Strategic Insurance Purchasing in the 21st Century

Kevin M. Bingham, ACAS, MAAA and
John Slusarski, FCAS, MAAA

Biographical Information

Kevin M. Bingham is an Associate of the Casualty Actuarial Society and a Member of the American Academy of Actuaries. He is employed by Deloitte & Touche LLP in Hartford Connecticut, as a Manager. Mr. Bingham received his Bachelor of Science degree from Clarkson University in 1992.

Prior to joining Deloitte & Touche LLP, Mr. Bingham was employed by a major Hartford based insurance company where he worked in Corporate Actuarial, Commercial Lines, and Reinsurance Assets Management.

Since joining Deloitte & Touche LLP in 1998, Mr. Bingham has served numerous clients in the public and private sectors. Work for these clients has included: analysis of loss reserves, reinsurance and insurance pricing reviews, demutualization, dynamic financial analysis, and review of alternative financing structures. Mr. Bingham also co-authored the paper *Implications of Dynamic Financial Analysis on Demutualization* with Jan Lommele which served as catalyst for the writing of this paper targeting strategic insurance purchasing. Mr. Bingham has also been a frequent guest speaker, including presentations for organizations such as the Casualty Actuarial Society (CAS) ratemaking and dynamic financial analysis special interest seminars, Chartered Property Casualty Underwriters (CPCU) Society, Casualty Actuaries of New England (CANE), American Association of State Compensation Insurance Funds (AASCIF), state insurance departments and other public and private companies.

John Slusarski is a Fellow of the Casualty Actuarial Society and a Member of the American Academy of Actuaries. He is employed by Deloitte & Touche LLP in Hartford Connecticut, as a Senior Manager.

Mr. Slusarski holds a Masters of Business Administration degree with a concentration in Economics and a Bachelor of Science degree from the University of Hartford. He has also attained the Chartered Financial Consultant (ChFC) and Chartered Life Underwriter (CLU) designations from the American College.

Prior to joining Deloitte & Touche LLP, Mr. Slusarski was employed by a major Hartford based insurance company, reaching the level of Assistant Vice President in 1994. He had recently served as Chief Actuary of the company's London Market reinsurance subsidiary. In that capacity, he developed and implemented reserving, pricing and planning models, while also serving as a key member of the reinsurance company's Security and Competitive Committees and its Senior Management Team. Other assignments at the insurance carrier include both commercial and personal lines experience.

Since joining Deloitte & Touche LLP in 1995, Mr. Slusarski has served numerous clients in the public and private sectors. Work for these clients has included: analysis of loss reserves, reinsurance and insurance pricing reviews and modeling, and review of alternative financing structures.

Mr. Slusarski and Mr. Bingham have assisted a number of insurance and non-insurance clients with the modeling and purchasing of insurance protection for their organizations. The authors have also developed and implemented quota share, excess of loss and simulation based reinsurance pricing tools for reinsurance clients. These tools are often utilized by underwriters and actuaries when evaluating broker submissions.

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Abstract

Strategic business management is concerned with both the level of financial performance and the uncertainty that surrounds it. Typically companies focus their strategic analysis on those core operations driving their basic business. However other components, such as investment and insurance, also may have the potential to introduce significant variability in financial results. The financial community has developed fairly sophisticated methods and products to deal with asset returns and risk, and the insurance industry is now doing the same with dynamic financial analysis (DFA). Businesses can improve their financial performance if they incorporate these newer tools into their risk management processes.

With the recent turmoil in the U.S. Stock market and interest rate volatility, a significant amount of attention has been paid to the risks and rewards associated with investing an organization's new cash, while at the same time revisiting the organization's current investment mix. Public and private companies spend a significant amount of time and money ensuring that their asset portfolio will generate the highest rate of return with hopefully the lowest level of risk along the efficient frontier[1]. These organizations utilize in-house investing experts in combination with outside investment advisors to perform in-depth analyses on all aspects of the organization's investment purchases. These in-depth analyses include numerous technical indicators and modeling techniques.

Unfortunately, the same amount of time and research may not be undertaken by the same organizations when purchasing property and casualty insurance coverages. The impact on an organization's financial results from various insurance programs are much less understood by risk managers than investment options used by investment managers to reduce an organization's investment risk, yet they can have potentially as significant of an impact on the volatility of the financial results.

[1] The efficient frontier, introduced by Harry Markowitz in the 1950's, illustrates the tradeoff between risk on one axis and return on the other. An efficient portfolio is a portfolio that generates the highest return for a given level of risk. The efficient frontier is a graphical illustration of all possible combinations of efficient portfolios.

This paper hopes to accomplish the following objectives:

1. We will use modern investment theory and call options to help explain the fundamental parameters of insurance;

2. We will identify and then help management answer a number of key questions which should be addressed when deciding whether to purchase, change or reduce the company's current risk retention strategy; and

3. We will describe and explain how the new and evolving field of dynamic financial analysis (DFA) can be used by organizations to enhance an analysis focused solely on the purchase of insurance to incorporate all internal (e.g., product sales, production targets, asset class allocation) and external risk factors (e.g., interest rates, inflation, raw material prices).

Background

The importance of delivering results that meet or exceed Wall Street estimates has become more important than ever. Channels such as CNBC, Bloomburge and CNN_{FN} constantly barrage the public with earnings estimates and surprises which can drive a stock up or down within a moments notice. The adoption of Regulation FD[2] on October 23, 2000 has also increased the speed to market of important financial information which can impact Wall Street expectations. Financial Accounting Standard Board (FASB) statements such as SFAS 115 and SFAS 130 also impact decisions of investment managers. FASB statements impact the classification of bonds (e.g., held to maturity, available for sale, for trading purposes) and the reporting of unrealized gains/(losses) that flow through to equity (please refer to Appendix A for a summary of FASB 115 and 130).

[2] Regulation FD, also known as fair disclosure, prohibits a company from intentionally disclosing material nonpublic information to security holders and securities market professionals unless the company discloses the information simultaneously to the public. Detailed information about Regulation FD is available on the U.S. Securities and Exchange Commissions (SEC)'s web site www.sec.gov.

Organizations use a number of investment options such as calls, puts, swaps and TIPs (treasury inflation protection bonds) to reduce investment risk. Similar to risk managers purchasing insurance to reduce insurance volatility, investment managers use different investment strategies to protect an organization against risks such as currency risk, credit and reinvestment risk associated with bonds, and portfolio variability exceeding management comfort levels. In-depth analyses on all aspects of the organization's investment purchases are performed. These analyses include numerous technical indicators and modeling techniques such as moving averages, on balance volume, trend lines, economic value added (EVA™)[3] and value at risk (VaR)[4].

Unfortunately, the same amount of time and research may not be undertaken by the same organizations when purchasing property and casualty insurance coverages like workers compensation, general liability, directors and officers, errors and omissions and automobile liability. A surprising number of organizations currently purchase the same insurance year after year without reviewing the impact of alternative insurance programs which could provide the organization with additional benefits like increased coverage, less earnings variance, claims handling expertise, higher investment income and lower premiums. Just as the fundamentals underlying stock and bond investments change each year, so do the insurance risks facing an organization. Organizations can experience rapid growth, make strategic acquisitions of companies with different claim handling philosophies, divest non-performing or non-target divisions, and develop target areas of business which may expose the organizations to new insurance risk and a more severe judicial environment (e.g., mass torts such as tobacco, product recalls).

With the above in mind, we believe it is critical to increase management awareness in the area of purchasing insurance strategically. Using call options, we hope to leverage the

[3] Economic Value Added (EVA™) was developed in the late 1980's by Stern Stewart & Co. EVA™ assists analysts in measuring the premium or discount that should be applied to a company's book value by comparing the company's return on capital to its weighted average cost of capital.
[4] Value at Risk (VaR) is a statistical risk measure which assists analysts in measuring the market risk of individual assets or a portfolios of assets. VaR provides answers such as "there is a 5% probability that your asset portfolio will drop by $5 million or your return on equity will be -20% or below".

knowledge most organizations have in the area of investing to define and demystify four commonly used insurance programs. This comparison, although theoretical, should help to highlight the similarities between purchasing insurance and investing an organization's cash.

We also hope to illustrate the importance of managing volatility using mathematical modeling. Our initial modeling example will focus on just the property and casualty exposures facing two organizations. We will then expand the discussion to include other key risks factors facing the organizations, an analysis labeled Dynamic Financial Analysis (DFA) by the insurance industry.

Finally, we hope to convince risk managers that a risk-financing program is more than just minimizing the organization's insurance volatility. A true risk-financing program (aka, enterprise risk management) mitigates variability in financial results that result from all the organization's major risks (e.g., insurance exposure, projected sales, production costs, asset returns, tax revenue, etc.). Strategic insurance purchasing involves the review and modeling of the organization's key risk factors in order to determine which combination of strategies best reduces the volatility of the company's earnings while at the same time maximizing the return for shareholders.

Surprisingly, the application of DFA may indicate that less insurance coverage (e.g., higher self-insured retention (SIR), deductible or attachment point, choosing self-insurance over guaranteed cost policies, increase liability retention in captive) may be the best solution for the risk manager and the organization. Stated another way, strategic insurance purchasing doesn't necessarily mean spending more money on property and casualty insurance coverage. Strategic insurance purchasing means allocating the organization's capital in the most efficient manner in order to generate the highest rate of return with hopefully the lowest level of risk.

Options and Insurance

Call/put options are at times as unfamiliar to actuaries as various insurance programs are to investment managers. Actuaries have historically been known for pricing and reserving property and casualty exposures while investment managers have historically focused on the returns achievable in the world's capital markets. Although the lines are starting to blur with integrated insurance and capital market products, securitization deals and enterprise risk management, insurance programs such as SIRs, large deductibles, excess of loss and aggregate excess of loss contracts are really nothing more than the buying and selling of call options.

