The Risk Premium Project (RPP)
Phase I and II Report

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Abstract

This report summarizes the authors' review o the actuarial and finance literature on the subject of risk adjustments for discounting liabilities in property-liability insurance. The authors find that the actuarial and financial views of risk priced in the market are converging: systematic, or non-diversifiable, risk still plays a central role in equilibrium pricing, but non-systematic costs arising from market frictions such as taxes and financial risk management also contribute to market valuations. Recent advances in risk assessment and capital allocation techniques are noted. A searchable website with an annotate bibliography of the literature is provided. Several empirical follow-up projects are identified.

Acknowledgement

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1. Introduction

This represents an interim report on the Risk Premium Project (RPP) of the CAS Committee on the Theory of Risk (COTOR). RPP was formed to respond to the committee's request: how should actuarially appropriate risk adjustments be computed when losses and expenses are discounted? Our response consists of three parts, or phases. The first phase is a search of the relevant literature from actuarial and academic sources. The second phase is an analysis of the question posed in light of the current literature. A final phase is intended to provide some useful empirical estimates relating to the analysis presented. COTOR will be offered several possible empirical studies in a subsequent proposal.

The remainder of this introduction provides background to the question posed and outlines our findings. Section II provides details on the literature search. A web-based annotated bibliography commemorates a representative sample of the important recent literature. Section III covers the analysis of the question posed and our theoretical conclusions. The final section poses a selection of possible empirical follow-up work. Appendix A provides a bibliographic summary, while Appendix B covers the implications of some of the important financial concepts for fair-value accounting.

1.1. The CAS Request for Researchers

COTOR solicited researchers to respond to a proposal to study the appropriate procedure(s) to account for risk in discounted loss reserves and premiums, through a synthesis of the actuarial, financial and statistical literature (www.casact,org/research/COTRproj.htm). Proposals were due April 1, 1999 and COTOR selected RPP to conduct the research with a final agreement effective August 13, 1999. A brief summary of the literature was provided by COTOR at www.casact.org/ctor/risk_adj.pdf. The committee specifically cited papers from both the finance and actuarial literature. Work by Fama and French that undermined the empirical validity of the single period, single factor CAPM is typical of the former while Butsic's development of a risk adjustment for liabilities represents the latter. Meetings with COTOR members were held on September 8, 1999 at the University of Pennsylvania and on November 16, 1999 at the CAS meeting in San Francisco. A draft report was presented to COTOR at the Ratemaking Seminar, March 10, 2000 in San Diego. This final Phase I and II report will be presented at the Casualty Loss Reserve Seminar, September 18-19, 2000, in Minnneapolis.

1.2 The Pricing Paradigms

This report takes as its principal focus the economic pricing of a portfolio of insurance contracts. Unless otherwise indicated, both new and outstanding liabilities are considered. We take the view that the apparent tension between the actuarial/statistical(AS) and financial (FIN) views of the value of risk stems primarily from implicit pricing paradigms.

AS takes the view of the individual insurer determining a proper rate to charge a customer for the risks the insurers will assume under an insurance contract. The AS rate will include some margin for expected profit in the form of an add-on to a similar but riskless contract, a *risk load*, or as a discounted liability value different from the risk-free value, a *risk adjustment*. The FIN price is determined within the context of an equilibrium for all financial assets. The AS view is predominately a supply side view while the FIN view is a total supply and demand view, at least in theory. Stated differently, the AS view is bottom-up, while the FIN view is top-down.

There is a great deal of overlap in the technical issues that confront either pricing paradigm. Actuaries like to calculate according to explicit formulae to get actual answers. Expected loss, loss adjustment expenses, investment income and tax liabilities are key determinants of price in both views and have a fair chance of being estimated. Where the two paradigms have diverged historically is in the identification and estimation of additional, mostly theoretical, components of the price. Evaluation of business risk, risk management costs, bankruptcy costs and other not-so-easily isolated costs of doing business are either claimed or assumed to be either present or absent in versions of both paradigms. Table 1 shows a comparison of some key components of modeling the pricing of an insurance contract from the current FIN (Market Equilibrium) and AS (Individual Insurer) pricing paradigms.

General Comparison of Pricing/Ratemaking Models

	Model Feature or Issue Addressed	Market Equilibrium View	Individual Insurer Ratemaking View
	Pricing paradigm	Rule of one price: same coverage = same price	Price offered = insurer's specific costs + desired profit margin; price taken incorporates competition and insurer's marketing strategies
A	Expected costs	Cost to representative insurer providing same level of service	Actual costs to insurer; sometimes adjusted to be competitive
B	Market risk premium	Risk value as if losses were traded in complete, frictionless market; varies by line of business	Usually B+C evaluated together
C	Business risk	Risk value associated with being in the insurance business; may vary by broad product class (personal, commercial); examples: regulation, competitive cycles; mismanagement. (Note: measuring implied betas may be measuring mostly this, instead of B)	Usually B+C evaluated together
D	Risk management cost (includes idiosyncratic risk, which has no price in a frictionless trading economy)	Costs associated with holding capital, with diversification, agency costs and costs associated with raising or accumulating capital.	Included in B+C
	Total risk cost (B+C+D)	Valued separately	Usually B+C evaluated together; sometimes B+C+D
E	Expected default	Based on a common default ratio; retained risk by insured, premium reduced by option price less prospective guaranty fund costs.	Generally ignored due to guaranty funds; implicitly considered in some reinsurance contracts
F	Loss adjustment and underwriting expenses	PV of cost to representative (marginal) insurer providing same level of service	Actual costs; sometimes adjusted to be competitive

Table 1

It is clear from this rudimentary table that in order to make sense of the risk premium question, we must clearly state the context of the question and make explicit any assumptions that are being made. Table 2 shows a comparison of some key components of premium determination for an insurance contract from the current FIN and AS points of view.

Components of Premium

	Component	Market Equilibrium View	Individual Insurer Ratemaking View
A	Expected Loss	Present value (PV) of expected value of loss at risk-free rate	Same; but each insurer will have different estimate
B	Market risk premium	Value as if losses were traded in complete, frictionless market; varies by line of business	Usually B+C evaluated together
C	Business risk premium	Risk associated with being in the insurance business; may vary by broad product class (personal, commercial); examples: regulation, competitive cycles; mismanagement	Usually B+C evaluated together
D	Risk management cost	Costs associated with holding capital, with diversification	Management risk tolerance will affect the price offered
	Total risk cost (B+C+D)	Valued separately	Usually B+C evaluated together; sometimes B+C+D
E.	Expected default	Based on a common default ratio. Insolvency put option deducted from default-free price net of guaranty fund costs	Generally ignored due to guaranty funds; implicitly considered in some reinsurance contracts
F.	Loss adjustment and underwriting expenses	PV of cost to representative insurer providing same level of service	Actual costs; sometimes adjusted to be competitive
G.	Income taxes	PV of cost to representative insurer providing same level of service	Actual costs
H.	Investment income	Included in present values	Sometimes actual costs; other times representative or by present value

Table 2

If we are to discuss the pricing of risk, we must make clear our conception of risk to be priced. The following sections discuss the historical treatments of liability risk.

