QUANTIFYING THE C-1 RISK
(DEFAULTS IN FIXED DOLLAR INVESTMENTS AND
MARKET VALUE CHANGES IN EQUITY INVESTMENTS)

Moderator: FAYE ALBERT
Panelists: JOSEPH J. BUFF
               ROBERT J. CALLAHAN
               IRWIN T. VANDERHOOF
Recorder: JOHN C. WINTER, III

o   Vanderhoof
     -- Bond default history in the United States and implications for insurance
        company asset determination
     -- One suggestion for appropriate provision for defaults, particularly on
        junk bonds
o   Callahan
     -- Regulatory concerns about recent activity by insurance companies
        investing in low-grade bonds
     -- Valuation actuary needs to consider this development
o   Buff
     -- Another suggested method for modeling the C-1 Risk in the context of
        the valuation actuary's cash flow review

MS. FAYE ALBERT: Welcome to the panel discussion on the C-1 risk, the risk
of asset default. We will be running the session with presentations from each of
our speakers first. There should be plenty of time for questions afterward.

First, I would like to introduce Irwin Vanderhoof, Senior Vice-President, Chief
Investment Officer, and Chief Actuary of Ordinary Operations at the Equitable
Life Assurance Society. He has been very active in the Society of Actuaries,
and served on the Board of Governors from 1983 to 1986. Further, he has been
very active on the Education and Examination Committee, serving as consultant

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on Investment of Life Insurance and Pension Funds and Valuation of Assets (Part 8) since 1973 and also on the Economics and Finance Committees. He has been chairman of the C-1 Risk Task Force since 1983, and will be presenting his work to date in that area.

I am sure that you are familiar with several of the papers that Mr. Vanderhoof has written, including The Interest Rate Assumption and Maturity Structure of the Assets of a Life Insurance Company, 1972; Choice and Justification of the Interest Rate, 1973; and New Mathematical Laws of Select and Ultimate Mortality with Aaron Tenenbien in 1980. Outside of the Society he has been an Adjunct Associate Professor with the College of Insurance since 1963, and also an Adjunct Associate Professor with the New York University (NYU) Graduate School of Business since 1982.

MR. IRWIN T. VANDERHOOF: This talk may be considered a summary of the work so far of the C-1 Risk Task Force. The work of this version of the Task Force, concerned with underlying data, will be finished by July 1, 1987. Since some portions of the work of the Task Force may contain opinions that may not be accepted as appropriate by the parent Committee on Valuation and Related Areas, the present talk will emphasize those more controversial aspects of the study. The stated opinions should currently be considered only the opinions of Faye Albert and myself, as two members of the task force.

A proper title for this talk might be Bond Defaults -- Then and Now. I will present information on experience on bond defaults during 1900 to 1944, and 1945 to the present. The reason for this organization is that in some ways the experience of both periods is very similar, except for one important difference. The item of difference is the default rate. I will also talk about junk bonds, since that was the keynote of this conference.

The data comes from a series of works. The first and basic work is the Hickman study done on behalf of the National Bureau of Economic Research (NBER). This study covers all large bonds issued from 1900 through 1943 and reports the experience on such bonds through the end of 1943. The study also covers experience on a portion of the smaller issue bonds during the same period. It consists of three volumes, one entitled *Bond Quality and Corporate*

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Investors' Experience and two volumes entitled *Volume of Corporate Bond Issues and Statistical Measures*, which is 600-pages of mathematical tables.

Subsequent to Hickman, a series of authors updated the study. First there was Atkinson who, also working on behalf of the NBER, published experience from 1944 through 1965, Hill and Post, on behalf of Smith Barney, published experience for bonds from 1966 through 1977, and Ed Altman of NYU, on behalf of Morgan Stanley, published experience from 1970 through the present.

Exhibit 1 gives columns listing the actual amounts outstanding, defaults, and default rates for each year from the period 1900 through 1985. The data covers all straight bonds outstanding for each year. The same data is summarized graphically in Exhibit 2. This gives two pieces of information for the entire period. One is the default rates, represented by a broken line, on all straight bonds outstanding for each year. The second piece of information, represented by the solid line, is the standard deviation in the nominal growth rates in the economy over ten-year periods. The graph shows clearly two important facts. The first is that default rates since 1944 have been much lower than they were in the previous forty-five years. The second is that the economy has been more stable during the last forty-one years than it was during the previous period.

Let us consider only the simple information of the default rates. The average default rate from 1900 through 1944 was 1.65% with a standard deviation of 1.47%. The average default rate from 1945 through 1985 was .091% with a standard deviation of .149%. That seems to me to be quite a change. You have two very clear periods. One period from 1900 through 1944 where default rates averaged 1.5% and a period starting in 1945 where they averaged a less than 1/10 as much.