In the following pages, we will use modern investment theory and call options to help explain the fundamental parameters of insurance. Hopefully, this alternative view will leverage the knowledge most investment and risk managers have attained in their day-to-day dealings with the capital markets. For the more interested reader, Appendix B and C expand upon the brief overview provided below. For a detailed discussion of Black-Scholes option pricing formula and the similarity between options and certain insurance concepts, we would recommend reading Mr. Michael G. Wacek's "*Application of the Option Market Paradigm to the Solution of Insurance Problems*" published in the 1997 Volume LXXXIV of the Proceedings of the Casualty Actuarial Society. Mr. Wacek's paper derives Black-Scholes formula as a special case of lognormal excess loss analysis and uses option market paradigms to think about and describe insurance.

An option is the right, but not the obligation, to buy or sell a security for a specified price (usually referred to as the exercise price or strike price) on or before a specified date (usually referred to as the exercise date or strike date). A call is the right to buy a security at the exercise price on or before the exercise date and a put is the right to sell a security at the exercise price on or before the exercise date. For example, a call option with an exercise price of $70 is worth nothing to the investor until the stock price exceeds the $70 exercise price. Once the stock price exceeds the $70 exercise price, the call option increases a dollar in value for each dollar increase in the stock price (see Appendix B for graphical example).

Real options analysis (ROA), a new and exciting focus of the academic community, has been used largely by pharmaceuticals companies such as Merck, in consumer electronics, industrial mining, and by oil companies evaluating petroleum exploration. ROA is often broken down into six categories: the option to defer investments, the option for staged investments, the option to change scale, the option to abandon investments, the option to switch investments, and the option to grow investments.

ROA, which focuses on real assets, can be used to analyze almost any type of investment. For example, a housing developer may own 15 lots in a depressed housing market which makes the construction of the 15 houses unprofitable. Instead of dumping the property, the developer could pay the property taxes (i.e., option premium) with the hope that the housing market will recover (i.e., option to defer investments). If the housing market improves, the developer could build a portion of the houses each year (i.e., option for staged investments). If the housing market doesn't rebound, the developer could sell the property at a later date (i.e., option to abandon investment) and use the proceeds for other business opportunities. The developer could also decide to sell the lots and purchase other lots of another type or in another area (option to switch).

Insurance programs like SIRs, large deductibles, excess of loss and aggregate excess of loss contracts can also be viewed as combinations of call options, using the following assumptions (see Appendix C for a detailed discussion of the four insurance programs):

- The exercise price of the purchased call option is equal to either the clients SIR, deductible or reinsurance attachment point[5]
- For excess of loss and aggregate excess of loss contracts, the exercise price of the sold call option is equal to the attachment point plus the insured limit[6]

[5] The attachment point represents the individual large loss amount or aggregate loss amount where the reinsurance company begins paying losses.
[6] The insured limit represents the dollar layer of coverage provided by the reinsurance company in excess of the attachment point. The attachment point plus the insured limit represents the individual large loss amount or aggregate loss amount where the reinsurance company ceases paying losses.

- The call option(s) lasts for one year (i.e., one accident year), with the expiration date equal to the last day of the accident year[7]

The purchased call option gives the insured the right to call upon the insurance company to make payments above the SIR, deductible or reinsurance attachment point. The sold call option gives the insurer the right to call upon the insured to resume making payments in excess of the attachment point plus the limit. For example, a company that purchases a $250,000 SIR is essentially purchasing a call option with an exercise price of $250,000. The call option is worth nothing until a large loss exceeds the $250,000 exercise price. Once the large loss exceeds the $250,000 exercise price, the call option increases a dollar in value for each dollar increase in the large loss (Appendix C displays each option scenario graphically and discusses some of the issues that make the conversion of insurance coverages into real call options difficult).

Viewed in this fashion, it is much easier for most investment managers and risk managers to understand the importance of purchasing insurance strategically. The questions one considers in selecting an organization's insurance attachment point or SIR (e.g., policy period, volatility of large losses, lost investment income) is similar to the considerations in selecting an exercise price for a Microsoft call option (e.g., time to maturity, volatility of Microsoft stock, risk free investment). The questions that need to be addressed when developing an insurance program are discussed next.

[7] The implications of IBNR will be discussed in Appendix C.

Purchasing Insurance

It is easy for most investment managers to understand why an investor would purchase a call option on a stock that has a high probability of exceeding the exercise price instead of purchasing a call option on a stock with a low probability of exceeding the exercise price. At the same time, if we were to redefine the exercise price as the client's $100,000 SIR, and treat the call option as the right of the insurance customer to call upon their insurance company to make payments above the SIR, most risk managers would still have trouble quantifying the impact of the SIR on their organization's financials. Although a risk manager could state with certainty to the CEO:

> "Our organization will never pay losses in excess of the $100,000 SIR on any individual claim." [8]

A number of other key management questions would be left unanswered:

- What is the organization's annual insurance cost with a $100,000 SIR (including retained losses)?
- What confidence level would the risk manager assign to the annual insurance cost estimate that feeds the organization's financial plan?
- Does the $100,000 SIR give the organization the best "bang for the buck" (e.g., would a $250,000 SIR be a cheaper and better fit for the organization)?
- Is the use of a SIR the best insurance solution for the organization (e.g., high frequency of losses which fall under the SIR might be better addressed by purchasing an aggregate excess of loss contract through the company's captive)?
- Given the insurance program the organization has developed, what is the potential variability in costs?
- Can the organization use the time value of money underlying its future insurance losses to help smooth other potential earnings variances?

[8] As we all know, nothing in life is certain. Depending on the financial rating of the insurance company selected by the organization, there exists a probability of insolvency that may ultimately result in the inability of a poorly capitalized insurance company to pay its obligations in full.

With the use of a module from our DFA model, questions like these can be analyzed to determine which risk retention strategies best meet the needs of an organization. The outputs from the model can assist an organization with their strategic insurance purchases and provide management with some comfort level surrounding their insurance related volatility expectations.

Purchasing Insurance – A Simple Modeling Example

Example Background

We will begin with a simple example using Company X and Company Y which are both self-insured and operating in the same industry. Although both companies incur $1,250,000 in workers compensation claims a year, they have historically exhibited dramatically different frequency and severity of losses. Table 1 details the historical frequency and severity of each company:

TABLE 1

	COMPANY X	COMPANY Y
FREQUENCY PARAMETER		
EXPECTED # OF CLAIMS: (POISSON DISTRIBUTION)	25	125
SEVERITY PARAMETERS		
MEAN:	10.473	8.406
STANDARD DEVIATION: (LOGNORMAL DISTRIBUTION)	0.833	1.269
AVERAGE CLAIM SIZE IN $:	50,000	10,000
STANDARD DEVIATION IN $:	50,000	20,000
EXPECTED TOTAL LOSSES:	**1,250,000**	**1,250,000**

With the recent volatility in the stock market and increased pressure for higher returns on equity, management of both companies have been looking for ways to increase earnings while at the same time reducing volatility. Given the historical volatility in workers compensation costs and the availability of insurance to reduce risk, risk managers at each company were asked to investigate purchasing a $100,000 SIR to eliminate the possibility of catastrophic losses impacting the companies' financials.

Risk manager X and risk manager Y, both wearing multiple hats within the organizations and limited by other time commitments, decide to purchase the $100,000 SIR policy with little or no actuarial review. In the end, both risk managers tell their CEO's the same story:

> "We have purchased commercial insurance that guarantees our organization will never pay losses on an individual claim in excess of $100,000. Therefore, we believe our organization's exposure to individual large losses that can have a major impact on financials has been significantly reduced."

Although the above statement is true for both companies, which risk manager has provided the best "bang for the buck" for their organization assuming they both paid the same $150,000 amount for the $100,000 SIR policy[9]? To answer this question, we focus on modeling each organizations insurance exposure.

Parameterization

The first step in using modeling to simulate future insurance losses for Company X and Company Y is to review the losses historically incurred by the companies. This is accomplished by gathering historical claims data over the last five to ten years for each company. Loss runs detailing individual claim activity can usually be obtained from each companies' risk management system or from the company's third party claims administrator (TPA). Depending on the size of the organization and the number of claims incurred each year, losses in excess of $25,000 or $50,000 may be used to fit the company's historical losses[10]. This may be necessary when a company is unable to provide individual claim detail under a certain threshold such as $25,000 or $50,000 or the number of claims is prohibitive. Although reviewing claim activity for smaller losses can be valuable, the historical distribution of losses under $25,000 will add little value to your modeling when looking at SIRs or reinsurance attachment points well above the

[9] The actual pricing of each company's insurance policy would depend upon a number of factors such as the class codes covered under the policy, insurance company performing the review, and the perceived credibility of the companies' historical data used in determining the experience modifier.

[10] If individual losses are provided in excess of $25,000 or $50,000, the trended and developed individual losses must be truncated, fitted to a lognormal distribution, then readjusted to ground up after simulation.

large loss threshold. This holds true as long as there exists a sufficient amount of loss data in excess of the large loss threshold to rely upon for modeling.

It is also important at this time to discuss and review any transactions that may have altered the underlying types of claims that will be faced by either company on a going forward basis before developing claims to ultimate. These discussions with the risk managers would include transactions such as the sale of a division and the impact of excluding that division's claims, current or future union negotiations or potential layoffs, dramatic growth in specific areas of the company that may increase or decrease loss frequency or severity on a going forward basis, acquisitions which may alter the composition of the book of business due to the claims handling practices of the acquired company, and external influences such as litigation and social factors.

Once the database of historical claims has been compiled and adjusted for any important changes as discussed above, each loss is developed to the ultimate settlement value[11] and trended to the loss level in effect during the modeling period. The average and standard deviation of the natural logarithm of the developed and trended losses is calculated for use as a starting point in parameterizing the lognormal distribution for each company. The mean and standard deviation of the lognormal distribution can be judgmentally adjusted to increase or decrease the variability of loss severities in the model based upon a comparison to the actual historical losses incurred by the organization.[12] The lognormal distribution has historically been used by actuaries to fit severity distributions because it appears to reasonably fit empirical loss data.

