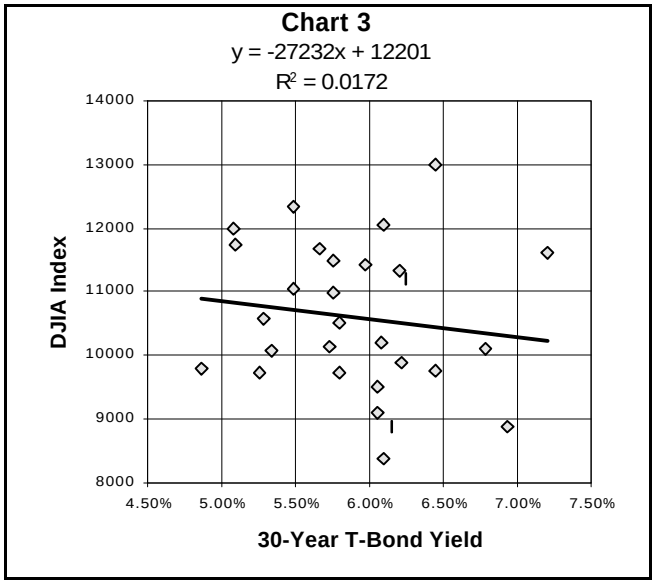
The pairwise scatter charts of Market Triathlon submissions reveal a positive correlation between short and long interest rate picks, and a negative relationship between the DJIA and interest rate picks (Charts 1, 2 and 3). The coefficient of determination of a linear trend line is very low in each case, indicating poor fit.

The outlook for price inflation is unclear despite buoyant U.S. consumer spending that's growing at a 4.5% per year clip. Americans are spending more than they take in as earned income, with the more fortunate ones making up the differential via stock and residential housing-market gains (the so-called "Wealth Effect"). While over 40% of households now have investments in shares, roughly double the proportion in the early 1980's, *rich* Americans have been selling their direct equity holdings of late. (Hmmm … this may very well be a lesson in how to stay rich.)

Year after year, the psychology of the market has undergone a *volte-face*: while deflation was the perceived threat last summer, a state of "apprehended" inflation currently exists. Should a round of higher interest rates be required? Can the central







(continued on page 28, column 1)

1999 Market Triathlon Update

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bankers lift their collective foot off of the accelerator without tamping the brake? One can only begin to wonder how fragile share valuations are at this point.

One thing is crystal clear: the fancier U.S. Federal Reserve Board Chairman Alan Greenspan's words on the subject of interest rates and markets are, the more important (and obscure) his message. Mr. Greenspan describes his technique as "mumbling with great incoherence" and one can only take him at his word. Remember irrational exuberance? American equity markets haven't looked back since that famous utterance. Consider his June 30 statement coincident with the announcement of a 25 basis point increase in the federal funds rate to 5.00% (offsetting by a third the cuts undertaken last autumn):

> Owing to the uncertain resolution of the balance of conflicting forces in the economy going forward, the Federal Open Market Committee has chosen to adopt a directive that includes no predilection about near-term policy action.

Hence the famous "neutral stance" that has accompanied each Fed rate increase this decade and is code for no further rate changes in the immediate future (no surprise). Thirteen days earlier, Mr. Greenspan told Congress about an "unsustainable trend that has been produced by an inclination of households and firms to increase their spending beyond the gains in their income from production," thereby telegraphing a modest increase in interest rates that was subsequently "fully discounted" by financial markets (no surprise). Yet, when news of the rate increase broke at 2:15 p.m. ET, the DJIA leapt up 200 points and the benchmark 30-year treasury yield fell from 6.07% to 5.96% (surprise). Efficient markets truly move in wonderful ways.

"Americans are spending more than they take in as earned income, with the more fortunate ones making up the differential via stock and residential housing-market gains."

What's to be done in the interim, while we wait for the results of the 1999 Market Triathlon? Well, the Federal Open Market Committee (FOMC) has meetings scheduled for August 24 and October 5 that you might wish to mark on your calendar. Or you might just go to the beach instead.