What would you do if you were reviewing mortality? If you were dealing with mortality, you would say that the first forty-five years were simply not relevant to the current experience. Forty-five years would seem an ample period of experience for that conclusion. The highest rate during the most recent period is only .6%. That is less than half of the average during the earlier period. They are simply different periods of experience. If you were examining mortality, you would have easily rejected the earlier experience. We are not using the 1941 CSO for setting premium rates; why should our thinking about bond

EXHIBIT 1

Year	Defaults	Outstanding	Dft Rt	Year	Defaults	Outstanding	Dft Rt
1900	25.30	5913.9	0.428%	1945	26.30	22130.0	0.119%
1901	36.70	6468.0	0.567%	1946	1.90	21510.0	0.009%
1902	78.00	7785.1	1.002%	1947	26.50	22980.0	0.115%
1903	15.70	8600.2	0.183%	1948	51.10	26380.0	0.194%
1904	194.40	9297.3	2.091%	1949	30.70	30610.0	0.100%
1905	58.50	10059.1	0.582%	1950	0.80	33310.0	0.002%
1906	24.50	10836.1	0.226%	1951	4.00	34910.0	0.011%
1907	90.90	11743.7	0.774%	1952	58.30	38360.0	0.152%
1908	271.80	12538.3	2.168%	1953	2.70	43100.0	0.006%
1909	116.10	13187.4	0.880%	1954	1.90	46620.0	0.004%
1910	83.30	13712.2	0.607%	1955	31.90	50200.0	0.064%
1911	102.30	14206.2	0.720%	1956	3.20	53240.0	0.006%
1912	225.20	15037.8	1.498%	1957	55.50	57220.0	0.097%
1913	265.40	15735.7	1.687%	1958	30.00	63260.0	0.047%
1914	746.40	16073.0	4.644%	1959	13.10	68920.0	0.019%
1915	571.90	15981.9	3.578%	1960	7.30	72010.0	0.010%
1916	193.10	16169.2	1.194%	1961	106.40	75470.0	0.141%
1917	206.20	16736.6	1.232%	1962	0.50	79690.0	0.001%
1918	359.30	17215.5	2.087%	1963	2.40	83770.0	0.003%
1919	491.40	17126.4	2.869%	1964	0.00	87550.0	0.000%
1920	205.30	17142.2	1.198%	1965	7.10	91550.0	0.008%
1921	179.50	17798.3	1.009%	1966	0.00	60400.0	0.000%
1922	213.50	18764.2	1.138%	1967	42.90	72800.0	0.059%
1923	197.10	19524.9	1.009%	1968	52.20	83500.0	0.063%
1924	303.40	20551.1	1.476%	1969	0.00	95400.0	0.000%
1925	292.30	21644.4	1.350%	1970	796.71	124400.0	0.640%
1926	125.40	22313.1	0.562%	1971	82.00	140500.0	0.058%
1927	284.00	23870.4	1.190%	1972	193.25	150900.0	0.128%
1928	57.10	25744.4	0.222%	1973	49.07	158800.0	0.031%
1929	96.80	26556.1	0.365%	1974	122.82	175200.0	0.070%
1930	228.10	26712.0	0.854%	1975	204.10	200600.0	0.102%
1931	940.20	28065.5	3.350%	1976	29.51	219200.0	0.013%
1932	1352.70	27839.5	4.859%	1977	380.57	237800.0	0.160%
1933	1901.40	26468.0	7.184%	1978	118.90	252200.0	0.047%
1934	710.40	24430.3	2.908%	1979	20.00	269900.0	0.007%
1935	1055.90	23741.7	4.447%	1980	224.11	295100.0	0.076%
1936	288.50	22572.9	1.278%	1981	27.00	312500.0	0.009%
1937	253.40	22682.8	1.117%	1982	752.34	329200.0	0.229%
1938	620.20	21916.7	2.830%	1983	301.08	350500.0	0.086%
1939	698.90	22040.7	3.171%	1984	344.16	391700.0	0.088%
1940	420.60	21473.1	1.959%	1985	992.40	428300.0	0.232%
1941	106.80	21348.1	0.500%				
1942	145.30	20842.1	0.697%				
1943	82.10	20638.3	0.398%				
1944	34.50	22340.0	0.154%				

Default Rate and
10 yr Nom Growth Std Dev

Default Rt

Std. Dev.