The expected number of claims can be selected by reviewing the historical number of claims incurred annually by the organization. The expected number of claims, similar to loss severity, may also need to be adjusted to reflect important organizational changes such as the sale of a division, acquisition, or rapid growth. External influences such as

[11] Development to ultimate settlement value includes a rigorous analysis of historical loss development patterns by coverage and type of claim (e.g., medical, indemnity, expense).

[12] Other distributions could be used to simulate the frequency or severity of losses if a thicker tail is desired. Excel currently offers the LOGINV(), GAMMAINV() and NORMINV() functions. @Risk and Crystal Ball offer a much larger variety of distributions to choose from for the more interested modeler.

the litigious environment and social factors also need to be analyzed for their impact on claim frequency.

Table 2 displays the non-exceedence probabilities of each company's projected average claim severity based on the parameters shown in Table 1:

TABLE 2

NON EXCEEDENCE PROBABILITY	COMPANY X AVG CLAIM SIZE	COMPANY Y AVG CLAIM SIZE
5.0%	8,989	555
10.0%	12,164	880
25.0%	20,164	1,901
50.0%	35,355	4,472
60.0%	43,657	6,167
70.0%	54,710	8,698
80.0%	71,246	13,008
89.4%	100,000	21,806
90.0%	102,761	22,730
95.0%	139,056	36,038
99.0%	245,245	85,554
99.3%	271,686	100,000
99.9%	463,241	225,487

The non-exceedence probability shows the estimated probability of an individual claim being of the size shown or smaller. For example, for Company X, there is a 10% chance that an individual claim will be less than or equal to $12,164.

From Table 2, we can see that the implementation of a $100,000 SIR would provide more protection for Company X than Company Y. Company X has a 10.6% (100% - 89.4%) chance that each one of its expected 25 claims will exceed the $100,000 SIR. Therefore, in an average year we would expect that between 2 and 3 claims would be $100,000 or higher. Company Y has only a 0.7% (100% - 99.3%) chance that each one of its expected 125 claims will exceed the $100,000 SIR. Therefore, in an average year, Company Y should expect approximately 1 claim greater than $100,000.

Simulation Results

Using the above assumptions, we modeled the impact of a $100,000 SIR on both companies. Table 3 displays our simulation results for various non-exceedence probabilities:

TABLE 3

(000s)		NON-EXCEEDENCE PROBABILITY					
	AVG.	50.0%	60.0%	70.0%	80.0%	90.0%	95.0%
AGGREGATE LOSSES							
COMPANY X	1,250	1,226	1,324	1,429	1,554	1,727	1,863
COMPANY Y	1,250	1,227	1,286	1,350	1,431	1,569	1,713
CEDED LOSSES							
COMPANY X	163	123	158	202	259	375	462
COMPANY Y	64	14	32	56	95	177	285
RETAINED LOSSES							
COMPANY X	1,098	1,093	1,156	1,229	1,324	1,434	1,527
COMPANY Y	1,193	1,182	1,231	1,288	1,347	1,444	1,523

The simulation results for both companies produced average aggregate losses of $1,250,000, which tie back to the original assumptions shown in Table 1. The more interesting results of the modeling come from the amount of reinsurance coverage (i.e., ceded losses) provided to each company from the $100,000 SIR. Appendix C.3 (Company X) and C.5 (Company Y) display ceded losses sorted in ascending order for the 1,000 simulations. Appendix C.2 (Company X) and C.4 (Company Y) display retained losses sorted in ascending order for the 1,000 simulations. The non-exceedence probabilities on each graph feed directly into Table 7.

Table 4 displays the (cost)/benefit analysis for a $150,000 insurance premium:

TABLE 4

	INSURANCE PREMIUM		(COST)/BENEFIT ANALYSIS NON-EXCEEDENCE PROBABILITY					
COMPANY	(000s)	AVG.	50.0%	60.0%	70.0%	80.0%	90.0%	95.0%
CO. X	$150	13	(27)	8	52	109	225	312
CO. Y	$150	(86)	(136)	(118)	(94)	(55)	27	135

Table 4 illustrates the (cost)/benefit[13] of purchasing the $100,000 SIR policy. The true value of the insurance policy for each company equals the losses ceded to the insurer minus the premium paid for the policy. If the (cost)/benefit is positive, then the insurance policy adds value to the organization, since premium paid is less than the coverage provided.

Table 4 quickly illustrates the (cost)/benefit difference between Company X and Company Y. With a $150,000 insurance premium, the insurance policy adds value to Company X approximately 40% (100% - 60%) of the time. On the other hand, the insurance policy only adds value to Company Y approximately 10% (100% - 90%) of the time. 50% of the time, Company Y will have overpaid for the insurance policy by at least $136,000, since the coverage provided by the insurance policy (i.e., ceded losses) will be $14,000 or less.

Management Q&A

Using the results of our modeling, the above non-exceedence probabilities now provide both risk managers with the firepower to answer some of the key management questions addressed above:

- What is the organization's annual insurance cost with a $100,000 SIR?
  - Company X - $1,248,000 average ($1,098,000 + $150,000 premium)
  - Company Y - $1,343,000 average ($1,193,000 + $150,000 premium)
- What confidence level would the risk manager assign to the annual insurance cost estimate that feeds the organization's financial plan?
  - Company X – $1,306,000 assuming 60th percentile ($1,156,000 + $150,000 premium)
  - Company Y – $1,381,000 assuming 60th percentile ($1,231,000 + $150,000 premium)
- Does the $100,000 SIR give the organization the best "bang for the buck"?

[13] For simplicity, we have ignored the impact of the time value of money (i.e., the premium is paid up front while the losses are paid over time) and other impacts such as tax consequences, etc.

- Company X – Yes, the $150,000 insurance premium implies a positive (cost)/benefit 40% of the time. On average, the policy will save the organization $13,000.
- Company Y – No, the $150,000 insurance premium implies a positive (cost)/benefit only 10% of the time. On average, the policy will cost the organization $86,000.

- What is the potential variance in insurance costs?
  - Company X – There is a 10% chance that insurance costs could be as low as $905,000 and a 10% chance that it could be as high as $1,584,000.
  - Company Y – There is a 10% chance that insurance costs could be as low as $1,107,000 and a 10% chance that it could be as high as $1,594,000.
- Is the use of a SIR the best insurance solution for the organization?
  - Company X – Yes, the $100,000 SIR appears to be a strategic investment for $150,000 in premium.
  - Company Y – Yes, but the $100,000 SIR may need to be lowered. An aggregate excess of loss (AEOL) contract could also be purchased that would provide the same amount of coverage on average as Company X (i.e., average ceded losses equal to $163,000). Using the simulation results, a $250,000 xs $1,000,000 AEOL contract or $175,000 xs $850,000 AEOL contract would provide approximately the same amount of coverage on average as a $100,000 SIR for Company X.

A final consideration depends on the organization's risk tolerance level which can vary significantly from one organization to another. Each organization's financials are a direct function of the confidence levels assigned to each of the inputs feeding into the financial plan such as projected sales, asset returns and insurance costs. Using our previous example, Company X may be extremely conservative and prepare a financial plan that targets the 90th percentile confidence level. The organization's estimate of the annual insurance cost would then increase $336,000 from the $1,248,000 average to $1,584,000. Company Y, on the other hand, may target a lower confidence level such as the 40th or 50th percentile when preparing their financial plan.

Referring back to the call option terminology we presented earlier, Company X's purchased call option, with an exercise price of $100,000, has a significantly higher probability of being "in the money" than Company Y's call option. 40% of the time, Company X's exercised call option value will exceed the $150,000 cost (i.e., insurance premium) of purchasing the option.

In this simulation, we have just analyzed the proposed insurance program by itself. In reality, there are several factors that are interrelated. For example, a poor economy, a prolonged strike and acrimonious labor negotiations could effect not only a company's workers compensation costs but also cause lower earnings due to impacts on the companies sales, invested assets and labor costs. A way to model these interactions is called DFA.

Dynamic Financial Analysis (DFA)

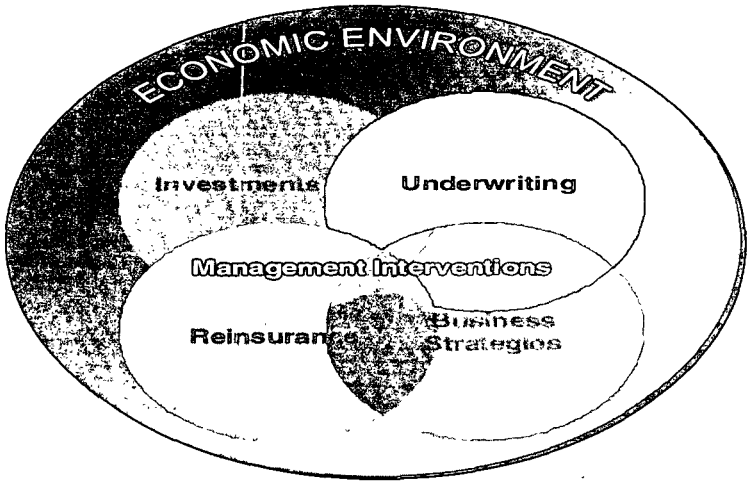
The insurance analysis presented above was performed independent of other organizational considerations such as projected sales, production costs and asset returns. The next step in reviewing an organization, known as DFA in the insurance industry, is to model a majority of the risk factors facing an organization that may have a material impact on the organization's financials.

Martin Frank and Mark Priven said it best over five years ago in their article "*Bringing Actuarial Science to the Risk Management Process*"[14]:

> *"Traditional risk management and its focus on conventional treatment of a limited range of insurable risks have become passé. It is now and will continue to be incumbent on the risk manager of the 21st century to recognize the need of understanding all risks that may have a financial impact on a corporation's bottom line."*

[14] Fall 1995 edition of "The John Liner Review – The Quarterly Review of Advanced Risk Management Strategies", Volume 9, Number 3.