1.3 Sources of Liability Risk

The predominant source of liability risk for insurers is the difference between the expected loss, expense and taxes included in the collected premium and the actual values when realized. Since the liability components are realized at different times, measured from policy inception, the variability of liability cash flows (patterns) is an additional source of risk. Likewise, discounting those uncertain flows to account for the time value of money introduces interest rate risk into the transaction. These are all sources of risk familiar to actuaries. Business risks, such as bankruptcy costs, and risk management costs for the ability to attract and maintain desired capital levels may be less familiar and certainly have not been included explicitly in the AS models we reviewed. The FIN models include, at least theoretically, all those risks and more, priced according to the way investors perceive their values. In order to begin to reconcile the AS and FIN views of risk pricing, we start with a discussion of liability risk in terms of process and parameter risk, terms prevalent in the actuarial literature and systematic, or market risk, from the finance literature.

1.3.1 Process Risk

Process risk is the uncertainty created by underwriting insurance policies for which the ultimate loss amounts the insurer will be responsible to pay are unknown at the time of origination. The two primary sources of process risk are the uncertainty regarding the

frequency and severity of loss claims. Most papers on this topic in the actuarial literature assume both the idiosyncratic (diversifiable) and systematic (undiversifiable) risk components of the insurance loss cash flows should be priced. Models that fall under this heading include the actuarial premium principles literature, specifically the variance principle and the standard deviation principle (Goovaerts, et. al, 1984). Hybrid actuarial models have been constructed that combine a form of the variance principle with capital market concepts.

Also included in this literature would be the utility theoretic approach to pricing which requires insurers to price risk such that the expected utility of the insurer is unchanged by underwriting a risky insurance policy. Papers in this literature include Borch (1961), Bühlmann (1980), and Gerber and Pafumi (1998).

Finally, recent papers based upon transforms of the loss distributions would fall under this category. For example, Wang's PH transform papers published in *IME* (1995), *ASTIN* (1996), and PCAS (1998).

1.3.2 Parameter Uncertainty

Parameter uncertainty is the risk inherent in pricing insurance loss cash flows due to the inability to accurately estimate parameters of models (or the models themselves) characterizing the stochastic nature of the ultimate loss amounts. The majority of papers reviewed focus on quantifying the increase in the variance of ultimate loss payments due

to the parameter uncertainty and then uses arguments similar to those made in the process risk literature to determine the fair value for the insurance. Papers of this type include Meyers (1991), Meyers and Schenker, (1993), and Kreps (1997).

The finance literature suggests the only adjustments to the liability discount rate should be for risks that can not be diversified. Thus, for example, any correlations present amongst the insurance risks, that are otherwise uncorrelated with aggregate market risks, would not be priced. There are numerous theoretical pricing papers we could cite in this literature including, among many others, Myers and Cohn (1987) and Taylor (1994). A review is provided in Cummins and Phillips (2000). There are authors in the insurance literature who would suggest correlations between an individual insurer and the industry's loss cash flow should also be priced (e.g., Wang 1999), although their arguments would not be consistent with the current thinking in mainstream finance.

The primary work we are interested in this area includes the original work on the Capital Asset Pricing Model (CAPM) and the subsequent literature, which includes:

1. Determinants of beta and variance decomposition work by Campbell (1991) and associated work with co-authors in Campbell and Ammer (1993), Campbell and Mei (1993), and the paper by Cornell (1999).

2. Full information CAPM beta work by Kaplan and Peterson (1998) and related work conducted for the Automobile Insurers Bureau of Massachusetts on full information

betas for the property casualty sector.

3. Failure of the CAPM and identification of non-market priced risks. A short sample of the papers here (there are many others) include Fama and French (1993, 1996, 1997), and Barber and Lyon (1997). A nice review is provided in Cochrane (1999).

4. Arbitrage Pricing Theory (APT) approaches, which identify other market priced risks in additional to the standard CAPM beta (equity risk). Papers here include the original APT paper by Ross (1976) and other papers we currently consider: Connor and Korajczyk (1988) and Cummins and Lee (1998).

5. Parameter Uncertainty in Pricing Systematic Risk. There are a number of papers that investigate the mispricing error due to parameter uncertainty estimating the equity cost of capital using the CAPM and/or multi-factor models. Papers here include the work by Ferson and Locke (1998), MacKinlay and Pastor (1999), Pastor and Stambaugh (1998), and Stambaugh (1999).

1.4 An Arbitrage Free Framework

Papers in this category determine prices by assuming securities and insurance markets are complete and insurance loss cash flows can be replicated using fundamental securities with prices that are assumed to be known. This greatly simplifies the problems associated with using the risk-adjusted discount rate models since the complete markets

assumption allows the discounting of all expected cash flows to be done using the risk-free rate of interest after taking expectations with respect to a risk-neutralized probability measure. This framework provides a broader view of financial pricing than either the CAPM or the APT. There are numerous papers we could cite here including Cummins (1988), Derrig (1989), Myers and Read (1999), Phillips, Cummins, and Allen (1998) and others.

1.5 Pricing in the Presence of Market Imperfections

These papers assume various imperfections exist in the capital and insurance markets that will be taken into account when determining equilibrium discount rates and prices. Imperfections include asymmetric information, agency problems, costly external capital, taxes, etc. Froot (1999) provides a nice discussion of numerous insurance market frictions. Other papers include Brennan and Subrahmanyam (1996), Froot and Stein (1998), Froot, Scharfstein, and Stein (1993), Merton (1997), and Froot and O'Connell (1999). Campbell (2000) summarizes the current status of the asset pricing literature.

The presence of market imperfections, and their associated costs that can be priced in the non-frictionless markets may provide the key in a potential integration of the AS and FIN views of liability risk.

1.6 Summary of Findings

RPP searched the relevant actuarial and academic literature. A total of 248 references from 37 sources were reviewed for the most recent papers on subjects related to valuation of liabilities. A total of 138 papers and books constitute the results of the literature search and review as described in section II. Our references are divided into major thematic categories: CAPM/ASSET PRICING, INSURANCE RISK, GENERAL FINANCE, HISTORY, SURPLUS ALLOCATION, MISCELLANEOUS and a few selected BOOKS on topics of interest. The full set of references by Theme is attached as Appendix A. Annotated references are also available electronically at www.casact.org/cotor/index.htm

The number of conclusions we could discuss after reviewing over two hundred papers covering a variety of topics is too numerous to list here. However, we believe there are five principal theoretical conclusions that have a direct bearing on the research question outlined in the call for proposals. They include:

I. The opinions of financial economists and actuaries regarding the role of systematic vs. non-systematic risks in determining the equilibrium insurance prices are converging. Both see a role for non-systematic risk in pricing.

II. A systematic risk adjustment for the cash flows associated with a line of insurance should be included in the discount rate used to determine the fair value of the

insurance premium. The adjustment to the discount rate will be a function of the cash flow pattern of the liabilities.

III. The returns of financial assets cannot be adequately explained by the CAPM beta. Researchers have shown extensions of the CAPM which include additional factors that significantly enhance the explanatory power of the models. In addition, although research using more sophisticated empirical tests has been published extending the CAPM, similar research focusing on insurance company returns does not currently exist.

IV. A theoretically consistent way to allocate the costs of holding equity capital to individual lines of insurance has been identified. Thus, the costs associated with holding capital can now be charged to individual lines of insurance.