Year
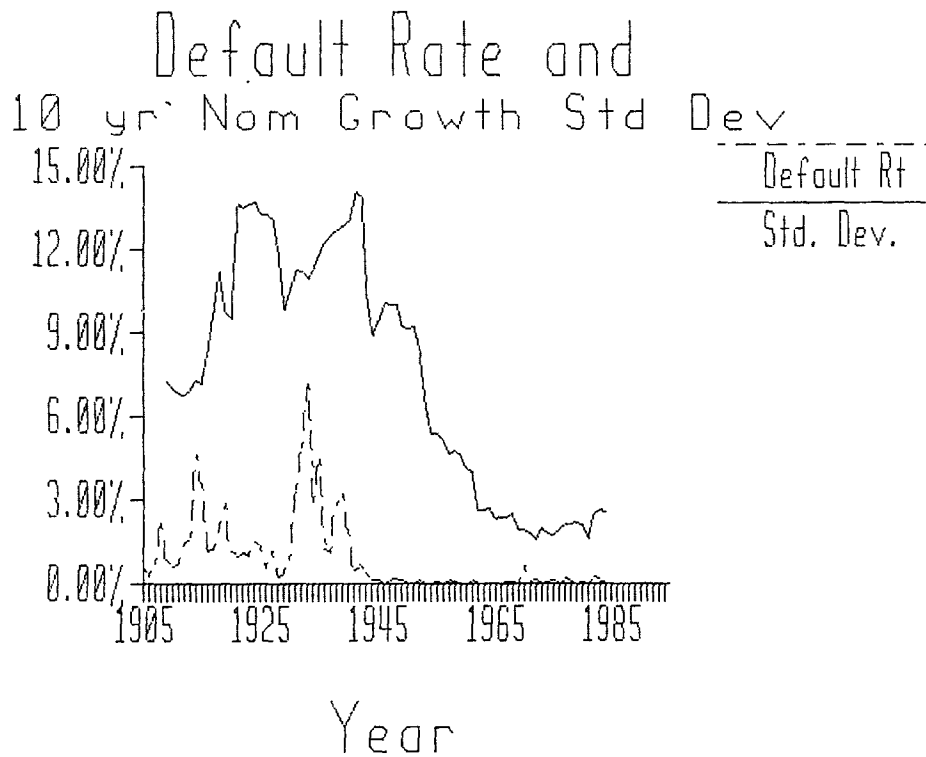
default rates be based on experience dating from the 1941 CSO period? When I said that, one actuary asked, "Well, yes! But what about AIDS?" I said, "Yes, in mortality you are probably considering some additional margin and additional underwriting criteria to protect yourself against AIDS. And perhaps you should have some additional margin or criteria to protect yourself against the risk of a reversion to the earlier less stable period in the economy. That is perfectly sensible, but you would still not revert to using the 1941 CSO table for setting rates."

Exhibit 3 gives the same default rates, represented by the broken line, along with ten-year real growth rates in the economy. (Real growth rates are obtained by taking the real gross national product, dividing it by the real gross national product 10 years earlier, and taking the one-tenth power of the quotient. They are essentially the average compounded growth rate in the economy during the previous ten years.) You see that the earlier period had very wide swings. However, during the period in which most of us have had our business careers, we have not had these kinds of swings. We have not had any period where there was a negative real growth rate. We have not had periods when the growth rate fluctuated, even as much as it was fluctuating prior to 1925. The reason that bond defaults now are lower than they were during the earlier period, is that we now know more about managing the economy than we knew forty years ago. And the economy actually does perform in a more stable fashion than it did forty years ago.

To create the experience of the 1930s it was necessary for the Federal Reserve, after a collapse in the stock market and after the Depression started, to reduce the money supply by 1/3. Now figure out what the chances are that the Federal Reserve will again reduce the money supply by 1/3 during a period of recession and you can figure the chances of recurrence of these types of default rates.

That does not mean the default rates cannot go up. It does not mean companies cannot issue and investors cannot buy bonds that will have terrible experience. It absolutely does not say that everybody should get confident that buying junk bonds will be good for financial health. Once you have convinced yourself you will have no risk and that all you need to do is to buy anything that comes out with a junk label on it; once you are no longer concerned about the risk, you will lose money. Guaranteed.