DFA is currently being used by the insurance industry to model the major risk factors facing an insurance company, not just a limited range of risks analyzed independently by different areas of the company. DFA helps tie together the critical areas of the company and the impact of management interventions such as reserve strengthening, writing new lines of business, changing reinsurance coverages, asset allocations and asset liability matching considerations:



DFA has also allowed the insurance industry to take what used to be a fragmented approach to financial planning (i.e., independent investment department, independent actuarial department, independent underwriting department, etc.) and develop an integrated approach that considers all functions and actions of the insurance company as a whole. The combined modeling approach allows an insurance company to compare it's asset liability mismatch between projected liabilities and investment allocations, optimize its current reinsurance selection by line and in total (e.g., multi-line aggregates) and to reduce the cost of overhedging when the company can afford to retain more risk than originally thought.

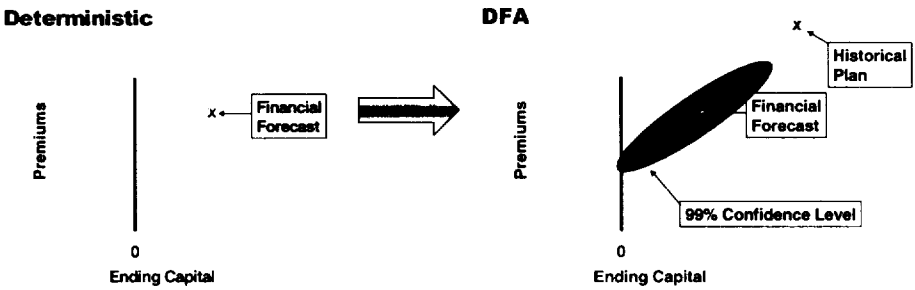
DFA integrates internal risk factors (e.g., underwriting, claims initiatives, investment portfolio allocation and use of reinsurance) and external risk factors (e.g., interest rates, inflation, equity swings, natural catastrophes, competitor activity and underwriting cycles) to develop an analysis that provides confidence levels instead of a single point estimate. The difference between the single point estimate approach used in the past (i.e., deterministic) and the confidence level modeling of the future (i.e., stochastic) is illustrated below using operating profit as an example:

Deterministic		*Stochastic*	
# Policies	100	# Policies	100
X Premium / Policy	20	X Premium / Policy	20
= Total Premium	2,000		
X 1 - Operating Ratio	.13	X 1- Oper. Ratio	0.13
= Operating Profit	260	= Operating Profit	260

Companies historically provided management with a single point estimate, sometimes including a low and high estimate, of the future operating profit of the company. In the above table, this estimate would have been $260. The analysis utilized significant amounts of person-hours to create a deterministic estimate of the company's future. This estimate, often part of a three-year or five year strategic plan, usually became obsolete within six to nine months of its creation, just in time for next year's strategic planning process to begin. This cycle occurred because companies budgeted expected values for variables which inherently involved a significant amount of volatility. Underwriters may have expected to sell 100 policies, but a competitor could have introduced a new product which took away market share and resulted in only 90 policies being sold. Similarly, a company may have expected $20 per policy, but a delayed rate filing for an increase in a key state may have resulted in the collection of only $19 per policy.

A stochastic model (i.e., DFA) uses mathematical distributions or company defined distributions to incorporate the volatility surrounding each variable feeding the strategic plan. Instead of loading the expected number of policies, premium per policy and operating ratio, each variable is programmed using a distribution of potential outcomes based on discussions with the appropriate personnel at the company. Instead of just generating a single point estimate of operating profit as shown in the deterministic example, a range of potential operating profits can be described to management at various levels of confidence.

The below illustration displays the transition from the historical deterministic financial forecast to the expected financial forecast using a DFA model:



The DFA model in the above example provides a range of premium and ending capital projections based upon the 10,000 simulation runs. Other statistics, such as probability of ruin (i.e., 1% probability that surplus will be eliminated), can be easily determined from the model output. Lastly, the DFA model may bring some reality into the financial planning process due to the time spent parameterizing a model. It has been our experience that DFA models help to quickly illustrate that some of the historical plans of an organization may have been overly optimistic.

The output from the DFA model can assist management (insurance and non-insurance) with numerous questions and concerns such as:

- Selecting the confidence level that management feels would provide them with the optimal probability of meeting earnings per share estimates on Wall Street (e.g., there is only a 5% probability that earnings per share will fall below Wall Street consensus);
- Quantify to the board of directors different circumstances which may cause the company's financial statements to be impaired (e.g., probability of asset portfolio dropping 25%, probability of top line revenue dropping 10%, probability of a two rare events occurring simultaneously);
- Quantify how well the company is protected against catastrophic losses such as a hurricane, flood, fire, or earthquake (e.g., there is a 1% probability of ruin, or what is the expected policyholder deficit);
- Modeling alternative asset allocations and reinsurance protection which display various levels of return along the efficient frontier;
- Risk based capital (RBC) modeling and rating agency management; and
- Tax optimization.

DFA, Beyond the Insurance Industry

Although some of the risk factors facing most non-insurance companies vary significantly from a typical insurance company, the quantification and parameterization of the risk factors facing an organization is a similar exercise whether you are quantifying personal automobile profitability, computer chip manufacturing profitability or the impact of investing a portion of the organization's assets in stocks, bonds, currency hedges or CMOs. With the help of DFA, we can take our simplified insurance purchasing example to the next level by factoring in other items such as projected sales, production costs, tax revenues and asset returns. DFA allows the organization to consider various combinations of alternative risk retention strategies, asset allocations, sales targets and production costs in order to determine the optimal mix of production, sales and investments which provides company management with the best strategy for delivering the highest return on equity to their shareholders. The outputs of the DFA model can assist the organization with their strategic insurance purchases while at the same time reducing over hedging that may result from reviewing insurance purchases independent from other functions within the organization[15].

The 1996 Casulaty Actuarial Society Forum article written by Mr. DiCenso and Mr. Michael R. Levin "*A Stakeholder Approach to Risk Financing Programs*" defines non-strategic versus strategic insurance purchasing:

NON-STRATEGIC	STRATEGIC
Typically assume entity purchases insurance	**Rather, assume entity will not purchase insurance**
◆ justify assuming risk	◆ analyze benefit from having insurance
◆ compare premiums to expected losses	◆ base purchase on other entity strategies
◆ "if it ain't broke, don't fix it"	◆ buy insurance to eliminate variability

[15]Swiss Re New Markets recently addressed the issue of "over hedging with separate solutions" in their publication "Integrated Risk Management Solutions - Beyond Traditional Reinsurance and Financial Hedging" with their new integrated risk management alternative financing option which combines insurance and financial risks into a single product.

The authors note that non-strategic insurance purchases do not reflect the risk bearing capacity of the organization and often times are not consistent with other decisions made by the organization. Such non-strategic insurance purchases result in inefficient insurance programs where organizations purchase insurance coverage where it isn't needed and insurance coverage not being available where it would be most beneficial to the organization.

The strategic approach to insurance purchasing described by Mr. DiCenso and Mr. Levin describes basing insurance purchases on other organizational strategies and the ability of the insurance purchase to reduce the organization's variability. This forward-looking view described by the authors is essentially DFA for non-insurance entities. As noted above, the risk manager of the 21st century must be aware of all the risks which may impact the bottom line of the organization. Strategic insurance purchasing involves the modeling of all the organizations risk factors in order to determine which combination of strategies best reduce the volatility of the company's earnings while at the same time maximizing the return for the shareholders.

Relative Importance of Strategic Insurance Purchasing

The relative importance of strategic insurance purchasing varies dramatically depending upon a number of different drivers. Size is a key driver in the ability of an organization to retain and control their insurance risks. A publicly traded company varies in size based upon its market capitalization. Market capitalization, equal to shares outstanding multiplied by price per share, is usually classified as micro-cap, small-cap, mid-cap or large-cap. State and local governments vary in size depending upon the population and geographic area covered. Similar to a public company, the larger the municipality or county, the higher the probability will be that the municipality or county will be able to control their insurance decisions. As the size and homogeneity of the data increases, the easier it can be stratified and analyzed.

Industry focus is another important driver in the ability of an organization to retain and control their insurance risks. Industry sectors are often classified as manufacturing,

retail, service, internet, etc.. Manufacturers such as General Motors and Ford have some traditional insurance exposures which are fairly easy to benchmark. Their workers compensation, general liability and automobile liability exposures can be easily priced using standard industry classifications available from the National Council on Compensation Insurance (NCCI) and Insurance Services Offices, Inc. (ISO) weighted with their own experience. Similarly, state and local governments face property and casualty exposures which can be easily benchmarked and priced due to the large amounts of historical information available across the country. Internet companies on the other hand represent new and exciting exposures with very little historical data. Internet companies also introduce new types of exposure such as data privacy, firewall security and internet copyright infringement (e.g., Napster.com)

Exposure to businesses interruption is a critical driver in the ability of an organization to protect itself against catastrophic events which may not be totally self-insurable. Business interruption events can be classified as location dependant (e.g., earthquake risk in California, hurricane risk in Florida), supply side dependant (e.g., Firestone tires supplied to Ford SUVs, fire at key supplier or plant), demand side dependant (e.g., temporary embargos and exercise taxes), product recall (e.g., Tylenol and Firestone tires) and union strikes (e.g., baseball players strike and airline "blue flu" sick days).

The litigious nature of the products manufactured by an organization can vary from insignificant to significant if not properly insured. A number of products come to mind when discussing major litigation items of the past century such as asbestos, lead based products, tobacco, fen-phen dietary supplements and silicon.

With the above insurance purchasing drivers in mind, it is easy to see that the importance of insurance purchases can vary dramatically among organizations, whether they are competing in the same industry or not. The following two examples should help to illustrate this critical point.