V. The risk of insurer default to the policyholder should be recognized in pricing the risk transfer.

Section III discusses each of these conclusions in more detail below. Our views are based upon the large body of work we reviewed in section II. Research into the issues we identify is still ongoing. In some cases the reasons why some of the relationships exist have not been explained and in other cases empirical tests of the theoretical conclusions have not been conducted. That being said, it is fair to say that much progress has been

made that can be exploited for the insurance pricing problem.

2. Literature Search

The procedure for gathering actuarial and academic literature relating to the discounting of liabilities consisted of several steps. For papers relating to the topic, we systematically searched mainstream actuarial journals, such as the Proceedings of the Casualty Actuarial Society, and academic journals, such as the Journal of Risk and Insurance. Additional sources known to the authors, such as the French publication Quants, were searched for topical articles or summaries. The National Bureau of Economic Research (NBER) and others were also consulted for their series of working papers, anticipating that the later working papers (1998-1999) may not be published in journals at the time of inquiry. Finally, the authors each contributed references they deemed useful to the enterprise. In general, we have restricted ourselves to literature citations in the 1990s to provide up-to-date thinking on the issues. At times, however, papers published prior to 1990 are included for historical purposes. Table 3 shows a complete listing of the sources consulted. A total of 38 potentially relevant sources were identified in this process.

Actuarial and Academic Sources
ASTIN Bulletin
Contemporary Finance Digest
Eastern Finance Association
Economic Journal
European Finance Review
Financial Management
Financial Review
Insurance: Mathematics and Economics
International Conferences on Insurance Solvency and Finance (ICISF)
Journal of Applied Corporate Finance
Journal of Banking and Finance
Journal of Business
Journal of Business Finance & Accounting
Journal of Economic Literature
Journal of Econometrics
Journal of Finance
Journal of Financial and Quantitative Analysis
Journal of Financial Economics
Journal of Financial Research
Journal of Portfolio Management
Management Science
New England Economic Review
North American Actuarial Journal
Proceedings of AFIR
Proceedings of the Casualty Actuarial Society
Quants
Review of Financial Studies
Review of Quantitative Finance and Accounting
Transactions of The Society of Actuaries
Working Papers
Automobile Insurers Bureau of Massachusetts
Forschungsinstitut Fur Mathematik (ETH)
Georgia State University
Harvard University Graduate School of Business Administration
Merrill Lynch
National Bureau of Economic Research
SCOR
Wharton School, University of Pennsylvania

Table 3

2.1 References and Categories

The authors collectively reviewed all references for specific relevance to the assignment and chose 138 references to include in an annotated bibliography. A small number of recent books whose topics or series of articles especially related to our view of the valuation of liabilities, such as Campbell, Lo and MacKinlay, The Econometrics of Financial Markets (1997), were also included. All references were assigned to one of the following thematic categories.

- CAPM / ASSET PRICING: All references that discuss CAPM and alternative asset pricing models.
- INSURANCE RISK: All references that discuss the valuation process for insurance.
- GENERAL FINANCE: All references that discuss valuation issues from the modern financial point of view other than CAPM/ASSET PRICING and INSURANCE RISK.
- HISTORY: A selection of papers bearing on the asset, liability, or insurance premium questions, usually from the 1970-1990 period.
- SURPLUS ALLOCATION: A few papers directly on the capital allocation question.
- MISCELLANEOUS: All other papers.
- BOOKS: A few selected books on topics of interest. By no means a list of what could be selected.

Table 4 shows the count of articles and books recommended by RPP for this report.

Final Reference Selections	
Theme Name	**Number of RPP Items in Each Theme**
Books	14
CAPM/Asset Pricing	33
General Finance	25
History	10
Insurance Risk	47
Misc.	4
Surplus Allocation	5
Total	**138**

Table 4

2.2 Annotations

Each of the references recorded for our literature search has an annotation attached. Generally, the annotation is the abstract when available or a short summary of the results. Books are annotated using material from their preface, introduction or other overviews of the contents. The annotations, like abstracts, are designed to give a flavor of the principal results but without any details. For example, one of the studies of security returns by Fama and French would appear as follows:

Fama, Eugene F. and Kenneth R. French (1996), Multifactor Explanations of Asset Pricing Anomalies, *Journal of Finance*, 51:1, 55-84.

> Previous work shows that average returns on common stocks are related to firm characteristics like size, earnings/price, cash flow/price, book-to-market equity, past sales growth, long-term past return, and short-term past return. Because these patterns in average returns apparently are not explained by the CAPM, they are called anomalies. It is found that, except for the continuation of short-term returns,

the anomalies largely disappear in a 3-factor model. The results are consistent with rational ICAPM or APT asset pricing, but also considered are irrational pricing and data problems as possible explanations.

A complete compilation of the bibliography is attached to this report, without annotations, as Appendix A.

2.3 Website for References

The entire set of RPP references is available at the web site www.casact.org/cotor/index.htm. The references appear as an annotated bibliography, searchable on the web site by author, subject or keyword. Full PDF versions of the bibliography with and without annotations are available on the web site. Additionally, copies of virtually all of the reference papers and the web site itself are available for transfer to the CAS at the direction of COTOR. We feel that a compilation of this kind available to members of CAS will prove valuable beyond the duration of this project because the references tend to cover many more topics than we will summarize in our theoretical conclusions section that follows.

3. Theoretical Conclusions

The number of conclusions we could discuss after reviewing over two hundred papers covering a variety of topics is too numerous to list here. However, we believe there are five principal theoretical conclusions that have a direct bearing on the research question outlined in the call for proposals. They include:

I. The opinions of financial economists and actuaries regarding the role of systematic vs. non-systematic risks in determining the equilibrium insurance prices are converging. Both see a role for non-systematic risk in pricing.

II. A systematic risk adjustment for the cash flows associated with a line of insurance should be included in the discount rate used to determine the fair value of the insurance premium. The adjustment to the discount rate will be a function of the cash flow patterns of the liabilities.

III. The returns of financial assets cannot be adequately explained by the CAPM beta. Researchers have shown extensions of the CAPM which include additional factors that significantly enhance the explanatory power of the models. In addition, although research using more sophisticated empirical tests has been published extending the CAPM, similar research focusing on insurance company returns does not currently exist.

IV. A theoretically consistent way to allocate the costs of holding equity capital to individual lines of insurance has been identified. Thus, the costs associated with holding capital can now be charged to individual lines of insurance.

V. The risk of insurer default to the policyholder should be recognized in pricing the risk transfer.

This section discusses each of these conclusions in more detail below. Before we begin we should state that our views are based upon the large body of work we reviewed in section II and that research into the issues we identify is still ongoing. In some cases the reasons why some of the relationships exist have not been explained and in other cases empirical tests of the theoretical conclusions have not been conducted. That being said, it is fair to say that much progress has been made that can be exploited for the insurance pricing problem.

3.1 The Role of Systematic vs. Unsystematic Risk

Insurance economists often claim actuaries make a basic mistake in their approach to the equilibrium valuation of insurance risks. Economists generally make this claim by appealing to the following logic. First, a fundamental tenet of corporate finance states the appropriate discount rate to value a project will be greater than the risk-free rate of interest only in cases where the expected cash flows from the project contain systematic risk.