Default Rate and
10 Yr Real Growth Rate

Year
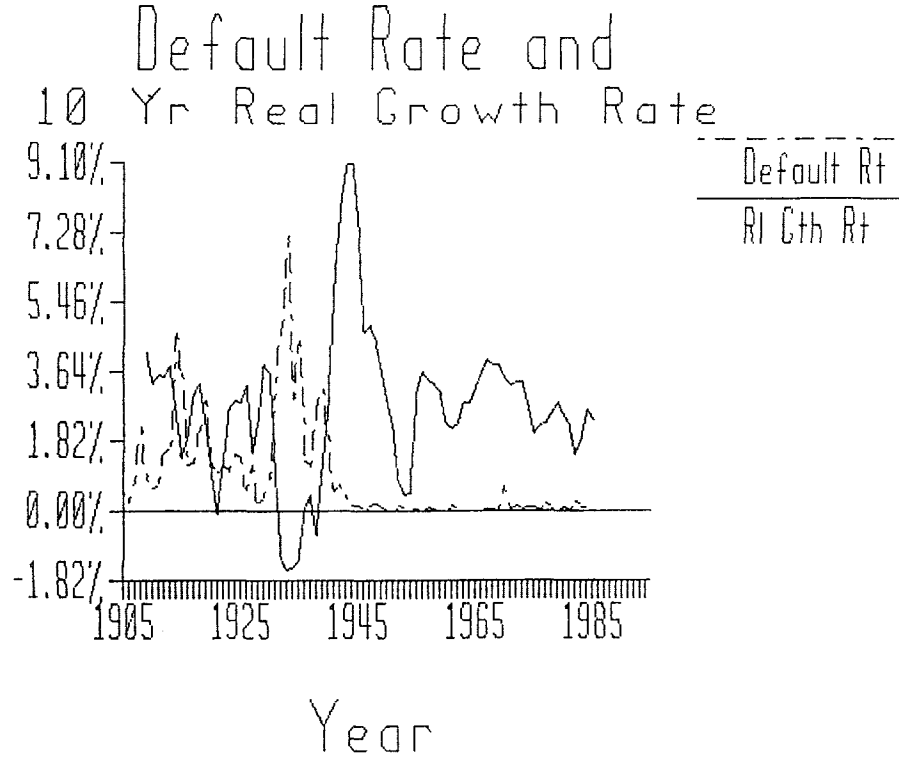
However, as long as you are concerned about the risk and pay attention to it, I see no reason that the risk which will dominate the investments of the business of the future are on the same order as those which have dominated much of our thinking, because our thinking is dominated by the level of defaults in the 1930s. That is the big difference.

Now let me talk about the ways in which bond defaults are the same as they were during the earlier period. If a bond defaulted, the average loss from issue to the date of default was about 60% of the face value during both periods. For defaulted bonds held from issue to final settlement, the final loss for both periods was about 40% of face value. The highest returns on bonds are achieved by buying immediately after default and holding to extinguishment. The probability of default seems to be mostly related to agency rating or other measures of financial strength, but not to the period since issue if rating has not changed.

Defaults during both periods require about the same amount of time to be settled. In the Hickman study it took 2.6 years. The only current data I have is consistent with that. A study for one company of its private placements shows a time of one year less and somewhat better salvage. The data support a cause and effect relationship. Defaults which settle earlier settle for more.

Overall there are more similarities than differences in the two periods of experience. The many similarities seem to give more credibility to the one major difference -- the default rates.

I said that I would talk a little about junk bonds. The first step would be toward the question of returns by agency ratings. Hickman concluded that low-quality bonds had higher returns. Fraine disagreed, pointing out that Hickman had included call premiums. Fraine concluded that higher rated bonds had higher returns during the earlier period. But Fraine excluded from his study bonds issued as part of reorganizations.

There is one clear conclusion. If you bought the highest yielding bonds during each period you would get better returns than buying lower yielding bonds. The difference is that the group of higher yielding bonds includes unrated bonds. They simply did much better than bonds rated either high or low.

Similar results have been found in the stock market where stocks on which there is little data do better than those more carefully studied. Investors insist on being paid for ignorance about their investment. I don't think this means that you should try to be ignorant about how you invest money, only that there is an opportunity here.

Where does that leave us on junk bonds? The junk bond universe had an average default rate of 1.6% for the period 1971 through 1986 with a standard deviation of 1.2%. Remember that the rate for all bonds for the period 1900 through 1944 was 1.7% with a standard deviation of 1.5%. These are almost the same. Aaron Tenenbien explained how you fit a beta distribution to such data and I tried it. It reproduces the distribution of default rates quite well. In summary the distribution indicates that there is about a 50% chance that the rate will exceed 1.5% in any year, about a 10% chance that it will exceed 3.5% in any year and less than 1% that it will exceed 5.5% in any year. However, in 1970 the rate did exceed 10% because of the Penn Central default.

There is another argument in favor of some consideration of junk bonds as an investment. That is diversification. Conventionally a perfectly diversified portfolio is a single percentage of the whole market. The current bond market is about 25% junk bonds. Therefore a diversified bond portfolio would be 25% junk. This is another similarity. During the late 1920s the bond market had a similar portion of junk. Maybe we should keep that in mind also.

