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Danger to Life Insurance Companies of Asset Default – C-1 Risk

by Faye S. Albert

The life insurance industry has been under more and more pressure to reduce margins in life insurance contracts. And we have seen these margins go down. Each source of profit in life insurance contracts has been identified to the consumer separately, and competition has appeared in each major area, mortality, interest credited and expense allowance. At the same time, life insurance company managements are reviewing their financial positions and options more carefully. Statutory results are used to check for solvency requirements but have been replaced largely in financial analysis with GAAP. Annual profit or loss figures drive company plans. Quarterly and even monthly progress of results versus plans are monitored. The most efficient use of capital is an increasing concern for these managements, and identification of an appropriate level of capital to be in business is a logical outcome. More attention has been given to directing capital to alternative businesses where the return could be higher. Emphasis on operating results has worked to drive down reserve cushions.

These developments have been a source of concern to regulators whose charge is to assure the solvency of individual life insurance companies. As a result, state regulators have been looking to the actuarial profession for help to make sure life insurers remain solvent.

Attention has been focused on identification of reserve standards, so

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After the Crash: Statistical Implications

by Aaron Tenenbein

The events of Monday, October 19, 1987, during which the Dow Jones Industrial Average dropped over 500 points, has dramatically changed the world. That day, which is sometimes referred to as Black Monday, the crash of 1987, and often even less complimentary terms, charted the general outlook towards investments. I will try to put the effects of Black Monday into a statistical perspective. It is useful to consider what assumptions and underlying statistical methods were used to analyze investments before Black Monday, and how the assumptions are likely to change as a result of the events of Black Monday.

Distribution of Returns

In many investment analyses, including portfolio selection methods and the determination of the value of options, it is assumed that the rate of return has a lognormal distribution. This implies the following: let R be the rate of return on an equity investment over a given period of time. Then the natural logarithm of $1 + R$ has a normal distribution. This assumption has some properties which make it amenable for approximating the actual distribution of equity returns, namely:

1. The minimum value of R is -1. This corresponds to a 100% loss in the investment which is the lowest value which R can take.

2. If the individual returns over a given number of n periods have independent lognormal distributions, then the return over the entire single time frame of n periods also has a lognormal distribution. This is not true for many distributions.

3. The lognormal distribution allows for increased skewness for investments which have a high coefficient of variation (the ratio of the standard deviation to the mean). This implies that the skewness increases as the volatility of the instrument increases.

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For a lognormal distribution, the mean is a measure of the expected rate of return on the instrument and the standard deviation is a measure of the average variability of dispersion from the expected rate of return. The standard deviation is then a measure of the volatility of that instrument. Some researchers use the coefficient of variation as a measure of volatility because it expresses this variability as a percentage of the expected rate of return.

It is too early to assess quantitatively the effects which the events of Black Monday would have on this distributional assumption. However, a few statements can be made about the likely impact which these events will have on the distribution of these returns. If the lognormal distribution still represents a reasonable approximation to the actual distribution of returns, then the standard deviation would have to be higher. As mentioned before, the standard deviation is a measure of volatility. Before Black Monday or perhaps before 1987, a change in the Dow Jones Industrial Average of more than 100 points, or equivalently a percentage basis of 5%, was very rare. Now it occurs more frequently.

However, the whole concept of the use of the lognormal distribution may be questionable. The assumption inherent in the use of the lognormal distribution is that the volatility can be measured by the standard deviation. The standard deviation, however, may turn out to be unstable in the presence of large fluctuations in the value of these equity instruments. As a result, the standard deviation may not be a reasonable measure of volatility because of its instability. This implies that any distribution which has a finite standard deviation, such as the lognormal distribution, will fail to model the actual fluctuations of these instruments.

One of the effects of Black Monday may be that other distributions may have to be used to model the distributions of returns on equity investments. These other distributions would have heavy tails in order to measure the increased volatility. One such family of distributions is the so-called stable symmetric family of probability distributions which has been discussed by E. Fama and R. Roll in the *Journal of the American Statistical Association*, particularly "Some Properties of Symmetric Stable Distributions," Volume 63 (1968), pages 817-36 and "Parameter Estimates for Symmetric Stable Distributions," Volume 66 (1971), pages 331-38. B. Mandelbrot also discussed the topic in "The Variation of Certain Speculative Prices," *The Journal of Business*, XXXVI (1963), pages 394-419. In these papers a family of distributions is introduced. This family is characterized by the parameter alpha which is called the characteristic exponent. This parameter varies from 0 to 2. For alpha = 2, the distribution is normal, and it is the only distribution in this family which has a finite standard deviation. When alpha = 1, the distribution is Cauchy. The Cauchy distribution is a symmetric distribution for which both the mean and standard deviation do not exist. Obviously other measures for the volatility, such as the interquartile range, and other measures of location, such as the median return, would be utilized in this context.