Since the cash flows associated with the underwriting of insurance liabilities are triggered by events that are largely uncorrelated with any fundamental economic or market factors, the systematic risk of an insurer's loss cash flows must be near zero. Therefore all discounting should be done at about the risk-free rate of interest. In addition, the amount of non-systematic risk inherent in insurance cash flows is irrelevant since, according to theory, shares of profit-maximizing insurers are held by diversified investors who, operating in frictionless and complete markets, can eliminate this diversifiable risk through their portfolio choices.

Actuaries, on the other hand, have long argued that the uncertainty associated with insurance cash flows is inherently costly for the firm to bear and therefore the appropriate discount rate should be set above the risk-free rate of interest. In essence, the actuarial viewpoint suggest insurers should be treated as if they risk-averse and predicts they will only agree to accept an insurance risk in cases where the discount rate used to value the expected loss cash flows is set below the risk-free rate of interest producing a positive expected risk load for the insurer.

Recent research investigating the risk management practices of profit-maximizing firms suggests the actuarial and economic viewpoints are converging. The reasoning lies in the answers economists have devised to address the following question posed in the literature - why do the managers of corporations expend costly resources to do for shareholders what shareholders could reasonably be assumed to do for themselves? For example, why

would the manager of an insurance company with a large portfolio of equity securities reduce this exposure by engaging in a costly hedging strategy designed to eliminate the equity risk from its portfolio? It seems perfectly reasonable that the insurer's shareholders could easily do this for themselves by either reducing the number of shares they hold in the company or by engaging in the hedging strategy for themselves. Likewise, insurance companies expend costly resources on reinsurance premiums which presumably only reduce the non-systematic risk exposures of the firm. Given that shareholders can eliminate non-systematic risk at no cost through asset allocation and diversification strategies, it is not clear why they would reward managers who agree to pay large premiums to reinsurers.

The answer to the questions posed above is that a number of imperfections exist in financial markets such that it is more costly for the firm to bear risk than it is to pay someone else to bear it.[1] For example, Smith and Stulz (1985) argue that if increases in the probability of bankruptcy or financial distress impose direct costs on the firm, shareholders may be willing to hedge profits in an effort to forgo these costs. The costs of financial distress include both the direct legal and regulatory costs of bankruptcy as well as the indirect costs resulting from deteriorating relationships with key employees, suppliers, or customers. Merton and Perold (1993) suggest the costs of financial distress are particularly relevant for financial institutions because of their illiquid liabilities and their highly credit sensitive customer base.

[1]Cummins, Phillips, and Smith (2000) provides a more a more in-depth discussion of the risk management literature as it relates to the insurance industry than we are able to present here.

The tax-code provides a second set of reasons why risk is costly to bear within the firm. First, increasing volatility in the firm's before-tax net income will increase the firm's expected tax liability since corporate taxes increase at a non-decreasing rate in corporate profits (Smith and Stulz 1985). Second, increases in earnings volatility increases the likelihood firms will be unable to fully take advantage of deductions against current income because income is either too low or negative. In addition, loss deductions are not always fully transferable to offset income in other time periods.

Froot, Scharfstein, and Stein (1993) suggest that a third rationale why bearing risk is costly is due to differential information between managers and potential outside investors. In this case firms may encounter situations in which funds are needed, but outside capital either is not available or is too costly. Thus, bearing risk is costly for the firm since increases in the volatility of the insurer's cash flows increases the likelihood the firm will either be forced to access costly external capital markets or that it will be forced to stop underwriting insurance policies which otherwise would have been profitable.

In each case cited above, firm value will increase as long as the costs associated with the practice of risk management do not exceed the benefits of the risk management program. However, in many cases the costs associated with reinsurance (or risk management more broadly defined) may be prohibitive. The question then becomes - what is the fair value to underwrite an insurance policy given both the loss cash flows the firm expects to pay and

the frictional costs associated with retaining the volatility of the firm's earnings? The answer comes in two parts.

The first part is obvious - all expected cash flows associated with the underwriting of insurance must be accounted for and discounted at a risk-adjusted discount rate which takes into account any systematic risk contained therein. The expected loss costs are relatively easy to measure and to allocate to a particular line of insurance.

The second part is less obvious. The frictional costs associated with bearing risk depend on firm-wide volatility, which is a function of the volatility from each line of insurance and a function of the covariance of each line with the insurer's entire portfolio of risks. Given this mixing of risks, it has not been obvious how to allocate the frictional costs associated with bearing risk back to individual lines of insurance. Froot and Stein (1998) address this question and develop a model in which they suggest that rather than measure and allocate the frictional costs directly, the firm can instead correctly allocate the costs by adjusting the risk-adjusted discount rate by line of insurance. The modified risk-adjusted discount rate for a line of insurance will now include two adjustments : (1) the traditional *market adjustment* (i.e., using the underwriting beta) to reward the firm for bearing systematic market risk and (2) a *company specific line adjustment* which adjusts the discount rate upwards (downward) for lines of insurance that positively (negatively) co-vary with fluctuations in overall firm capital. Adjusting the discount rates in this way will then lead the firm to value the insurance premiums in a way such that the fair value for the

individual firm is determined.

There are a number of important implications of the Froot and Stein model. First, the risk-adjusted discount rate for a line of insurance will vary company by company depending upon the particular operating characteristics on the individual insurer. Second, a line which co-varies very little (or negatively) with the rest of the insurer's portfolio should have a competitive advantage in underwriting this risk. Finally, the line specific risk-adjustment will not only be a function of the correlation with the risks in the firm's other lines of insurance, but is also a function of the capitalization of the firm. Insurers' that are highly capitalized will make smaller adjustments to their line of business discount rates since the frictional costs of bearing risk will be lower. In the limit, a firm that faces no frictional costs of risk, or a firm with unlimited amounts of capital (or unlimited access to the market for capital), will make no adjustments to their line-specific discount rates other than an adjustment for systematic market risk.

3.2 Systematic Risk and the Role of Duration

Recent research by Campbell and Mei (1993) suggests projects with long duration contain systematic risk even if there is no correlation between the cash flows of the project and market returns. In addition, one does not have to assume that imperfections in the financial markets exist which make it costly for firms to bear both systematic and non-systematic risk as was discussed in the previous section. Thus, under the theory discussed by Campbell and Mei, a long-tailed line of insurance for which the cash flows

are uncorrelated with economic factors may still need to be discounted at a rate set below the risk-free rate of interest to produce a positive risk load.

The reasoning for the Campbell and Mei result is straight forward when we provide the answer to the question the author's considered in their work - where does systematic risk come from? Campbell and Mei's answer suggests the CAPM beta for a firm (or a line of insurance), β_m, can be decomposed into three components:

$$\beta_{i,m} = \beta_{cfi,m} + \beta_{r,m} + \beta_{ei,m}.$$

$\beta_{cfi,m}$ is the portion of the CAPM beta which arises from common innovation between the firm's cash flows and innovations in market returns. This is the component of beta that is referenced most often in the discussion of insurance liability betas and the one most researchers are not surprised to learn empirical studies have had difficulty finding to be significantly different than zero. However, the total beta also depends upon two other factors: (1) an economy-wide beta, $\beta_{r,m}$, that results from correlated innovations in future realizations of the short-term real-rate of interest and future expected excess market returns; and (2) a company specific beta, $\beta_{ei,m}$, that results from innovations in the future expected excess returns for the company's stock and future expected excess market returns. Campbell and Mei use a vector auto-regressive model to estimate the relative importance of each component of systematic risk using a data set of equity returns on companies representing a broad cross-section of industries over the time period 1952 -

1987. The results they report are striking as the absolute value of the excess-return beta, $\beta_{ei,m}$, is always larger in magnitude than the absolute value of the cash flow beta, $\beta_{cfi,m}$ regardless of the time period they look at or the industry. The implication of this result is that the correlation between a company's cash flows and market returns is not the primary determinant of the firm's equity beta.