I am obviously partial to junk. If 25% junk constitutes diversification, then some might feel that the insurance industry should vary from that in the direction of higher quality. A somewhat lower figure doesn't seem inconsistent with a desire for diversification. On the other hand, 50% junk for a bond portfolio does seem to me to differ significantly from any normal standard of diversification.

In this talk I have tried to cover several points. The first was that we should consider the economy as being essentially different from that which lead to the high defaults of the 1900 through 1944 period. It could change back. There is no current evidence that it has. My second point is that in other ways the operation of defaults has been about the same in the earlier period and the current period. This includes the volume of junk bonds issued in the late 1920s. The final point is that, with an adequate margin for default losses, say

1.25%, and an adequate additional return, say 250 basis points, some investment in junk bonds can be seriously considered as appropriate for insurance company investments.

MS. ALBERT: Our next speaker will give a different perspective on the C-1 risk. I am happy to introduce Mr. Robert J. Callahan. He is a Fellow of the Society and has been with the New York State Insurance Department for over 35 years. He was appointed Chief of the Actuarial Valuation Bureau in 1973 and in 1985 Chief Life Actuary of the Department. Mr. Callahan is going to discuss regulatory concerns about recent activities by insurance companies in investing in low-grade bonds and how the valuation actuary can take this into considera-tion in doing his work.

MR. ROBERT J. CALLAHAN: It has been said that if you have an idea and it's doable, walk around it. And if you like it, do it. It is easier to apologize afterwards than it is to get approval beforehand. Now that applies to many companies out there. There are many companies that will go ahead and do something and let us holler and object to it afterwards. At the reinsurance session at this meeting, one speaker noted that her company had filed a rein-surance contract with the New York Insurance Department having made the approval of the department a precondition to the approval of the contract. And I asked her afterward why she sought the prior approval of the Department when the treaty involved two nonaffiliated companies and there was neither any legislation nor regulation that pertained. However, sometimes it is a good idea, if you think that something may be in doubt, to get a reading on it ahead of time, rather than three years later in the course of examination to be called up on the carpet about what you did.

Sometimes it is the same with insurance departments. If you like the idea, go ahead and do it. I think that is what the New York State Insurance Department (the Department) did with Regulation 126, and I think that that is what the Department is doing with Regulation 130 regarding investments in high-yield, high-risk obligations by domestic life insurance companies.

My prepared remarks are entitled Actuarial Opinion and Memorandum for Annui-ties and Guaranteed Interest Contracts: Valuation Methodology or Mythology.

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By the end of this talk, you will find that if you leave out of your considerations an important element, you will have mythology instead of methodology.

I wondered why I was asked to be on this C-1 risk panel; after all, that is not my primary area of responsibility. That is somebody else's primary area of responsibility within the Department. But when you look at the development of the valuation actuary, he is now being forced to come out of the back room where he has had a nice, comfortable, easy life and to look at things which are outside of his primary realm of responsibility.

I am the first to admit that the statutory formula reserves may not produce the correct answer. But it is a system that has worked over a number of years, and companies and regulators have felt comfortable with it.

Then in the early 1970s things started to change. To market their guaranteed interest products, companies found that they needed to change some of the requirements in the statutory formula system. Otherwise there was too much surplus strain.

We worked with these companies and we tried to produce a level playing ground. We tried to make the same requirements and conditions for both our domestic insurers and our foreign insurers. If we were going to relax the rules for our domestic insurers, we felt we should do the same for our foreign insurers. We got going with a number of yearly task forces composed of both domestic and foreign insurers, and we found out that the foreign insurers had already been using a more liberal interpretation. So in their case it was a matter of our adding additional requirements, but we came out every year during the 1970s with an interest rate applicable to that year's issues. Then in 1980, as interest rates grew very high, we realized we needed to make a condition that the companies demonstrate to us that they had call protection on their bonds. The following year, we added the additional requirement that they look at the transfer privileges of their contracts. In 1982 we passed a law requiring that in order to use a higher set of valuation interest rates, the actuary must produce an Actuarial Opinion and Memorandum as to the reserves and supporting assets making good and sufficient provisions for the future obligations.

Now a lot of people have looked upon this requirement as being just a C-3 risk requirement. Actually it goes far beyond that. As we progressed and learned more, we realized in the last couple of years that one of the important elements that the actuary had to consider was the default risk and the effect of the quality of the assets. We were into an area where most actuaries in most companies have little experience. Some companies may put an actuary in charge of investment, but that is unusual.