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Your Book Purchase Can Help the Profession

Through an arrangement with amazon.com, your purchase of a book or CD from that Web site can add to the fund that encourages qualified minority students to enter the actuarial profession. This arrangement was made soon after the March/April 1999 issue of *Contingencies* magazine produced by the American Academy of Actuaries featured a cover story by Robert Randall. He was the first African-American Fellow of the Society of Actuaries, and the article told of his experiences as a pioneer black actuary and the instigator of the SOA's minority recruitment program. Randall's article received a tremendous response, with many letter writers agreeing that the profession should do more to encourage minority recruitment.

At about the same time, *Contingencies* editor Steve Sullivan signed an agreement with bookseller amazon.com to allow readers to purchase books directly through the *Contingencies* Web site, ***www.contingencies.org.*** Under the deal, *Contingencies* receives 15% of the price of books reviewed or recommended in the magazine. *Contingencies* receives 5% of the price of all other books and CDs purchased. *Contingencies* has agreed to contribute 25% of all revenues earned to the work of the CAS/SOA Joint Committee on Minority Recruiting. Since 1977, this committee has been funding scholarships for qualified African American, Hispanic and American Indian students interested in actuarial science. It awarded $29,500 in 1998 for scholarships and also contributed to several summer high school actuarial programs at universities.

How to purchase

Here is how to be sure your amazon.com purchase is credited toward the minority recruiting effort. It only takes three double clicks. First go to *www.contingencies.org ,* then to the Book Link page. Select a reviewed or recommended book with a direct link to amazon.com or scroll to the bottom of the page for the amazon logo. This puts you in the amazon.com virtual bookstore, where you can browse or make a purchase right away. The *Contingencies* site will be featuring an expanded selection of recommended books in the areas of insurance and risk management, finance, and general business titles. But if you're not interested in checking out the recommended titles, you can skip the Book Link page and go to amazon.com directly from the *Contingencies* home page. Remember, you must enter amazon.com through the *Contingencies* Web site to ensure your purchase is credited to the fundraising effort.

Help the profession attract diverse talent and help those with the qualifications with their expenses to prepare for a career in actuarial science.

Conference on "Strategies On Investing," April 29-30, 1999

by Tony Dardis

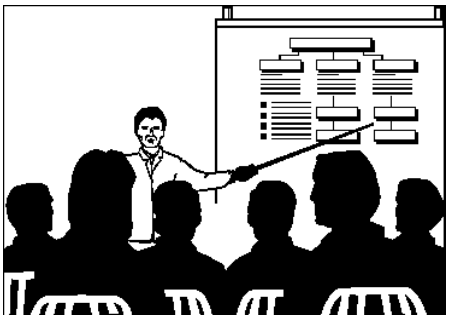
The Society of Actuaries Investment Section presented a two-day workshop-style conference on "Strategies for Investing," held in the rather pleasant venue of Marriott's Mountain Shadows Resort and Golf Club in Scottsdale, Arizona in April.

This was an excellent conference with plenty of opportunity to mix and exchange ideas on asset-liability management. It was interesting to see such a balanced mix of asset-side and liability-side professionals. The faculty was impressive and there was plenty of opportunity for audience participation. Indeed, I had never quite seen such lively audience participation at a conference of this nature. Interesting what can happen when a conference covers material that is relevant and gets right to the heart of the issues.

The conference was structured around a number of hot topics, some of which were examined by way of case studies. Although it is impossible to give an overview of everything that was discussed in a brief article of this nature, I will attempt to give you a flavor of what was covered.

Benchmarking (Alton Cogert)

This was a very timely session on customized benchmarks, lucidly presented by Alton Cogert from Strategic Asset Alliance. He introduced the idea of the TCB—the "Truly Customized Benchmark." This benchmark must have the same duration and credit characteristics of the company's strategic asset allocation. The securities that then get placed into each duration/credit benchmark bucket are actually randomly chosen (a "dart board" approach). Hence by comparing actual manager performance against the benchmark, you are truly answering the passive versus active management question.



Editor's Note: For more information on this topic, please refer to Alton Cogert's article on page 10 of this issue.

State of the Art Quantitative Tools to Support ALM and the Risk Management Process (Frank Sabatini)

As ever, Frank Sabatini of Ernst & Young was informative and, at times, controversial. He described various risk management techniques, explaining difficult concepts in a clear and concise way that the whole audience could fully appreciate.

Asset-focused Optimization (Larry White)

Larry White gave an introduction to optimization, and gave an overview of an optimizer he has developed for life insurance companies. This was a controversial session that caused lively debate "off-conference."