The Campbell and Mei analysis is relevant for a discussion of insurance pricing because it suggests long duration lines of insurance may contain high systematic risk even when the loss cash flows are uncorrelated with economic factors. The linkage between duration and systematic risk arises because the value of long duration projects will be more sensitive to changes in future excess returns since the discount rate used to value the project's cash flows is linked to excess market returns. Cornell (1999) conducts a simple yet elegant test to demonstrate this linkage by estimating the overall beta for two assets having different durations but for which the cash flow component, $\beta_{cfi,m}$, is known to be zero. In his test he calculates the overall beta for a portfolio of intermediate-term Treasury securities and the beta for a portfolio of long-term Treasury bonds. The cash flow component of both betas is zero by definition since the cash flows, and the timing of those cash flows, are fixed and known with certainty. The average maturity of the intermediate-term and long-term portfolios in his data sets is five and twenty years, respectively. Consistent with the Campbell and Mei hypothesis, Cornell reports the average beta for the intermediate-term portfolio over the years 1994 -1997 is 0.14 while the average beta for the long-term portfolio over the same sample period is 0.42 and the difference between

them is statistically significant. In addition, the average betas for both asset classes are significantly different than zero over the entire time period 1960 - 1998.

3.3 Multifactor Models

The Capital Asset Pricing Model predicts cross-sectional differences across the average returns on different asset classes can be fully explained by differences in their market portfolio betas. Assets with high betas will have high average returns as risk-averse investors will demand additional compensation to bear the systematic risk of the asset, which can not be eliminated by holding a diversified portfolio. The early empirical tests of the CAPM supported the predictions of the model and the model was widely hailed by finance academics as a theoretical success. In addition, the model has gained widespread acceptance amongst finance practitioners and is one of the standard methodologies used to determine the cost of capital for capital budgeting purposes.

This early enthusiasm for the CAPM has proved premature, however, as recent research documents a number of empirical anomalies which can not be reconciled within the assumptions that underlie the theory. For example research has shown that investments in small-cap stocks appear to earn average returns *higher* than would otherwise be predicted by the CAPM even after controlling for beta. Other research suggests assets with high book-to-market equity ratios (value stocks) have *higher* average returns after accounting for market beta (Fama and French 1992). Although other factors have been studied (including leverage, dividend yield, earnings/price ratio, etc.) the dominant

multifactor model to date is the three factor model presented by Fama and French. This model suggests that investors earn a premium for bearing market risk, risks associated with small-cap stocks, and the risks associated with high book-to-market stocks (see Cochrane 1999 for a review). Current research is underway to understand the real, aggregate, nondiversifiable risk inherent in holding in small-cap stocks and value stocks. The answer is yet to come.

In addition to the factors discussed above, numerous authors have investigated mutlifactor models based upon Arbitrage Pricing Theory (APT) which suggests average returns on individual stocks will be driven by various (unspecified) macroeconomic factors. Factors which have been discussed in the literature include labor income, industrial production, term structure variables, expected inflation, etc. Although easier to motivate from a theoretical perspective, most researchers have concluded models which include macroeconomic factors do not perform as well as the Fama and French three factor model discussed above (Cochrane 1999).

Although a tremendous amount of research has been published which investigates sources of priced nondiversifiable risk, very little work has been conducted investigating the sources of priced risk on insurer stocks. The primary exception to this conclusion is Lee and Cummins (1998) who estimate an APT multifactor model and show it outperforms the traditional CAPM model when applied to the property-casualty insurance business. Unfortunately the authors did not investigate any Fama and French style of multifactor

models, so the question of how well that model would explain insurer returns is not clear.

In addition to the work investigating multifactor models, there now exist new econometric methodologies that could be applied to study the return characteristics of insurer stocks. One promising area of research is the full information beta methodology discussed by Kaplan and Petersen (1998). In their paper, the authors use an instrumental variables approach to estimate industry specific costs-of-capital using information contained in the betas of both pure-play firms (firms producing goods in only one industry) and conglomerate firms. The authors show the standard errors associated with their full-information betas estimates are substantially lower than the same estimates obtained using more traditional estimation methodologies. Their methodology could easily be extended to investigate line specific costs-of-capital for property-casualty insurers. A proposal to conduct this analysis is presented below.

3.4 Surplus Allocation

The question of how to allocate the costs associated with holding equity capital to individual lines of insurance in a multiple-line insurance company has been a hotly debated topic for many years in both the financial and actuarial literature. The objective in capital allocation is to assess a cost of capital charge to each line based upon the amount of capital assigned to the line. The allocation of capital is motivated by the observation that holding capital in a financial institution is costly due to taxation and the free-cash flow agency costs associated with holding large pools of capital. The fundamental difficulty in

capital allocation is that equity capital is held in a common pool and if one or more lines incur deficits of losses over premiums, the lines in difficulty can draw upon the full amount of the firm's equity capital, including earnings from the "solvent" lines. In addition, lines of insurance which are not perfectly correlated provide internal diversification benefits that allow the multi-line insurers to write business at lower capital levels than could a stand-alone firm operating at the same level of default risk. Given the sharing of resources and the benefits of diversification, how to allocate the cost of equity capital to each line has been a thorny theoretical problem.

Nearly all the papers that have approached the problem of capital allocation have done so by assuming that the insurer's equity capital is allocated among lines of business in proportion to each line's share of the insurer's liabilities (e.g. Derrig 1989; and D'Arcy and Garven 1990). There is little theoretical basis for this assumption since the approach ignores the fact that the risk characteristics of each line of insurance, which provide the demand for the firm to hold equity capital in the first place, differ greatly across lines.

Recent theoretical work by Myers and Read (1999), and extended by Butsic (1999), has addressed the question of capital allocation using option pricing and microeconomics. The authors have developed a model that is both theoretically sound and intuitively appealing. Using an options theory approach, Myers and Read show the amount of capital that should be allocated to each line of insurance will be a function of (1) the individual line's volatility parameter, (2) the correlation between the line's losses and the

insurer's entire portfolio of loss, and (3) the correlation between the line's losses and the asset portfolio of the firm. Butsic (1999) simplifies the Myers and Read result and shows that if the covariance between the insurer's asset and liability portfolio can be assumed to be zero, the resulting capital allocation to an individual line of insurance will be a linear function of the line's *loss beta* defined as $\beta_i = \rho_{iL}\frac{\sigma_i}{\sigma_L}$ where ρ_{iL} is the correlation between the line I's losses and the insurer's entire loss portfolio, σ_i is the individual line's volatility parameter, and σ_L is the volatility parameter for the insurer's entire loss portfolio.