So the actuary now has to get involved in new matters. He has to interface with other people. In a seminar on valuation actuaries a few years ago they put up on the board, AIM -- Actuarial, Investments, Marketing: These People Need to Sit Down and Talk. Later the acronym was changed to VIP and I think that meant Valuation, Investment and the Product. Again, these people need to talk with each other in the companies.

I find the same thing in the Department: I need to talk to other people. I need to talk to the Chief of our Life Bureau, who is primarily responsible for reviewing the investments and looking at reinsurance agreements.

The American Council of Life Insurance (ACLI) had a task force develop recommendations as to whether or not they should pursue further the idea of the valuation actuary. Basically that task force said that we should have a committee to study the role of the valuation actuary. But the valuation actuary should not get involved in the quality of assets for the C-1 risk. The ACLI Board of Directors said that they were going to constitute a committee on the valuation actuary, and charge that committee with coming up with a proposal as to how to deal with the problem of the quality of assets. In 1986 the ACLI committee on valuation actuaries came up with its recommendations. These did not include a recommendation regarding the quality of assets. I think that the first draft was rejected by the ACLI Board, and that a compromise position was reached where the committee did not make any recommendation regarding the quality of assets, but did make some comments that the quality of assets must be considered by the valuation actuary. They felt that until such time as generally accepted methodology, techniques, and standards of practice were developed, the regulator should not require the valuation actuary to make any statement regarding the effect of the quality of assets.

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Now I think that the ACLI report was dated in October 1986. Our draft of Regulation 126 was sent out the end of August 1986 or beginning of September. On September 25, 1986 we held a public hearing. Our draft contained a statement to the effect that the actuary must consider the effects of the quality of assets. The ACLI objected to that in their public statement at the hearing and in writing. And we wrote back and said the actuary cannot ignore this particular element while waiting around for standards to be developed. The actuary must use his best judgment, seeking help where necessary, but there is no way that the actuary can develop an opinion as to the adequacy of assets supporting liabilities and ignore the effects of the quality of assets.

We expanded in the final regulation upon this aspect, and tried to define what we considered to be a high-yield obligation, which has a different definition from than that in Regulation 130. We suggested, but did not require, that the actuary deduct 2.5% of principal in making his cash flow projections. We noted that the actuary could use other techniques, but that he could not ignore the issue altogether. The reply letter I got from the ACLI said in essence, "Okay. As long as you are not prescribing the technique, fine." The ACLI letter sent out with their report on valuation actuaries made reference to the fact that they have put the actuarial profession on notice as having to develop the necessary methodology and techniques.

In the light of these prior developments, I was asked to write an article for *The Actuary*. I thought that this would be a good opportunity to drive home the importance of the quality of assets. I tried to make my point the Actuarial Opinion and Memorandum, and made reference to the fact that statutory formula reserves do not fit many situations, and then end with the example of how my thoughts applied to structured settlements.

The first draft focused on the structured settlement area, and this was printed in the April 1987 edition of *The Actuary*. In the longer version, I made reference terminated pension plans as well as to structured settlements. And I said that the aspect of the quality of assets has to be considered by the valuation actuary.

Elsewhere in the Department, they were attempting to restrict the amount of assets that any one company could invest in high-yield obligations. On

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February 24, 1987, the Department held a public hearing. I thought the super-
intendent's opening remarks were excellent. He noted that, prior to 1983,
companies' junk bond investments in their general accounts were limited by the
leeway provision to 4% of their admitted assets. In separate accounts, where the
companies did not guarantee principal and interest, the companies could create
separate accounts of junk bonds, but the policyholders and the individuals
buying these contracts were fully aware of the investment risk involved. In
1983 the legislature removed the qualitative restrictions on bond investments.
From that point on, perhaps two domestic insurance companies increased their
holdings in junk bonds. By the end of 1983 one company had something like 24%
of its general account invested in junk bonds; at the end of 1985, and 43%, at
the end of 1986, 57%. The other company's holdings are still in the 20-30%
range.

The Department's proposed Regulation 130 would have restricted general account
investments in publicly traded junk bonds to 10%. It had a 5% leeway on
leverage buyouts and another 5% leeway for private placements. I believe the
final regulation will have an overall 20% limit. It will not force the company to
divest itself of its current holdings, but a company cannot invest further in
high-yield obligations until its percentage comes down below 20%.

The final regulation was to be sent to the Department of State around this time.

In the final regulation they also mention the criteria for the Department's ap-
proval of an excess of the 20% limit, provided that the company complies with
certain requirements.

Following the Department's public hearings on the regulation, Senator Joseph
Bruno, chairman of the Senate's insurance committee, called a public hearing as
to the legislation on junk bonds for March 17, 1987. There were some that said
that the Department had sufficient authority to set forth regulations restricting
the quality of assets. Others said the Department exceeded its authority. If
something is doable and you like it, you walk around it; you do it and apologize
later.