Case Studies (Frank Sabatini / Mark Hunt / Rick Jackson / Steve Cernich)

Frank Sabatini kicked off the case studies with a "real" Board presentation that explained interest rate risk and demonstrated how some lines of business (e.g., DI) could cross-subsidize others (e.g., annuity). The Board presentation style gave rise to lively questioning from the audience, which Frank clearly enjoyed even if he did remark to his fellow panelists at one point, "Remind me not to do it like this again!"

Mark Hunt works in the Hartford Group's Investment Strategy Group and described something of a revolutionary approach to making investment decisions. The approach basically takes all strategic and tactical asset allocation decisions away from the "asset managers" and puts those decisions into the Investment Strategy Group. The asset managers are then left solely with the job of selecting individual securities. There is therefore no longer the concept of a "portfolio manager." The Investment Strategy Group is comprised of a wide variety of individuals, some with an asset-side background, others with a liability-side background. All their decisions get "signed-off" by the most senior management at the Hartford. This was a really powerful and interesting session, with many people discussing the concepts Mark described after the conference had officially ended.

Rick Jackson and Steve Cernich from the Zurich Group gave a really interesting presentation on asset-liability management issues from a global perspective. The differing attitude to equities around the world was highlighted. Also, the popularity of "embedded value" as a reporting method and management tool in Europe was discussed, again with lively audience feedback.

Tony Dardis, ASA, is a consulting actuary at Tillinghast-Towers Perrin in Dallas, Texas. He is also the chief editor of this issue of Risks & Rewards.

Investment Section Council Memorandum

by Peter Tilley, Spring Meeting Investment Section Representative

On behalf of the Investment Section Council I would like to thank all of the Section members listed below who participated in the Atlanta and Seattle spring meetings. Our panels were well received due to the quality of the speakers and the effort they put into their presentations. Now it's on to San Francisco for the special 50th anniversary meeting! Your Council member coordinating the San Francisco meeting is Josephine Marks, and all Council members are involved in recruiting speakers. So, if you feel the urge to speak, be a moderator, or even record a session, give any of us a call for more details. This could be your best strategy for getting a great trip approved. ("But boss, I have to go, I'm moderating a panel discussion!")

Section members participating in Atlanta

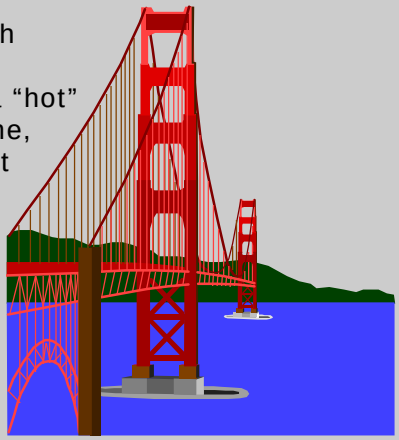
Faye Albert
Murray Becker
Lisa Markus
Nancy Elizabeth Bennett
Frank Sabatini
Anson J. Glacy Jr.
Marshall C. Greenbaum
Rick Jackson
David X. Li
Harry R. Miller
Victor Modugno
Kenneth P. Mungan
Elizabeth L. Olson
Max J. Rudolph
Frank Sabatini
Zenaida M. Samaniego
Neil T. Strauss
Peter Tilley

Section members participating in Seattle

Jeff Allen
Lisa Markus
Frank Sabatini

San Francisco Annual Meeting

The Investment Section will be sponsoring nine sessions at the 50th anniversary SOA meeting to be held in San Francisco on October 17 - 20, 1999. There will also be an investment "hot" breakfast with a "hot" meal and a "hot" speaker. In keeping with the SOA's anniversary theme, there will be a session giving a historical perspective of the investment practice area for actuaries. Other more current topics will include Equity-Linked Notes, European Union, Investors View of the Insurance Industry, Monte Carlo Derivative Pricing, Transfer Pricing (insurance companies vs. banks), Models in Credit Risk Management, Asset-Backed Securities, and Risks in Investment Accumulation Products. The Investment Section is also co-sponsoring sessions on Fair Value Reporting and on Guarantees in Variable Products. Come one, come all for "state-of-the-art" education and great networking opportunities.