The implications of the models developed by Myers and Read and Butsic are appealing for at least two reasons. First, since the weighted sum of line loss betas will sum to one, allocation rules based upon the Myers-Read methodology will uniquely allocate all the equity capital of the insurer to each line of insurance. A similar methodology proposed by Merton and Perold (1993) and Perold (1999) that could be applied to the case of insurance does not uniquely allocate all the equity capital of the insurer back to the individual lines. Therefore, it does not completely resolve the problem of how to allocate the costs associated with equity capital. Second, the result has the intuitively appealing implication that lines of insurance with higher levels of stand-alone risk, σ_i, will be assessed higher capital charges and lines of insurance which co-vary negatively with the insurer's entire loss portfolio will be assessed lower capital charges due to the diversification benefit they provide the insurer.

4. Proposals for Phase III

Given the theoretical conclusions explored in section III above, there are some clearly defined and feasible empirical studies that would expand our ability to solve valuation problems in property-liability insurance. Four areas have been identified as appropriate follow-ups. They are:

(1) Full Information Equity Betas Including By Line Estimates

(2) Surplus Allocation Estimates for a Representative Insurer

(3) Risk Load and Line Pricing Estimates via Phillips, Cummins and Allen Model

(4) Multifactor Asset Pricing Models witn Insurance Related Variables

These areas were chosen because they use methods that have recently been developed and are computationally feasible. They take advantage of the body of research that points toward multifactor asset pricing models and improved estimation techniques to provide new estimates of the systematic or non-diversifiable risk charges for insurance. Market pricing of frictions will continue to be estimated as overall risk charges in excess of the systematic charge.

4.1 Project (1): Full Information by Line Equity Betas

Project (1) intends to estimate full information equity betas, with autocorrelation adjustments, for a typical property-liability insurer in the manner of Kaplan and Peterson (1997). Additionally, the same technique will be used to estimate component equity betas

by lines, or groups of lines, by decomposing the "sales" variables into line components. Component ROE would be explored if Project (2), Allocation of Surplus, is also pursued. Sensitivity to time periods and company types would be tested. The database used for estimation would be the CRSP database (Ibbotson) supplemented by annual statement data (Georgia State). An efficient project would be done in collaboration with Ibbotson Associates.

4.2 Project (2): Allocation of Surplus to Line of Insurance

Project (2) intends to use the Myers-Read framework to provide capital allocation estimations for lines, or groups of lines, of property-liability insurers. Sensitivity to time periods and company types would be tested. Component ROE would be explored if Project (1) is also pursued. The asset and liability covariations would also have to be estimated for the representative companies and lines. Several notions of a "representative" insurer will be tested. The database used would be an expanded version of the database underlying the Phillips, Cummins and Allen (1998) paper (at least ten years of data) located at Georgia State in order to estimate the values of the insolvency put as a percentage of premium for the appropriate sample.

4.3 Project (3): Risk Load and Line Pricing via Phillips, Cummins and Allen Model

Project (3) intends to use the estimation technique developed in Phillips, Cummins and Allen (1998) to estimate the components of price embedded in historical data. The value of the insolvency put and the residual risk and tax premium (economic intercept) will be

estimated, controlling for growth and group membership. These estimations would provide for total risk premia from which the otherwise estimated systematic risk premia could be removed to obtain the value of non-systematic risks that command a positive price. The database used would be an expanded version of the database underlying the Phillips, Cummins and Allen paper (at least ten years of data) located at Georgia State in order to estimate the values of the insolvency put as a percentage of premium for the appropriate sample.

4.4 Project (4): Multifactor Asset Pricing Models with Insurance Related Variables

Project (4) intends to explore the estimation of the appropriate equity beta for a property-liability firm as the result of a multifactor modeling approach. Several of the current multifactor equity models (such as Fama-French and Campbell-Mei/ Cornell) would be studied for their appropriateness for property-liability insurers. Alternative insurance related variables (such as catastrophes and interest rate risk) would also be explored. Projects (1) and (4) would provide separate estimations of essentially the same value.

APPENDIX A

Risk Premium Project Bibliography

Themes

- Books
- CAPM/Asset Pricing
- General Finance
- History
- Insurance Risk
- Miscellaneous
- Surplus Allocation

Theme Name:	*Books*	
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Bradford, David F.	***RPP-132*** ***Book - The Economics of Property-Casualty*** The Economics of Property-Casualty Insurance	***1998***
Cummins, J. David **Derrig, Richard A.**	***RPP-241*** ***Book - Financial Models of Insurance Solvency*** Financial Models of Insurance Solvency	***1989***
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APPENDIX B

IMPLICATIONS OF ACCOUNTING

APPENDIX B

IMPLICATIONS FOR FAIR VALUE ACCOUNTING

The developments in financial economics that we have discussed in this report have had a major influence on the accounting profession which has proposed[1] that balance sheet items be recorded at fair value. Here, fair value is meant to represent an actual market value if the item has one and a theoretical market value if the item is not actively traded. In this appendix, we present a brief overview of some of the important finance concepts and their fair-value accounting implications for property-liability insurance.[2] In our discussion we emphasize several of the current controversial fair-value issues for liability valuation, such as treatment of default risk and value additivity of risk loads.

B.1. The Market-Value Balance Sheet

The accounting implications of modern finance can be illustrated by adopting an idealized balance sheet (as shown by Myers and Cohn, 1987) that displays market values. We assume that the insurance market is efficient to the extent that the insurer and the policyholder have the same knowledge about losses and market conditions. A firm is created to sell a single non-renewable policy with a limited coverage period. Assume that the owners have contributed a surplus

[1]The U. S. proposal is the Financial Accounting Standards Board, Preliminary Views document titled "Reporting Financial Instruments and Certain Related Assets and Liabilities at Fair Value", dated December 14, 1999. Also, a parallel international proposal is the International Accounting Standards Committee, Insurance Issues Paper, released in November 1999.

[2] The concept of fair value of life insurance liabilities has been discussed by interested academic and industry researchers in the mid 1990s. See Vanderhoof and Altman (1995) and Babbel (1995).

value S, that prospective insured claim liabilities have a market value L and that prospective income taxes have a market value T. There are no intangible assets (the effect of this item is discussed below). Both L and T, being market values, include a load for risk.

In the situation where the insurer is *certain to pay* the claim and tax liability, the fair premium P equals L + T. At the time the policy is sold we have the following balance sheet:

Table 1: Balance Sheet, Guaranteed Claim Liability Payment

Assets		Liabilities	
Investments	P + S	Claims	L
		Income Taxes	T
		Equity	S

These balance sheet items reflect market or fair values, as if the liabilities could be actively traded in an efficient market. Because the premium is a fair value, the market value of the firm with or without the insurance transaction remains S. Note that current fair value proposals do not contemplate the prospective tax liability T.

B.2. The Default Option

In the more typical situation, there is a possibility of default because the contractual obligations may exceed assets and the owners are protected by *limited liability* (i.e., they are not legally required to contribute additional capital). The balance sheet can be modified to recognize the market value of the insurer's lower expected liability payoff.

This value is less than L by the value of the firm-specific expected default amount D, which is called the *default put option* in finance. In a market *with no guaranty fund*, the fair premium now will equal the original full-liability premium P, minus D, the default value.

Table 2: Balance Sheet, with Liabilities and Premiums Adjusted for Default

Assets		Liabilities	
Investments	P – D + S	Claims	L – D
		Income Taxes	T
		Equity	S

The major accounting issue presented when there is a measurable default value is how to treat L, the original claim liability without respect to default. One cannot simply ignore default in measuring the liabilities. If we define the claim liability to be L, then equity must drop to S – D so that total liabilities balance to assets. However, equity must equal S, since the fair premium has been lowered to reflect the expected default.