Table 5 displays Intel's largest holdings with a market value in excess of $100 million as of December 31, 1999 and the projected change in portfolio value through December 31, 2000[16]:

TABLE 5

STOCK	NUMBER OF SHARES	12/31/1999 MARKET PRICE	MARKET VALUE (MILLIONS)	2000 PERCENT CHANGE	12/31/00 MARKET VALUE (MILLIONS)
VA LINUX	3,543,741	206.6	732.2	-95.5%	33.0
CMGI	5,112,168	138.4	707.7	-96.0%	28.3
RED HAT	6,010,116	105.6	634.8	-94.2%	36.8
ARIBA	3,030,304	88.7	268.8	-39.5%	162.6
WILLIAMS COMM.	9,225,093	28.9	267.0	-59.6%	107.8
ETOYS	8,109,502	26.2	212.9	-99.3%	1.5
COVAD	5,563,863	37.3	207.5	-95.6%	9.1
XIRCOM	2,516,405	75.0	188.7	-75.3%	46.6
CROSSROADS	1,476,147	84.5	124.7	-94.5%	6.9
CLARENT	1,519,756	77.7	118.2	-85.5%	17.1
MICROSOFT	996,612	116.8	116.4	-62.1%	44.1
ITXC	3,315,034	33.6	111.5	-79.4%	23.0
LIBERATE TECH	843,880	128.5	108.4	-89.9%	11.0
			3798.7		527.8
			IMPLIED CHANGE IN MARKET VALUE:		(3270.9)
			INTEL EMPLOYEES (1999 10-K):		70,200
			CHANGE IN MARKET VALUE PER EMPLOYEE:		46,595

The twelve month $3.3 billion change in Intel's investment portfolio, assuming no sale or purchase of stock throughout the year, equates to $46,595 of lost market value per employee. Another way to view this is that every one of Intel's employees could have fallen down on the job and filed a workers compensation claim worth $46,595. Although this example is extreme since Intel actively sold and bought investments throughout the year, it quickly and definitively illustrates the importance of Intel's investment decisions in relationship to their insurance purchasing decisions. Had Intel decided not to buy or sell investments throughout the year, Intel would be hard pressed to find $3.3 billion dollars of savings by implementing a strategic insurance program, let alone $3.5 million or $50 per employee.

[16] From the December 31, 1999 13F-HR filing "Quarterly Holdings or Combination Report by an Institutional Money Manager". The report displays the name of the issuer, title of class, CUSIP, value of the investment in thousands, shares/principal amount, etc.

State and local governments on the other hand spend a material amount of money on their property and casualty insurance coverage. This is due largely to the public sector's high exposure to risks such as police professionals, public officials errors and omissions, employment practices, medical malpractice, workers compensation and environmental impairment. The third biennial Cost of Risk Evaluation (CORE) in State and Local Government survey report sponsored by the Public Risk Management Association (PRIMA) and Deloitte & Touche LLP surveyed PRIMA members in 1998 and 1999 to gather information about risk management in the public sector. The CORE survey report analyzed the cost of risk using the following components:

- Property Costs – Total property costs for insurance premiums and retained losses.
- Liability Costs – Total liability costs for insurance premiums, pool entry fees and retained losses.
- Workers' Compensation Costs – Total workers' compensation premiums, pool entry fees, uninsured losses, and safety and loss control expenses.

The CORE study indicated that the overall average premium for the three components represented approximately 1.0% of the overall operating budget for all respondents (40% municipalities, 26% counties, and 34% states, schools and others). The CORE study also indicated that the overall average retained losses for the three components represented an additional 1.2% of the overall operating budget for all respondents. The 2.2% total represents in excess of $10 billion dollars in premium payments and retained losses for all respondents. The total by type of respondent ranged from a low of 1.6% for state/state agency to a high of 3.8% for other (e.g., special districts, pools and utilities).

Unlike the Intel example where the impact of changing strategic insurance purchases pales in comparison to changes in Intel's investment portfolio, state and local governments face significant risk when making strategic insurance purchases. Statement 10 of the Governmental Accounting Standards Board (GASB #10) requires governmental entities to disclose current and future liabilities under self-insurance programs such as

development on known claims, reopened claims and incurred but not reported (IBNR) claims. Dramatic changes in these estimates represent a material risk factor facing state and local governments, especially when an unfavorable bond rating by Moody's or Duff & Phelps could restrict them from raising capital through new bond offerings.

On the other hand, state and local governments have almost no investment risk. This is quite the opposite from Intel's investment risk which may potentially swing a billion dollars or more. Instead, state and local governments are more heavily affected by uncertainty surrounding future tax revenues. Tax revenues, similar to Intel's expectations of its return on investments or an insurance company's investment income from its bond portfolio supporting its liabilities, represent a major source of income for keeping the state and local governments functioning on a fiscally sound basis.

Conclusion

The "if it ain't broke, don't fix it" approach used by risk managers may have worked fairly well during the soft insurance market of the 1990's when the cost of guaranteed cost policies and large deductible policies dropped year after year driven by aggressive competition by insurance companies for market share. Unfortunately, the deteriorating insurance industry financial results and recent signs that rates may be hardening does not bode well for the "if it ain't broke, don't fix it" risk manager. Unlike the past decade where risk managers could renew their old policies and negotiate lower retentions with savings or almost no change in cost, the hardening market will likely result in a number of changes:

- Increasing cost of insurance coverage (double digit increases for some lines);
- Organizations increasing their risk retention levels, a reversal of the 90s trend, in order to offset the large premium increases;
- Increased use of captives; and
- Increased focus on enterprise risk management.

Instead of being reactive, we believe the time is right for risk managers to become proactive in addressing the hardening insurance market.

Strategic business management is concerned with both the level of financial performance and the uncertainty that surrounds it. We believe most organizations have taken a step in the right direction by developing or using fairly sophisticated methods and products to deal with asset returns and risk. With the hardening market fast approaching or already upon some of us, we believe risk managers should consider elevating their risk-financing program to the next level. This is especially critical for state and local governments who will be facing rising insurance costs at the same time there is a possibility of a recession and decreasing tax revenue. The application of a DFA model may indicate that less insurance coverage or the purchase of an integrated risk management financing option combining insurance and financial risks into a single product may be the best solution for the risk manager and the organization.

APPENDIX A

Summary of Statement No. 130[1]

Reporting Comprehensive Income

(Issued 6/97)

Summary

This Statement establishes standards for reporting and display of comprehensive income and its components (revenues, expenses, gains, and losses) in a full set of general-purpose financial statements. This Statement requires that all items that are required to be recognized under accounting standards as components of comprehensive income be reported in a financial statement that is displayed with the same prominence as other financial statements. This Statement does not require a specific format for that financial statement but requires that an enterprise display an amount representing total comprehensive income for the period in that financial statement.

This Statement requires that an enterprise (a) classify items of other comprehensive income by their nature in a financial statement and (b) display the accumulated balance of other comprehensive income separately from retained earnings and additional paid-in capital in the equity section of a statement of financial position.

This Statement is effective for fiscal years beginning after December 15, 1997. Reclassification of financial statements for earlier periods provided for comparative purposes is required

[1] Pulled from the Financial Accounting Standards Board (FASB) web site http://raw.rutgers.edu/raw/fasb

APPENDIX A

Summary of Statement No. 115[1]

Accounting for Certain Investments in Debt and Equity Securities

(Issued 5/93)

Summary

This Statement addresses the accounting and reporting for investments in equity securities that have readily determinable fair values and for all investments in debt securities. Those investments are to be classified in three categories and accounted for as follows:

- Debt securities that the enterprise has the positive intent and ability to hold to maturity are classified as held-to-maturity securities and reported at amortized cost.

- Debt and equity securities that are bought and held principally for the purpose of selling them in the near term are classified as trading securities and reported at fair value, with unrealized gains and losses included in earnings.

- Debt and equity securities not classified as either held-to-maturity securities or trading securities are classified as available-for-sale securities and reported at fair value, with unrealized gains and losses excluded from earnings and reported in a separate component of shareholders' equity.

This Statement does not apply to unsecuritized loans. However, after mortgage loans are converted to mortgage-backed securities, they are subject to its provisions. This Statement supersedes FASB Statement No. 12, Accounting for Certain Marketable Securities, and related Interpretations and amends FASB Statement No. 65, Accounting for Certain Mortgage Banking Activities, to eliminate mortgage-backed securities from its scope.

This Statement is effective for fiscal years beginning after December 15, 1993. It is to be initially applied as of the beginning of an enterprise's fiscal year and cannot be applied retroactively to prior years' financial statements. However, an enterprise may elect to initially apply this Statement as of the end of an earlier fiscal year for which annual financial statements have not previously been issued.

[1] Pulled from the Financial Accounting Standards Board (FASB) web site http://raw.rutgers.edu/raw/fasb

APPENDIX B

This appendix presents a quick background on call and put options. For the reader interested in a more thorough understanding of options and other investment vehicles, we recommend the following three sources:

- Richard A. Brealey and Stewart C. Myers' book "*Principles of Corporate Finance*" (refer to Casualty Actuarial Society exam part 2 syllabus)

- "*Characteristics and Risks of Standardized Options*", available from the Chicago Board Options Exchange, 400 S. LaSall Street, Chicago, IL 60605 or at the local office of your favorite stock broker

- The Association for Investment Management and Research (AIMR) Chartered Financial Analyst (CFA) Program[17] web site www.aimr.org

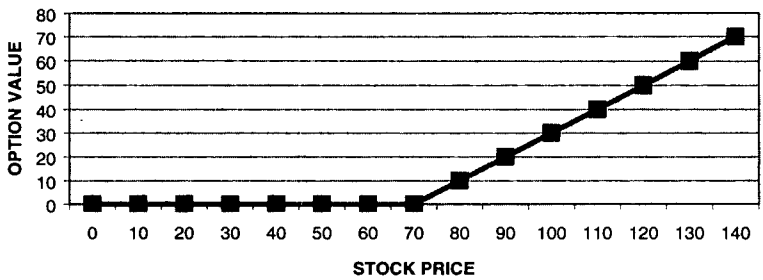
An option is the right, but not the obligation, to buy or sell a security for a specified price (usually referred to as the exercise price or strike price) on or before a specified date (usually referred to as the exercise date or strike date). A call is the right to buy a security at the exercise price on or before the exercise date and a put is the right to sell a security at the exercise price on or before the exercise date.[18] Table 1 illustrates the value of a call option ($70 exercise price) and a put option ($70 exercise price) at expiration, excluding the impact of commissions paid on the transaction:

[17] AIMR is a global nonprofit organization with 88 Member Societies and Member Chapters and more than 90,000 member candidates – investment analysts, portfolio managers, and other investment decision makers employed by investment firms, banks, broker/dealers, investment company complexes, and insurance companies. The association's mission is to serve investors through its membership by providing global leadership in investment education, sustaining high standards for professional conduct, and administering the CFA Program.