Review of Finance Journals

Reviewed by Edwin A. Martin and William Babcock

Editor's Note: In this issue, we are highlighting some articles that make use of actuarial methods in finance. Also, reference is made to the May 1999 edition of The Journal of Portfolio Management. This is the 25th Anniversary issue with a special theme of derivatives and risk management.

Actuarial Methods in Finance

- **"Constructing a Credit Curve" by David Li, ASA, from *Risk* magazine's *Credit Risk Special Report,* November 1998.**
  The author uses life contingencies and survival model concepts to define the credit curve for pricing credit derivatives. Construction of the credit curve is central to the valuation of credit derivatives and is "as important to credit derivative pricing as the yield curve is to fixed income derivative pricing." Familiar notation such as ${}_tp_x$, ${}_tq_x$ and S(t) are used for illustrations.

- "**Estimating Credit Spread Risk Using Extreme Value Theory, Application of Actuarial Disciplines to Finance" by Wesley Phoa, from *Journal of Portfolio Management,* Spring 1999.**
  Another area where we have seen actuarial methods used is in extreme value theory. This article discusses using EVT to estimate maximum credit spread movements for constructing risk models. Examples of different extreme value distributions are given depending on the distribution of the underlying data. A method of fitting the models is also discussed. This is a well-written and understandable article on this subject.

- **"For Use in Extremes" by Till Guldimann, *Risk* magazine, February 1999.**
  EVT is also discussed in this one-page article, which credits "insurance mathematicians" with using EVT to measure the "tail risk" in financial models. This article also contains a useful example. Closer to home, an article in the April *North American Actuarial Journal* by Embrechts et. al. discusses these same concepts and shows their versatility.

- **"This Is the Way the World Ends" by William Rhode, December 1998.**
  Perhaps prompted by last year's market turmoil, this article on stress testing gives some good rationale for stress testing plus examples and categories of stress testing.

- **"Investment Performance Analysis for Investors" by Meyer Melnikoff, FSA, *Journal of Portfolio Management,* Fall 1998.**
  The author describes a method of computing risk-adjusted returns, in this case using mutual fund performance, that are more understandable and meaningful than the methods used by Morningstar and in the mean/variance approach.
  Editor's Note: Meyer Melnikoff is a member of the Investment Section and a former Council member.

Of A More General Interest

- **"The Design and Production of New Retirement Savings Products" by Zvi Bodie and Dwight Crane, *Journal of Portfolio Management,* Winter 1999.**
  With the rise of 401(k) plans, investment risk is being passed from employer to employee and that "even when employees adopt the standard advice during their working years, they are still exposed to considerable investment risk if their objective is to achieve target income during their working years." This article discusses how products such as Treasury TIPs and other insured products could be used to increase the odds of achieving a target level of savings at retirement.

- **"Why Do Valuation Rates Forecast Long-Run Equity Returns?" by Thomas Phillips, *Journal of Portfolio Management,* Spring 1999.**
  Those of us looking to high equity returns to help with retirement will find this article of interest. Through an analysis of accounting factors such as ROE, payout ratio and book value as well as economic considerations, the author concludes that future returns on the equity market are likely to be lower than returns we have seen over the past two decades. The author states, "I believe that investors have mistaken a steady decrease in the expected return of equities, which leads to exceptionally high returns in the short term, for a substantial and permanent increase in the expected return of equities...the current bull market may end abruptly when investors recognize that stocks no longer offer exceptional prospective returns."

Value At Risk

- **"Value at Risk for Derivatives" by Lina El-Jahel, William Perraudin, and Peter Sellin, Journal of Portfolio Management, Spring 1999.**
  This article explains a new method of calculating the VaR on derivative instruments and reviews the limitations of the standard delta and delta-gamma for calculating VaR for options. The authors' method, the JPS method, utilizes multivariate square root processes instead of the usual Gaussian returns assumption and compares very favorably to Monte Carlo and delta-gamma methods of calculating VaR. Due to the approximations made in the JPS method, the VaR calculations for short-term out-of-the-money option become significantly inaccurate. Nevertheless, this article should certainly be reviewed by practitioners calculating VaRs for derivatives.