There are several alternatives to address this issue. One is to show the claim liability as a reduced amount L – D, as in Table 2. Another alternative separates the default from the contractual obligation L:

Table 3: Balance Sheet, with Liabilities and Premiums Adjusted for Default Default Shown as a Separate Liability

Assets		Liabilities	
Investments	P – D + S	Contractual Claims	L
		Expected Default	– D
		Income Taxes	T
		Equity	S

A third alternative shows the default value as an intangible asset and keeps the original claim liability L.

Table 4: Balance Sheet, with Liabilities and Premiums Adjusted for Default Default Shown as an Intangible Asset

Assets		Liabilities	
Investments	P – D + S	Contractual Claims	L
Expected Default	D	Income Taxes	T
		Equity	S

All three alternatives maintain the integrity of the balance sheet and give economically valid measures for the components. However, the second and third have the added benefits of displaying the original contractual obligation as well as the default value. This information is valuable to regulators, investors and policyholders.

B.2.1. Default Option under a Guaranty Fund

Under a guaranty fund system, an additional liability Dg is created, which equals the insurer's prospective share of other companies' aggregate expected default. Under a full guaranty fund system, where policyholders' claims are completely paid, the average insurer's guaranty fund liability Dg will equal its expected default D. This occurs because the sum of all the individual Dg values will equal

the expected total default of the industry. The total expected default in turn must equal the sum of all the individual D values.

The fair premium now will be equal to the original full-liability premium P, since the claim liability is fully guaranteed. The policyholder will not care about the size of the insurer's default, since the claim benefit is guaranteed. The claim liability to the insurer is now the contractual obligation minus the value of the firm-specific default D. There is an added liability equal to the expected cost of the future guaranty fund assessments Dg. Thus, we get the following balance sheet reflecting the additional transactions created by the presence of default in the insurance system:

Table 5: Balance Sheet, with Liabilities and Premiums Adjusted for Default Full Guaranty Fund

Assets		Liabilities	
Investments	P + S	Claims	L - D
		Guaranty Fund Liability	Dg
		Income Taxes	T
		Equity	S + D - Dg

Notice that the owners' equity has changed by the difference between the specific default D and the share Dg of other insurers' pooled defaults. This illustrates a well-known criticism of U.S. guaranty funds (see Cummins, 1988). These funds are not risk-based, so Dg will stay constant as D increases. This asymmetry creates incentives for insurers to increase risk, because doing so increases the default value and therefore, owners' equity.

An alternative balance sheet display (similar to Table 4) recognizes the default put option, net of the value of the expected guaranty fund assessments, as an intangible asset Dn = D - Dg. This asset supplements the higher or lower fair premium P (Myers and Read, 1999):

Table 6: Balance Sheet, with Liabilities and Premiums Adjusted for Default Full Guaranty Fund; Default Shown as an Intangible Asset

Assets		Liabilities	
Investments	P + S	Contractual Claims	L
Net Default	Dn	Income Taxes	T
		Equity	S + Dn

Notice that this display preserves the original no-default general obligations (L and T) as if there were no default risk. A further refinement would disclose the separate components D and Dg within the fair premium P. For most insurers the net default value would not be materially different from zero, and probably could be ignored in practice. But for insurers with default significantly different from the industry average Dg, the underlying over (under) capitalization carries a significant positive (negative) capital cost.

B.2.2. Franchise Value and the Default Option

The above single-policy model ignores (non-default related) intangible assets that can represent significant value for an ongoing firm. These intangible assets are often called *franchise value*. They arise from economic rents, which an insurer is expected to attain due to its licenses, distribution network, expertise, brand name and so forth (see Babbel, 1999). The franchise value equals the

value of future earnings and includes the present value of future business, both renewals and new policies.

We extend the above single-policy model to include the value of future business (the franchise value), denoted by F. Here, the fully guaranteed fair premium remains at P = L + T, since the contractual obligations are the same. However, the owners' equity may be different since, as an ongoing entity, capital contributions or withdrawals may have occurred in the past. We denote the owners' equity, before including franchise value, as Sf. This value represents the breakup (liquidation) value of the firm, where the assets and liabilities are transferred to third parties at market values. With no guaranty fund and treating the default value as an intangible asset, the market value of the firm is Sf +F. We get the following balance sheet:

Table 7: Balance Sheet, with Liabilities and Premiums Adjusted for Default
Ongoing Firm
Default Shown as an Intangible Asset

Assets		Liabilities	
Investments	P – D + Sf	Contractual Claims	L
Default	D	Income Taxes	T
Franchise Value	F	Equity	Sf + F

If the franchise value is excluded from the accounting treatment of the balance sheet, there are some undesirable consequences. Suppose that the ongoing firm increases the risk of its assets after issuing the policy at premium P. The default value will increase to D' > D. However, this action will simultaneously reduce the

franchise value to F' < F. The franchise value drops because future policyholders are less willing to insure with this firm than before it became riskier. Therefore, the owners' equity will decline to a value less than S + F, if the franchise value drops more than the default value increases.

In contrast, suppose that the single-policy firm increases the risk of its assets after issuing the policy. Since there is no future business and thus no franchise value, the owners' equity will increase by an amount D' – D. Thus, income will also increase by D' – D. This increase in the firm's economic income arises from a simultaneous reduction in the economic income of the policyholder, since the expected claim payment is lower.

Suppose that the firm is ongoing, but the franchise value is not recorded on the balance sheet while the default value is included. Then the balance sheet appears identical to Table 4 (with Sf replacing S), which represents the single-policy firm. An increase in asset risk will consequently boost the book equity and the reported earnings. In this case, an insurer can increase its accounting earnings by becoming financially weaker. This result may not suit the public interest for an industry built on the promise to completely pay its obligations to policyholders.

It may be impractical to include franchise value on an accounting statement due to the difficult nature of measuring the underlying intangible assets. If franchise

value is excluded from the balance sheet there are alternatives that somewhat preserve the economic income measurement.

The first alternative is to book the fully guaranteed claim liability value, ignoring the default value. This is a simple alternative, but it provides no direct insolvency information to financial statement readers. This shortcoming could be overcome by disclosing the default value as a footnote.

The second alternative is to create an artificial franchise value as a fixed percentage of assets or liabilities and use the Table 7 presentation. When the default value changes, the difference is exactly offset by a reduced franchise value, with no income effect. The major disadvantage with this approach is that the equity value now includes the artificial franchise value and may not adequately represent the true market equity.

B.3. Accounting for the Risk Load

Since the typical claims liability is not actively traded in a competitive market, to determine the fair value L we employ financial pricing methods. These techniques use the estimated cash flows of the liability to derive a proxy for a market value. The result is a present value that recognizes both the timing of the cash flows and the risk. The risk load is defined as the difference between the liability fair value and the present value of the cash flows assuming no risk. In the following discussion we assume that the insurer has no default risk.