The Department is getting set, if they haven't already sent it up to the Depart-
ment of State, to issue Regulation 130 restricting companies' investments into

junk bonds. One company in particular has put the Department on notice that it will litigate this regulation. If it does, we will have to meet that when it comes. But I do not see how, as regulators, we can see a situation that calls for action and do nothing. I feel that it is right and proper for the Department to take corrective action.

MS. ALBERT: The final speaker is Joseph Buff, who is a consultant in the New York Division of Tillinghast, TPF&C. He is a Fellow of the Society of Actuaries and before joining Tillinghast was a product manager at Morgan Stanley & Company. There he consulted to life insurance companies on investment strategies and asset liability management.

He has done research on the pitfalls of Macaulay duration testing for interest-sensitive assets and liabilities, and discusses this in the chapter he wrote for the Society of Actuaries Handbook entitled, "The Valuation Actuary." Recently, Mr. Buff has been doing research on assets default risks, the C-1 risk, and asset quality strategies for life insurance companies. He will continue Mr. Vanderhoof's work chairing the C-1 Risk Task Force. In addition to that, he is chairman of a subcommittee on investment valuation and the mandatory security valuation reserve for the NAIC, which is a special advisory committee on valuation laws.

Mr. Buff is going to review with us another method for modeling the C-1 risk. In the context of the valuation actuary's cash flow review, he will be trying to integrate the C-1 risk review with some of the work that has been done on C-3.

MR. JOSEPH J. BUFF: Let me try to put my talk into some perspective. Basically, I will outline the problem with the C-1 risk; how C-1 risk happens; how bond defaults take place, and what they can do to insurance companies. In the beginning I will take a look at the definition of the problem of C-1. After going through that, which is going to start off by belaboring the obvious, I will have a little discussion of several things which I think a C-1 methodology ought to be able to accomplish for insurance companies. I will discuss a particular model which has been developed and programmed that implements this type of methodology, describing for you briefly what was done to construct it, and what it takes to use it. Then I will go through some of the results that have come out of preliminary runs that we have been doing using the model, and

some of our tentative conclusions. Then at the end I will recap the kind of approach we have come up with and what additional research lies ahead.

C-1 risk is the risk of asset default. That I guess is most relevant to talking about fixed income investments, but we also should think about the loss of value on common stock and other equity investments which can result from reduced credit worthiness of the issuer of the security. When a default event takes place, there's also a related reduction of investment income which is really part of the C-1 risk picture.

Now let's begin by taking a look at the particular process of default and what this can mean. That will enable us to focus on the problems of C-1 risk, to look at factors that influence risk exposure, and then to analyze the financial processes that risk seems to affect and the financial processes that seem to affect risk. Then, as I said, we will look at a proposed modeling solution. It is a methodology, but the methodology cannot be carried out, since it involves a lot of calculations, without a computer. I am just using the word *model* for the thing you have got on your computer that actually carries out the methodology for you.

Now, I tried to take a look at the world of insurance valuation and pricing and investment strategy practices and see what are the kinds of things that can be done now with C-3 risk cash flow simulations, and what are the kinds of things we might similarly want to be able to access for C-1 risk.

First, and perhaps most important, is the whole question of the liability cash flows. To get a good handle on C-1 risk exposure, we really cannot deal with the asset side of the balance sheet in isolation. We have got to look at things like recurring premiums, payment of liabilities, perhaps even new business. We should have something that really is specifically usable to analyze reserve and surplus requirements for those of us who are valuation actuaries and need to make statements as to the adequacy of our companies' reserves and the accompanying assets. For pricing purposes, on one hand, it would be nice if we could get a handle on the risk charges that seem appropriate given the investment strategy that we select. But I think that the pricing process involves a kind of exercise: you can think of it as an equation that goes something like yield plus C-1 risk, or maybe minus C-1 risk, equals our implied credited rates.

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I think it would be good if we could integrate all three considerations in one place in the balance. The next point of the approach is the basic theme of cash flow analysis in general, using existing assets straight from schedule D and using assumptions that the actuary selects as being appropriate, the individual company's experience.

Bob Callahan has already referred to New York's Regulation 126 and the cash flow testing that it discusses that is applied primarily for the C-3 risk, but maybe we ought to be considering the C-1 risk as well. What you will see is that the techniques are like those used in cash flow scenario testing, except that they are now applied to the C-1 rather than the C-3 risk. In fact, the more like C-3 risk techniques it seems, the more I make my point.