- **"A New Analytical Approach to Value at Risk," by H. Gifford Fong and Kai-Ching Lin, *Journal of Portfolio Management,* May 1999 special 25th Anniversary issue.**
  This article explains a new analytical approach to calculate VaR for

(continued on page 32, column 1)

Review of Finance Journals

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derivatives and portfolios. The authors investigate the relationship between the VaR of the derivative and the VaR of the underlying rather than using standard deviations. They claim that their approach will improve the accuracy as well as reduce computational time.

Risk and Derivatives

- **"The Derivatives Revolution After 30 Years," "Derivatives and Risk Management," "Research Trends in Derivatives and Risk Management since Black-Scholes," "Business as Usual and Rare Events," and "The Great Risk Hunt."** ***Journal of Portfolio Management,*** **May 1999.**
  This special issue of the *Journal of Portfolio Management* contains a large selection of articles that discuss derivatives and risk management. Readers who are new to derviatives or are interested in understanding the history of the derivatives industry should definitely read then. These articles are tailored to readers with limited derivative background and provide important insights into derivatives without losing the reader in formulas.

Credit Risk

A recent development in academia and financial markets is the renewed focus on credit risk. Two articles in the Spring 1999 issue of the *Journal of Derivatives* addresses different aspects of credit risk.

- **"Building Models for Credit Spreads," by Angelo Arvanitis, Jonathon Gregory, and Jean-Paul Laurent,** ***Journal of Derivatives,*** **Spring 1999.**
  The authors describe a model for credit spreads that would be appropriate for pricing default swaps and other derivatives that take credit risk into account. The article explains how the model is built from a simple default/no default model into a model that incorporates credit migration, default, memory in credit ratings, credit spread volatility, and mean reversion.

- **"Valuation of European Options Subject & Financial Distress and Interest Rate Risk," by Peter Klein and Michael Inglis,** ***Journal of Derivatives,*** **Spring 1999.**
  This article focuses on the credit worthiness of the writer of a derivative instrument. The authors develop a model to value derivatives that take default risk of the writer of the derivative and interest rate risk into account. They develop somewhat complicated analytic solutions for European calls and puts. However, the comparison of the authors' model versus actual over the counter derivative prices show that both credit and interest risk are both significant influences on a derivative's price and hedge ratios. As with any other derivatives pricing model, the assumptions should be thoroughly understood before implementation.

Edwin A. Martin, FSA, is Asset/Liability Strategist at Aeltus Investment Management in Hartford, Connecticut. He can be reached at MartinE@aeltus.com. *William L. Babcock, ASA, is an assistant actuary in the ALM Department at Nationwide Financial in Columbus, Ohio. He can be reached at* babcocw@nationwide.com. *They are both associate editors for* Risks and Rewards.

Bowles Symposium on Financial Services Integration

by Anne Chamberlain Shaw

The Department of Risk Management and Insurance at Georgia State University in Atlanta, Georgia, will host the 4th Bowles Symposium on December 9-10, 1999. The symposium, entitled "Financial Services Integration: Fortune or Fiasco?" will be led by current Bowles chairholder Harold D. Skipper, Jr., Ph.D., CLU.

The two-day program will host an interdisciplinary array of experts in insurance and finance:

- Allen N. Berger, senior economist at the Board of Governors of the Federal Reserve System and Senior Fellow at the Wharton Financial Institutions Center.
- Peter Kuys, general manager and group chief actuary of the ING Group.
- Robert E. Carlson, executive vice president of the Northwestern Mutual Life Insurance Co.
- Jean-Pierre Daniel, owner of VIGIE, a Paris-based company which provides Insurance marketing.
- Ian R. Harper, Professorial Fellow in the Melbourne Business School; and Robert St. Jacques, a senior consultant with Tillinghast-Towers Perrin in Toronto.
- Joseph M. Belth, professor emeritus of insurance in the Kelley School of Business at Indiana University (Bloomington) and editor of *The Insurance Forum.*
- Ravi Kalakota, director of the Center for Digital Commerce Research at Georgia State University.
- Michael Thom of the Insurance and Pension funds division at the Internal Market and Financial Affairs Directorate-General's office at the European Commission

For more information and registration materials, visit the Bowles Chair web site at: http://www.gsu.rmi.edu/bowles/b-chair or contact Anne Chamberlain Shaw, conference manager, at 404-651-0931 or by e-mail at achamberlain@gsu.edu.

Anne Chamberlain Shaw is the marketing and conference services manager in the Department of Risk Management and Insurance in Atlanta, Georgia.