We distinguish two perspectives for recognizing the risk load as it affects P, L, and S. The first, the *composite* view, is a strict market value accounting convention. In this perspective, the nominal value of the expected liabilities, including taxes, is discounted at the risk-adjusted rate that yields P. Since P is loaded for risk and appears as an asset, L and T must be suitably discounted for risk in order to preserve the market value of equity S:

Table 8: Balance Sheet, Composite View

Assets		Liabilities	
Investments	P + S	Claims, including Taxes	L + T
		Equity	S

Here, the risk load is indirectly taken into earnings and (accounting) equity S as the risk is resolved over time.

The second perspective, the *separation* view, adopts the convention of posting the nominal value of the liability, discounted at the risk free rate to recognize the time value of money. Under this view (Babbel, 1999), nominal values underlying L and T are discounted to Lf and Tf using an expected spot yield curve matching the expected liability and tax flows. This exposes a risk load R satisfying L = Lf + R. We assume that the risk load for the tax liability is immaterial for accounting purposes. This perspective yields a balance sheet:

Table 9: Balance Sheet, Separation View

Assets		Liabilities	
Investments	P + S	Claims	Lf
		Risk Load	R
		Income Taxes	T
		Equity	S

Ideally, both perspectives preserve the market value of the firm given fair premium pricing of liabilities and taxes. In other words, either view will give the same owners' equity. Since income under fair value accounting equals the change in equity, income will also be equal. Both methods require periodic fair value updating to determine the residual S. It should be noted that in either view, the economic value of equity S is determined using an implicit fair value premium whether or not that premium has been charged to the policyholder.

Premiums charged above (below) the fair value will increase (decease) the value of equity by changing the book equity, the franchise value or both. A balance sheet that contains Lf+T, but does not separately recognize the risk premium, implicitly takes the risk premium into a book equity value of S+R.

B.4. Process Risk and Value Additivity

Much of the early groundbreaking development in modern finance (in particular, the CAPM) is based on efficient markets concepts. Under these idealized conditions, diversifiable risk (also called process risk) commands no price in the marketplace. However, newer work (Stultz, 1999) shows that process risk does in fact command a price. This occurs because managers incur costs to reduce

process risk, and these are passed along to policyholders. As discussed below, the cost associated with process risk does not necessarily become a part of the risk load.

Three major methods for managing insurance process risk are reinsurance, maintaining adequate capital and product diversification.

Reinsurance is costly compared to the self-insurance alternative, due to underwriting and marketing expenses. Also, reinsurers will assume that the ceding insurer is adversely selecting against it and charge an additional premium.

Holding a large capital amount limits the risk of insolvency from diversifiable losses. But capital is costly due to double taxation. The insurer pays taxes on investment income from the capital funds provided by the investor. These taxes would not be paid if the investor purchased the same assets directly.

Product diversification creates additional costs as line managers act in their territorial interests rather than the corporate interest. Also, additional overhead costs are needed to manage a diverse multi-line operation.

Each of these costs appears on the income statement in a category of expense (or revenue reduction) that does not include a risk load per se. Reinsurance

costs will appear as a reduction in premium (net of ceded losses). Capital costs will appear as income tax expense. Product diversification costs will appear as overhead expense.

Most of the process risk facing an insurer has already been eliminated by the above risk management measures. In particular, product diversification reduces the firm's total risk enormously, compared to the sum of the stand-alone risk at the individual policy level.

We expand the previous fair premium definition to include expenses, which are split into the costs of risk management (ER) and all other expenses (EO). We also split the income tax cost to show the double taxation cost TC and all other tax costs (TO). To simplify, we also assume that the default value is zero. Thus,

$$P = Lf + R + ER + EO + TC + TO.$$

The risk load R includes any residual process risk (not captured in ER) valued in the market. For example, catastrophe losses are diversifiable, but still command a large risk load (Froot & O'Connell, 1999).

B.4.1. Allocation of Costs Due to Joint Risk

Since P represents a market price, we would expect that the components satisfy value additivity. For example, the sum of risk management expenses ER for all of

the product lines should equal the total for the firm. In fact, it does in conventional accounting statements. However, it is not as clear that the risk load R and the tax cost TC should satisfy value additivity, since they are a function of diversifiable process risk.

Diversifiable risk is non-linear when combining risks, since, by definition, the standard deviation of two diversifiable risks is less than the sum of the individual standard deviations. Thus costs associated with process risk can be non-linear as well. For example, if two firms with respective expected defaults D_1 and D_2 are combined, the joint default D is less than $D_1 + D_2$ if process risk is present.

How does the market allocate joint costs? Clearly, joint costs such as overhead expense are allocated to product line because prices do not include the firm's entire amount of overhead expense for each line. If prices are determined in a competitive market, the *one-price rule* (the same product fetches the same price) forces an efficient allocation of joint costs. Firms allocating too large a share of joint costs to a particular line will not be able to recover those costs in the premium.

Here we examine how joint costs are partitioned in the setting of competitive prices. An example is above tax cost of holding capital. The general technique is adapted from Butsic (1999) and Myers and Read (1999):

1. Set an objective function that incorporates the cost to be allocated. For capital allocation, the total firm default D is a function of the total capital and some risk parameters Q, or
   D = f(S, Q). The insurer's total capital S determines the tax cost T such that T = t x S, where t is the per-unit tax cost.

2. Determine a variable that remains constant as the product mix changes under the assumption of a competitive market. It should be a function of the cost being allocated. For capital allocation, the default value per unit of liability, or D/L, would remain constant. This follows from the assumption that, in equilibrium, prices are homogeneous.

3. Relate the variable to be allocated as a constant times a non-allocated variable. For example, the capital for product i can be expressed as a factor s_i times L_i. Here we denote product i by subscript i.

4. Vary the product mix by an infinitesimal change in product i, measuring the corresponding change in the objective function. For capital allocation, we take the partial derivative of D with respect to L_i.

5. Set the result of step 4 equal to the variable in step 2 and solve for the product-specific constant in step 3. For capital allocation, we solve for each capital factor s_i.

The above procedure guarantees that the sum of the product allocations equals the total cost. The approach is general. For example, the method can also be used to allocate reinsurance costs for an aggregate treaty to the component lines of business. Thus, risk loads as well as the various costs of risk management all obey value additivity with respect to a fair value accounting standard. This occurs even though the underlying variance or standard deviation of loss is not value additive.

B.5. Summary

Most of the difficult (and interesting) issues in fair-value accounting for insurance derive from the treatment of risk, particularly in valuation of liabilities. Because insurance liabilities are not actively traded, it is necessary to apply financial economic principles to determine values as if liabilities were traded in a competitive market.

We have explained how default risk alters the components of an insurer's economic balance sheet and have shown some alternative ways to present the market values of assets and liabilities. Much of the controversy regarding the fair value treatment of default exists because the proposed accounting measures exclude important (but difficult to measure) intangible assets or liabilities. These include franchise value, prospective income tax costs and prospective guaranty fund assessments.

Also, we have briefly discussed how risk loads can be presented in fair value accounting. In the composite view, the risk load and prospective tax liability are directly built into the claim liability value. The separation view discloses each of these components. Either view will give the same owners' equity and income.

Finally, we have described how the cost of an insurer's process risk becomes transformed into either operational expense, reduced revenue or risk load. Under a competitive market framework, which is the theoretical basis for fair value, the costs of process risk are additive when considering a firm's product lines (or other subdivisions). We have outlined a general method for allocating these costs in a way that mimics the competitive market mechanism.