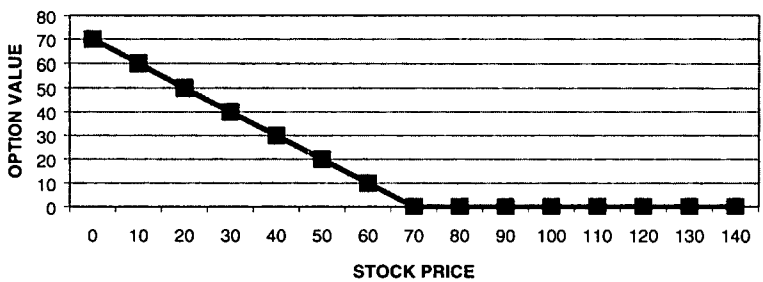
[18] Options that can be exercised on or before the exercise date are usually referred to as American options. Options that can be exercised on the exercise date only are known as European style options.

TABLE 1

CALL OPTION



PUT OPTION



The call option is worth nothing to the investor until the stock price exceeds the $70 exercise price. Once the stock price exceeds the $70 exercise price, the call option increases a dollar in value for each dollar increase in the stock price. For example, if the stock price is $90 at option expiration, the call option value is equal to $20 (i.e., $90 – $70) since the call option gives the investor the right to buy the stock at $70 and sell it at $90. The put option is worth nothing to the investor until the stock price falls below the $70 exercise price. Once the stock price falls below the $70 exercise price, the put option increases a dollar in value for each dollar drop in the stock price. For example, if the stock price is $50 at option expiration, the put option value is equal to $20 (i.e., $70 – $50) since the put option gives the investor the right to sell the stock at $70 and buy it at $50.

A call option that is "in the money" is a call option that is above the exercise price on or before the option expiration date. A put option that is "in the money" is a put option that is below the exercise price on or before the option expiration date.

APPENDIX C

The following assumptions are necessary to define insurance programs using call options:

- The exercise price of the purchased call option is equal to either the client's SIR, deductible or reinsurance attachment point

- For excess of loss and aggregate excess of loss contracts, the exercise price of the sold call option is equal to the attachment point plus the insured limit

- The call option(s) lasts for one year (i.e., one accident year), with the expiration date equal to the last day of the accident year

The purchased call option gives the insured the right to call upon the insurance company to make payments above the SIR, deductible or reinsurance attachment point. The sold call option gives the insurer the right to call upon the insured to resume making payments in excess of the attachment point plus the limit.

We will use three option scenarios to demonstrate the following four insurance coverages:

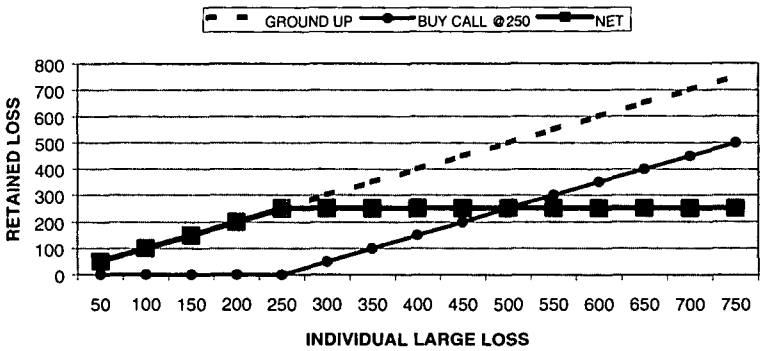
- SELF INSURED RETENTION
  LARGE DEDUCTIBLE ⇨ TABLE 2
- PER OCCURRENCE EXCESS OF LOSS ⇨ TABLE 3
- AGGREGATE EXCESS OF LOSS ⇨ TABLE 4

After presenting the three options, we will discuss some of the issues that make the conversion of insurance coverages into real call options difficult.

SIR/Large Deductible

SIRs[19] and large deductible policies[20] provide insurance coverage for all losses in excess of the SIR/large deductible. Each claim that is incurred by the organization can be treated as a single option. Table 2 displays an example of these insurance transactions using a call option with a strike price of $250,000 (i.e., the SIR/deductible):

TABLE 2



The dashed line represents the individual large loss amount (ILLA) incurred by the insured (i.e., organization). The value of the call option, represented by the circle line, is worth nothing to the insured until the ILLA exceeds the $250,000 exercise price. Once the ILLA exceeds the $250,000 exercise price, the call option increases a dollar in value for each additional dollar incurred by the insured above the exercise price.

The insured's retained loss amount, represented by the square line, equals the value of the ILLA incurred by the insured minus the value of the call option. Using insurance terminology, the insured's retained loss amount equals the ILLA incurred by the insured minus the ceded losses to the insurer. Referring to Table 2, it is easy to see that the

[19] Under a SIR, the insured accepts the entire risk plus expenses, the insured needs to provide or contract for claims handling and loss control services, the insurer provides coverage excess of the desired retention, the insurer has no responsibility for losses within the SIR and the insurer does not provide insurance certificates or administrative services for this layer.

[20] Under a large deductible policy, the insured pays the insurance company a deductible handling charge and the insurer pays all losses under the deductible, the insured is billed for losses plus administrative costs and the insurer is eventually reimbursed for loss payments under the deductible.

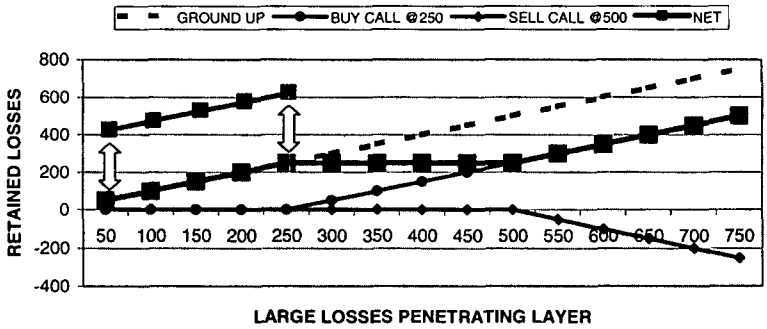
insured's maximum exposure to an ILLA is $250,000 after reflecting the value of the call option.

Excess of Loss

Excess of loss (EOL) contracts provide insurance coverage for all ILLAs in excess of the reinsurance attachment point that fall within the layer of coverage. Table 3 displays an example of this insurance transactions using two call options:

TABLE 3

$250,000 XS $250,000 EOL CONTRACT; 0 REINSTATEMENTS



The dashed line represents an ILLA incurred by the insured that would penetrate through the purchased call option and sold call option (i.e., call spread). EOL contracts, unlike the previous SIR and large deductible policies, may restrict the total amount of insurance coverage for the insured layer based upon the number of reinstatements provided in the contract.

The above EOL example assumes the insured purchased no reinstatements (i.e., equivalent to one call spread) or $250,000 dollars of insurance coverage for losses falling in the $250,000 to $500,000 layer[21]. If the insured purchased one reinstatement (i.e. equivalent to two call spreads), the insured would receive $500,000 dollars of insurance coverage for losses falling in the $250,000 to $500,000 layer. If the insured purchased unlimited reinstatements (i.e., equivalent to unlimited call spreads), then the

insured would receive an unlimited dollar amount of insurance coverage for losses falling in the $250,000 to $500,000 layer.

The value of the purchased call option, represented by the circle line, is worth nothing to the insured until the ILLA exceeds the $250,000 exercise price. Once the ILLA exceeds the $250,000 exercise price, the call option increases a dollar in value for each additional dollar incurred by the insured above the exercise price. When the ILLA reaches the sold call option exercise price (i.e., $500,000 or $250,000 + $250,000), represented by the diamond line, the call sold to the insurer costs the insured a dollar in value for each additional dollar incurred by the insured above the $500,000 exercise price. If the ILLA doesn't exhaust the $250,000 layer of coverage provided by the contract (i.e. ILLA < $500,000), the unused portion of the $250,000 layer can be applied to other ILLAs until the entire layer is exhausted.

The insured's retained loss amount for ILLAs exhausting the layer, represented by the square line, equals the value of the ILLAs incurred by the insured minus the value of the purchased call option plus the value of the sold call option. Using insurance terminology, the insured's retained loss amount equals the ILLAs incurred by the insured minus the insured's ceded losses to the reinsurer within the limit. An example of the insured's retained losses for two scenarios which exhaust the $250,000 layer is shown below:

	ILLA	CEDED LOSSES	RETAINED LOSSES
EXAMPLE 1	**500,000**	**250,000**	**250,000**
	300,000	50,000	250,000
	350,000	100,000	250,000
	350,000	100,000	250,000
EXAMPLE 2	**1,000,000**	**250,000**	**750,000**

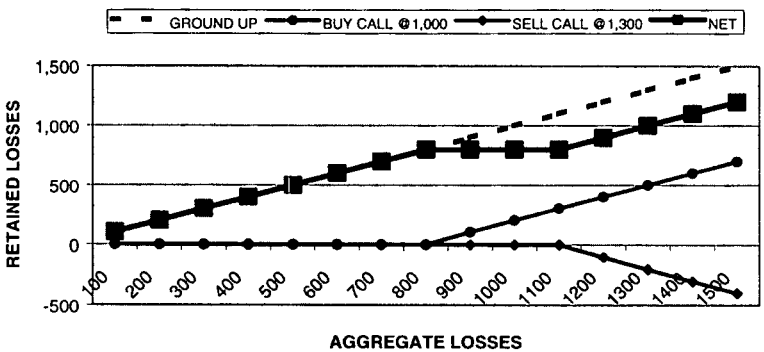
[21] Layers of coverage = (1 + number of reinstatements).

