DISCUSSION BY: ALFRED O. WELLER

OF: "EVALUATION OF THE FINANCIAL CONDITION OF INSURANCE COMPANIES - A THEORETICAL APPROACH" BY MARY LOU O'NEIL

REVIEWER: ALFRED O. WELLER

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DISCUSSION BY

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"EVALUATION OF THE FINANCIAL CONDITION OF INSURANCE COMPANIES - A THEORETICAL APPROACH"
BY MARY LOU O'NEIL

Mary Lou O'Neil has presented a metatheoretical discussion paper. In contrast to analyzing solvency in terms of current concepts, her central theme is the tractable definition of financial strength. She argues that financial strength can and should be viewed as a characteristic that has dimension and is continuous, rather than as an on-off condition.

The distinction is important. Crucial to the progress of actuarial science is the fit of its concepts and tools to its subject. The existence of degrees of financial strength is commonly accepted. However, current approaches to measurement of financial strength emphasize a two-way or three-way classification system at the expense of the determination of a continuous scale of measurement suited to the many degrees of financial strength.

To better appreciate the difference between an on-off condition and a continuous property, take a few seconds and try to draw a picture depicting financial strength.

. . . .

Those of you, who have actually drawn something, have probably sketched a dollar sign. Some might have drawn a vibrant human figure, some bars of gold, and a few fellow New Jerseyans the Rock of Girbraltar. But I venture no-one has drawn a picture that directly portrays financial strength. Solvency and solidity are not commonly treated as dimensional properties susceptible to pictures and graphs. The conventional classification of insurers as solid, solvent, or insolvent is analogous to categorizing physical objects as blue, violet, or red without appreciation of the broad spectrum of color - not to mention saturation and brightness. If one picture is worth a thousand words, how much more should we prize a conceptual refinement that engenders the creation of many pictures?

Ms. O'Neil's paper is a step in the direction of such refinement. The paper presents neither fully developed theory nor an innovative solution of a particular problem. It is a discussion paper in the true sense of the term; the opportunities for discussion of incipient theory are myriad. Accordingly, this review broaches issues relating to three aspects of the development of more refined measures of insurer financial strength in anticipation of fuller discussion at the Spring meeting. The three aspects are:

I. Fundamental Concept and Logical Structure

II. Mathematics and Measurement

III. Major Challenges to Actuarial Science

I. Fundamental Concept and Logical Structure

The fundamental concept in the paper is the definition of financial strength as an indexed continuum with insolvency and solidity as endpoints. By comparing current index values to prior index values, one can assess whether financial strength is increasing or decreasing. Assuming proper construction of the index, insurers can also be compared. And, as users become increasingly familiar with the index, judgmental interpretations of individual index values become possible.

The index is a means to an end. The ultimate issue confronting the index user is an insurer's "probability of performance." For the policyholder, ceding insurer, and regulator, the concern is the probability of performance of all obligations arising from earned insurance exposures. Investors are commonly concerned with probable levels of earnings and dividends. Company executives may have company goals such as stable earnings and growth in market share, in addition to solvency, to consider. In this light it appears more appropriate to think of a probability surface with several dimensions than a single index that attempts to consolidate possibly conflicting objectives.

It should further be noted that persons concerned with solvency have different perspectives as well as different basic concerns. For example, point estimates of the "probability of performance" computed on a liquidation basis are apt to differ significantly from estimates computed on a continuing operation basis. Similarly, the imposition of time horizons (i.e., performance within one year, two years, etc.) will cause insurers of long-tailed lines to appear artificially strong for shorter horizons.

In regard to logical structure, the paper's distinction between factors and variables will probably evolve into a multi-tiered structure. The analysis of premium to surplus ratios serves to illustrate this point. Premiums can increase as a result of (1) tighter market conditions and greater profit loadings, (2) increased use of cash-flow underwriting (e.g., book premium now, collect cash later), or (3) underwriting additional risks homogeneous with the current book of business. The three sources of premium increase have radically different implications for the risk of insolvency. Consequently, it is appropriate to consider not just the factor premium but also various ur-factors that influence premium.

Before turning to mathematics and measurement, it is important to note that our knowledge of financial strength can increase both by efficacious design of theory and by actual measurement of the functions hypothesized by that theory. By analogy, the concepts of continuous demand and supply curves proved fruitful tools for economic studies independently of econometric efforts to precisely measure these functions. Likewise, actuarial science should be able to derive general properties of insurer financial strength independently of actual measurement of the associated probabilities.

II. Mathematics and Measurement

From the foundation of an indexed continuum of financial strength, Ms. O'Neil concludes that "There exists a specific matematical function relating individual variables or any combination of two or more variables to company position, within a confidence interval, on the solvency continuum."

A further consequence is that a corresponding measurement system can be constructed to evaluate the financial condition of individual insurance companies.

Although the existence of such a function is intuitively plausible, proof of its existence or its actual determination requires a Herculean effort. Whether the cost of detail and precision in identifying the function will produce adequate benefits is not clear. For the function to have practical value, it must be able to predict in some sense. A diagnosis of weak financial condition, that first becomes available after an insurer is in liquidation, is of little use. In short, it is impractical to try to consolidate all relevant factors. The ability to rapidly focus on factors crucial to financial strength is a vital property for any proposed measurement system.

The ability to focus can be theoretically developed in several ways. In dealing with a multi-dimensional probability surface, a canonical base of vectors defined in terms of data that is rapidly reported would delimit the factors to be integrated into a single function. In computing statistical point estimates, the use of sufficient statistics produces further economies of effort. A third possibility is to distinguish controllable from uncontrollable factors; the goal is not to merely observe financial strength but to take sensible action based on its diagnosis.