Portfolio Selection Methods

Portfolio selection methods attempt to balance risk versus return. Generally the more risky the portfolio, the greater the return must be in order to justify the selection of that portfolio for investment purposes. In classical portfolio analysis, the risk is measured by the standard deviation of the returns, and the mean is used to measure the rate of return of the portfolio. The problem then becomes one of selecting a portfolio to minimize the risk for a fixed rate of return or vice versa.

With increased volatility, the use of the standard deviation may not be realistic and perhaps other measures of risk will have to be utilized. At any rate, increased volatility will result in the selection of instruments with less risk. As a matter of record, this is precisely what did happen in the marketplace. The increased risk of equity instruments caused a dramatic flight into short-term fixed income instruments such as money market funds, certificates of deposit, and Treasury Bills. This in turn resulted in decreased returns of the instruments.

Option Values

The theoretical determination of the value of a call on an option has been carried by Black and Scholes and is sometimes referred to as the Black-Scholes Option Formula. The value is determined under the assumption of

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a lognormal distribution. The results of Black Monday may have two effects on this pricing methodology. First, if the lognormal distribution is still valid, the option values can be adjusted to take into account the higher volatility of the equities upon which the options are based. Second, if the lognormal distribution is not valid, then the value of the option should be determined under other distributions which may fit the data more effectively.

Summary

It is too soon to forecast the statistical implications of the crash of 1987. However, it is clear that a change has taken place and only time will determine how lasting the effect of this change will be.

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C-1 Risk Cont'd.

cash-flow payments out will be anticipated reasonably and will be accommodated by cash coming in. Fluctuations in the value of assets due to changes in interest rates and changes in demand for insurance company contracts has been one part of the focus: the C-3 risk. A more obvious aspect of this concern is, how will the quality of assets be taken into consideration in setting a proper level of surplus for a life insurance company? The C-1 risk deals with the problem of nonperforming assets.

This article relies on data in the C-1 Risk Task Force Report prepared for the Committee on Valuation and Related Areas; the purpose of the article is to summarize those results and conclusions. Please refer to the full report for supporting data.

The major investment vehicle for insurance companies has been bonds, and performance on corporate bonds has been studied since the turn of the century. By looking at this type of asset where most historical information is available, conclusions will be suggested that may be applicable more generally.

Review of the aggregate results shows there has been a radical reduction in the percentage of outstanding bonds going into default after 1940. It is hard to attribute this change to anything except a dramatic change in the financial environment, that is, drastic decrease in default levels after 1945 are the result of a more stable economy. The U.S. government has learned to provide economic adjustments to help the economy steer a more level course.

The incidence of default can be forecast at the time of issue by risk class. Classes have been set up and differences in the probability of default for different classes successfully recognized over the years by a few different systems. Futhermore, changes in the rating of particular bonds appear to properly reclassify these instruments into categories that will give similar default experience. There has been a lot of discussion about junk bonds and how these are different from the kinds of investments available in the past. In the late 1920s, bonds below investment grade constituted about 20% of the issues. However, probably because of the default experience from the 1930s, there were fewer issues in that category until lately. The recent economic climate and particularly the experience for the last 40 years seem to have made investors bolder and willing to take more of a gamble on the bonds' principal for a greater return. Re-rating an existing bond reclassifies the probability of its performance based on updated information. A newly issued "junk" bond can have the same classification as a downward rated existing issue. There is every reason to expect these two bonds to subsequently exhibit the same probability of default. To the extent that existing statutory provisions adequately mark insurance company surplus for lower quality assets through the mandatory securities valuation reserve, the same should conceptually take care of junk bonds.

How bad is an insurance company hurt by a bond default? Of the total loss in value at the time of default, about two-thirds of that loss existed at the beginning of the year before default actually happened. This must be based on the market being informed of what was coming. Further, after default, many bonds returned to good standing, and there is an average recovered, about 60% of their original value, though results differ and depend on the individual security. Providing surplus for defaults, though, seems less of a problem if only 40% of the asset value is permanently lost rather than 100%. And what was the final financial return for bonds that eventually went into default? The yield was less than promised, but usually the principal was intact by final settlement. Only issues in the 1920s showed a small negative return, that being .003.

Though diversification is considered important in portfolio management, it does not appear that diversification helps modify the loss results on investment bonds. This can partly be explained because default rates in the major industries are correlated with each other and with the total market, and there isn't a particular difference in returns within major industry divisions. The period during which the investment was made is more important in the default results than the particular industry. This harkens back to the idea that the economic conditions are more predictive of default experience than any other factor. In a stable economy, there are not a large number of defaults. In an unstable economy, default rates soar.

The Task Force suggests that the risk to insurance companies of defaults on junk bonds does not justify setting required surplus levels higher than currently exist. This categorical statement is pretty strong and needs to be watched. However, as long as default rates on total bonds are less than 1.5%, it does not appear imprudent.

Faye S. Albert is a Consultant for life insurance companies in Miami, Florida. She was a member of the C-1 Risk Task Force and moderated a session on that topic at the 1987 New York spring meeting.

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