Aggregate Excess of Loss

Aggregate excess of loss contracts provide insurance coverage for an organization's aggregate losses in excess of the reinsurance attachment point that fall within the layer of coverage purchased. Table 4 displays an example of this insurance transactions using two call options:

TABLE 4

$300,000 XS $800,000 AGGREGATE EOL CONTRACT



The dashed line represents the aggregate losses incurred by the insured. The value of the purchased call option, represented by the circle line, is worth nothing to the insured until the aggregate losses exceed the $800,000 exercise price. Once the aggregate losses exceed the $800,000 exercise price, the call option increases a dollar in value for each additional dollar incurred by the insured above the exercise price. When the aggregate losses reach the sold call option exercise price (i.e., $1,100,000 or $300,000 + $800,000), represented by the diamond line, the call sold to the insurer costs the insured a dollar in value for each additional dollar incurred by the insured above the $1,100,000 exercise price.

The insured's retained losses, represented by the square line, equals the value of the aggregate losses incurred by the insured minus the value of the purchased call option plus the value of the sold call option. Using insurance terminology, the insured's retained loss amount equals the aggregate losses incurred by the insured minus the ceded losses to the

reinsurer within the limit. Referring to Table 4, it is easy to see that the insured has no liability for claim payments that fall within the call spread (i.e., $800,000 to $1,100,000 layer).

Conversion Thoughts

There are a number of issues that make the conversion of insurance coverages into real call options difficult:

- Type of policy;
- Incurred but not reported (IBNR); and
- Time value of money.

The type of policy written by the insurance company impacts the quantification of the losses ceded under the insurance contract (i.e., losses exceeding the exercise price of the purchased and sold call options presented above). Under a claims made policy, the date of the claim report is deemed to be the date of the loss event. All claims reported during the year are therefore covered, regardless of when the original event occurred. Under an occurrence policy, the date of the loss event is deemed to be the date of the occurrence, regardless of when the claim was reported. For certain cumulative injury cases such as asbestosis and environmental exposure, it is even difficult to determine the date of loss.

The amount of IBNR also impacts the quantification of the losses ceded under the insurance contract. IBNR represents the actuarial estimate of reserves required to pay the ultimate losses incurred by an organization. IBNR includes the following:

- "Pure" incurred but not reported (IBNR); claims not yet known and not recorded in the loss system
- "Pipeline" IBNR; claims known but not yet recorded in the loss system
- Case development; future development on known, recorded claims
- Reopened claims; future reopened claims which are coded to the year in which the original claim occurred.

Both the policy type and amount of IBNR incurred by an organization make it somewhat difficult to compare insurance transactions directly to call options. Although claims

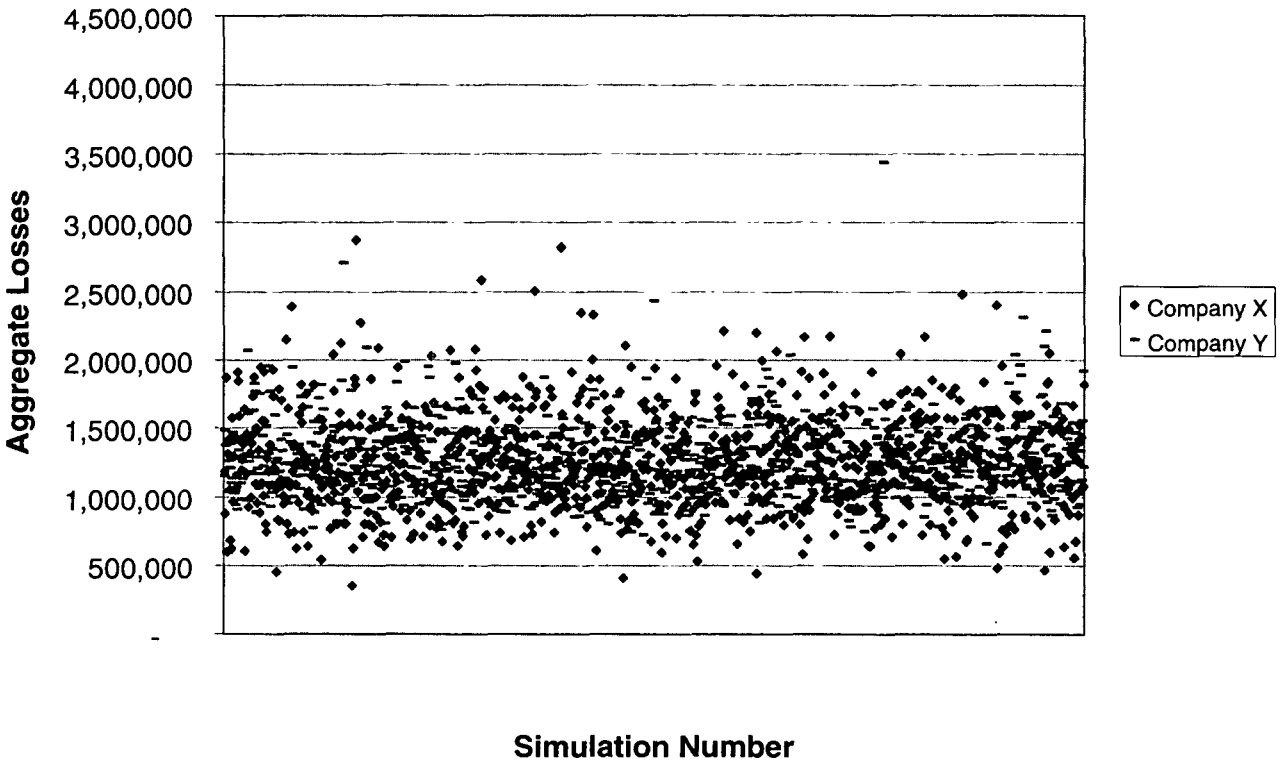
made policies cut off the tail (i.e., eliminate "pure" IBNR) observed under occurrence policies, a significant amount of uncertainty exists for both policy types when estimating case reserves for individual large losses.

Certain claims may take years to determine the final ultimate cost because of litigation, appeals and settlement talks. Insurance losses may take in excess of 10 years to develop to ultimate for certain coverages like workers compensation. This timing delay associated with the final determination of the ultimate cost for an individual large loss or aggregation of losses complicates the determination of the final call value. Unlike a one year Microsoft call option where Microsoft's stock price will be known at expiration, the ultimate cost of an individual large loss/aggregate loss may not be known for a number of years after policy expiration.

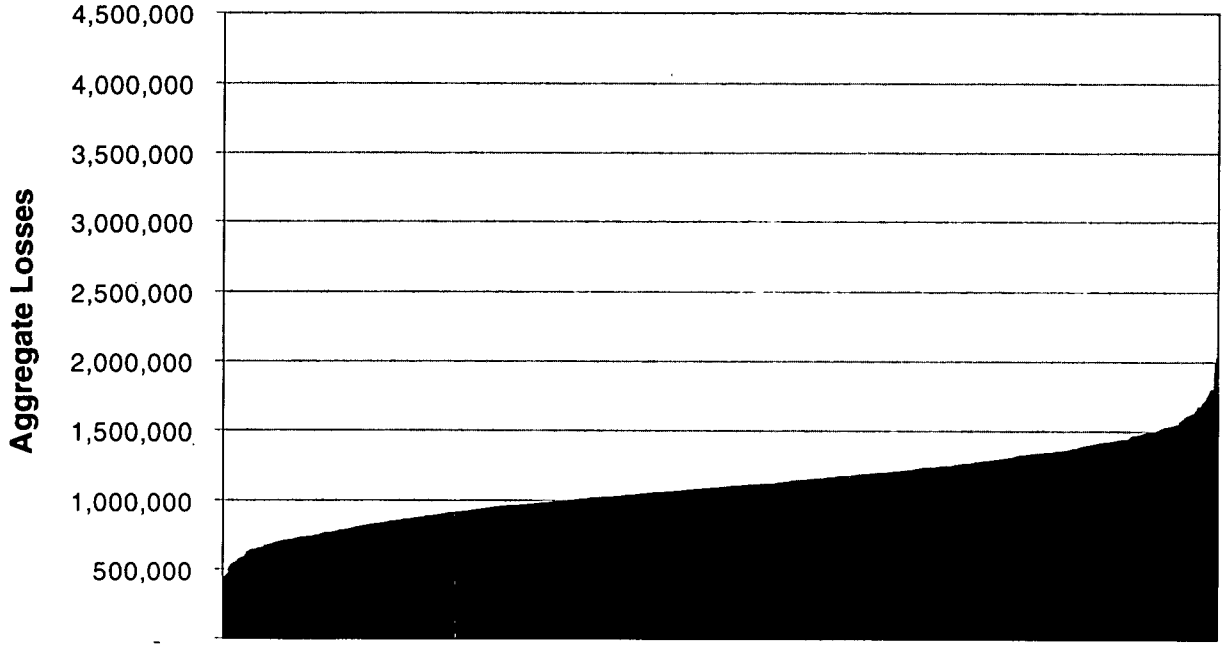
This timing delay introduces additional uncertainty when using call options to define insurance programs. At the same time the value of the call option changes with each revision of the ultimate cost, the time value of money associated with the actual reimbursement of payments from the insurance company changes as well.

Although there are a number of issues that make the conversion of insurance coverages into real call options difficult, we believe the above illustrations will help organizations leverage their investment knowledge to view insurance purchases more like investments. This alternative view, combined with the modeling discussed in the article should help risk managers and their organization develop a stronger understanding of the importance of modeling all aspects of the organization.