Regardless of the tactics employed to develop the measurement system, there will be factors beyond it purview. Ideally such

factors would have limited influence on the measure (e.g., the width of the confidence interval), but this cannot be guaranteed. Shifts in accounting practices, off-balance sheet items such as window coverages, portfolio transfers, revised collection standards, and changes in investment policy are all likely to occur without advance notice to facilitate evaluation of financial strength. Problems exist not only with respect to available data, but also with respect to business complexity. Through reinsurance, various pools, and insolvency funds, the financial conditions of insurers are intimately related. For a measure of financial strength to reflect the financial strength of business "partners" is difficult at best.

III. Major Challenges to Actuarial Science

The major challenge to actuarial science in the 1980's is not the creation of new and interesting mathematical models per se. The major challenge is bridging the gap between underlying insurance phenomema and the selection of mathematical models. Ms. O'Neil's approach to measuring financial strength relies on theoretical relationships in contrast to empirical measurements and correlations. She adroitly develops mathematical functions from underlying phenomena. The approach is sound albeit oversimplified and incomplete. The shortcomings lie in the impossibility of analyzing the vast array of insurance transactions within the confines of a call paper.

Ms. O'Neil employs size of loss distributions to illustrate the difference between theoretical and empirical selection of models. If an actuary truly understands an insurance operation, he or she should be able to logically derive the forms of the mathematical functions that describe that operation. These forms then become a testable hypothesis susceptible to revision and refinement. If the hypothesis is supported, it can be logically extended beyond the confines of available data. If, on the other hand, analysis is restricted to fitting a mathematical function to available data, such extension is a leap of faith.

Current measures of financial strength suffer from the absence of a fundamental unifying theory. Their logical justification lies in empirical derivation and in the interpretation of individual ratios (as opposed to the entire measurement system). At this stage, the limitation on future developments is insurance-related, not mathematical. The challenge is to proceed from insurance fundamentals to appropriate integrated mathematical models of financial strength.

Meeting the challenge involves much work. Ms. O'Neil's paper provides a conceptual perspective and heuristic guidelines for its accomplishment.

Title: EVALUATION OF THE FINANCIAL CONDITION OF INSURANCE COMPANIES -- A THEORETICAL APPROACH

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Biography of the Reviewer:

Vice President, F&G Reinsurance Inc.
Fellow of the Casualty Actuarial Society, May 1984
Member of the American Academy of Actuaries, 1983
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The author's objective is to construct a theoretical framework for the evaluation of an insurer's financial condition. It is a noble objective, and relates directly to the various methods used to quantify the value of an insurance company. This topic could lead to future results of interest to regulators, investors and managers.

The key to the author's viewpoint is the solvency continuum. This reviewer has interpreted it as a nonnegative real number range of a solvency function. At one endpoint, zero represents the "insolvent" company. At the other endpoint infinity represents the "solid" company. At any fixed point in time, a particular company holds a solvency position somewhere on this continuum.

Part I of the paper discusses the concepts of insolvency, solvency and solidity. Although the format is definitional, it may be helpful to consider the initial discussion as mainly descriptive and to leave undefined these three terms in a strict sense. Much like $[0,\infty)$ itself, the solvency continuum is easy enough to grasp but tiresome to define properly.

In the examples which numerically walk through the method, a transformation from solvency on $[0,\infty)$ to an index

on [0,100) is accomplished with an index function. This simple transformation does no harm but the complication of an index function is not a necessary one. If S represents solvency, there is no harm in working with the S range itself rather than a transformed value of S. In fact, if we could objectively estimate some type of distribution of solvency, for any particular ordinate system, the financial condition evaluation problem would be solved. The result could then be transferred to any desired one-dimensional index region.

The general approach is to build a structure which will help quantify S. The author assumes there is an "identifiable mathematical function" that relates company operation variables $V_1,\ldots V_n$ to the solvency variable S, and uses the notation $S = h(V_1,\ldots V_n)$ to represent this function. As the "within a confidence interval" concept is new to this reviewer, it is interpreted as meaning that h is a continuous function.

The operation variables chosen for the examples are: premium to surplus ratio; liabilities to liquid assets ratio; ratio of potential claims under a stop-loss reinsurance contract to surplus; and the estimated reserve deficiency to surplus ratio. The intuitive relationship between each of these variables and solvency is that solvency decreases as the variable increases. Typically, the author suggests

$S = h(V) = 1/V$ as representative of this inverse relationship. This is, of course, a gross simplification of all possible inverse relationships; and the author points out the need for further developing the structure of the solvency function.

It may be appropriate to consider a probabilistic structure. If we were to start with Mr. Mayerson's definition, that a solvent insurer would be one "whose probability of ruin during a specified time interval is less than a predetermined amount"[1], we then could relate solvency to the probability of ruin concept. For any particular company, we could define S to be the complement of the probability of ruin, and in that way, S would have a natural domain of definition on $[0,1]$. Also, the problem of estimating the S value could then be assigned to a classical risk theory setting.

We could conclude that our task is to estimate $S = h(V_1,\ldots V_n) = 1 - P(\text{Ruin}/V_1,\ldots V_n)$ where the right hand side of the equation represents the conditional probability of solvency. The calculation of this probability is not an easy task. In fact, it may be impossible to within a degree of precision necessary for regulators, investors, and managers to heed the results.

[1] Insurance, Government, and Social Policy Richard D. Irwin, Inc. 1969 p.148

The concept of measuring solvency in a continuum between the poles of insolvency and solidity may prove to be fundamental to the task of insurance company evaluation. The author has provided a seed from which inspired thoughts can grow.