COMPANY COMPARISON
TOTAL AGGREGATE LOSSES

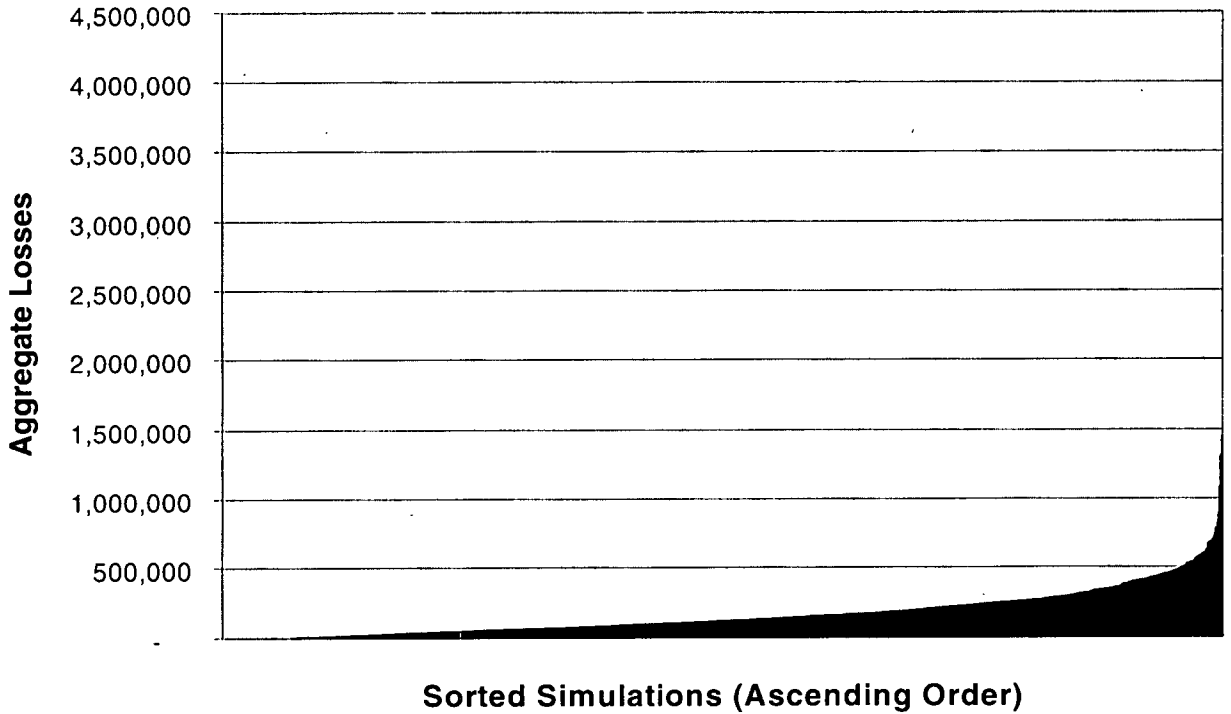


COMPANY X
RETAINED LOSSES (LOSSES < $100,000 SIR)



Non-Exceedence Probabilities									
5.0%	10.0%	25.0%	50.0%	60.0%	70.0%	80.0%	90.0%	95.0%	99.0%
680,063	755,280	921,969	1,092,909	1,156,101	1,229,168	1,323,773	1,433,690	1,526,509	1,736,358

COMPANY X
CEDED LOSSES (LOSSES > $100,000 SIR)



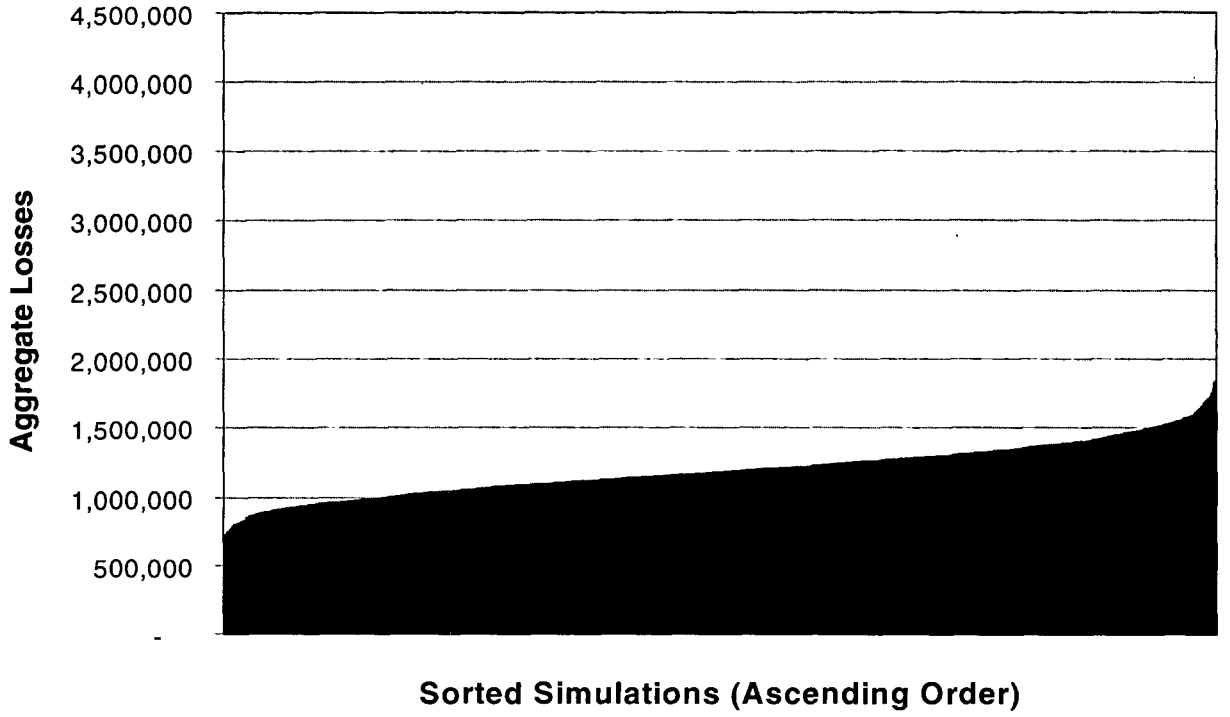
Non-Exceedence Probabilities

5.0%	10.0%	25.0%	50.0%	60.0%	70.0%	80.0%	90.0%	95.0%	99.0%
-	8,599	51,330	122,873	158,164	201,712	258,637	374,790	462,080	691,572

COMPANY Y

RETAINED LOSSES (LOSSES < $100,000 SIR)

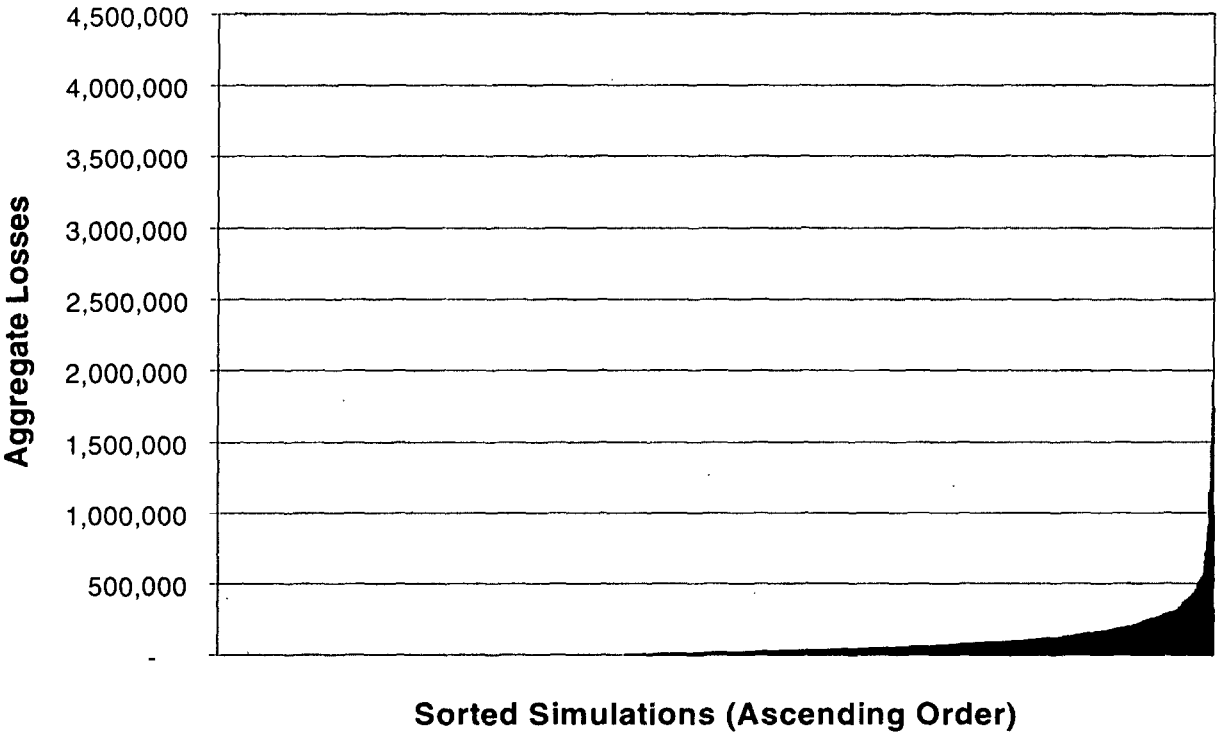
APPENDIX C.4



Non-Exceedence Probabilities

5.0%	10.0%	25.0%	50.0%	60.0%	70.0%	80.0%	90.0%	95.0%	99.0%
904,000	956,584	1,055,868	1,182,431	1,230,505	1,288,411	1,347,494	1,444,002	1,522,699	1,695,219

COMPANY Y
CEDED LOSSES (LOSSES > $100,000 SIR)



Non-Exceedence Probabilities

5.0%	10.0%	25.0%	50.0%	60.0%	70.0%	80.0%	90.0%	95.0%	99.0%
-	-	-	14,071	31,750	55,861	94,518	176,796	285,150	546,209