The last important application of this kind of methodology is in asset quality allocation strategy. Let me digress for a second. We talked about investment strategies and the different people within the insurance companies that get together and choose investment strategies. One important aspect of investment strategies is the maturity structure or the duration structure of the assets. This is probably what we think about in terms of asset liability matching, the C-3. There is another similar question that pertains to C-1: How do you allocate your portfolio by quality in at least a couple of dimensions? One of them is by different qualities or grades of bonds or mortgages or preferred stocks. The other has to do with the amount of funds that you are willing to put into any individual bond or any individual industry or other sector of the overall market. For instance, are you going to allow up to $5 million to be invested in any one bond or any one corporate issue, or are you willing in a special situation to put $25 million in an individual bond? These are, I think, asset quality allocation questions. In fact, companies are following strategies along these lines, but it would be nice to have a kind of methodology or modeling process that would help quantify some of the pluses and minuses and let you take a look at the risk exposure and see the ups and downs.

Let us just take a look at what the C-1 mechanics are. From that we will move on to how we can build a cash flow model. First we need to talk about the basic thing which is the default rates. The aggregate rate certainly varies by asset category. So we have got to talk about quality, (i.e., investment grade or high yield). High-yield bonds are sometimes called junk bonds, but I have never

heard anyone call investment grade bonds "low-yield" bonds. It's probably just as well. Industries, for instance the oil and gas industry, or the air industry, have different yield characteristics. Coupon and maturity dates also have an effect on yields.

I am now going to make an obvious point which I think is really the reason why there is a problem of C-1 risk. First, the default rates are difficult to predict accurately, and second, they vary over time to some extent. I think that this sounds a lot like statements that we can make about yield curves or interest rates: they are hard to predict accurately and they vary over time. So, some parallels to C-3 risk analysis are already starting to emerge as we define the problem.

I believe that we probably all feel intuitively and also from experience that diversification has a major effect on the risk exposure of a portfolio. The size of bonds and the industry category are variables that influence an individual company's risk exposure. In order to write down strategies or run models, there are at least a couple of variables that you need to specify. First, what are the starting assets on the valuation date, on your schedule D or whatever? Second, what reinvestment strategy do you think you will be following in the future? Or do you want to test several strategies and compare them? This is really comparable to the reinvestment strategy and the cash flow models for C-3 risks. It is probably important, since diversification is important, that a good C-1 risk model or methodology reflect diversification's impact on the risk. A nice test of that would be to look at two portfolios, one of which seems riskier. Would the model actually produce a higher indicated level of risk? If you were to take management action over the course of time or all at once in order to reduce the level of exposure to default risk, would the model actually show an improvement in things like risk charges, reserve levels, or surplus requirements?

It seems that basic to C-1 risk is the observation that bonds in default are rarely totally worthless. There is a residual stream of cash flows. And you can capitalize them, in other words achieve their present values, by selling the bonds in default, though it may not always be the most profitable thing to do. But, if you do sell for the salvage value, with some remarkable consistency over long periods of time, the average has been a salvage of about 40% of par. Now

in a given year, when you look at the actual bonds that have defaulted, that ratio can vary from 10% to 90%, but the average is remarkably stable over long periods.

Now at some point it is important to take a look at combined investment risks, which means C-1 and C-3 together. At some stage we can stop using separate numbers for them. This is probably true simply because in the real world it may be tough to manage them in isolation from each other. Just to explain why that may be true, economic conditions, the real external environment, are definitely going to affect both default rates and interest rates. In turn, the default rates and the interest rates influence each other. For one thing, default rates and salvage values depend in part on interest rate levels. For another, cash flows, duration, and book yields are all affected by asset default events.

So, let us take a look at what a model for C-1 risk should do. These are specifications in a sense, but not "specs" such as those for a computer program. They are specifications for what a model should be able to achieve when used within a management team, a management process, or a management information system. First, for valuation actuaries, C-1 risk analysis should be consistent with scenario testing for C-3 cash flow simulations. This is an opinion, but one which is borne out if we just take a look at what has developed in the last few years for ways to approach the C-3 risk. It would be nice if we could incorporate what all of us have learned from looking at C-3 risk in the context of things like the New York Regulation 126 requirements. It ought to be realistic, not too theoretical, and too expensive to build or use. Perhaps that last point would really be the acid test.

To be useful in individual companies, I think it would be helpful if the approach were one that let you handle your existing asset portfolio and also your existing liability in force that reflects recurring premiums, and reflects open blocks of business. And in particular (I think this is another acid test of methodology) it should reflect the sensitivity of gain and loss to the timing of defaults during the projection period. Timing would mean, for instance, timing of default events versus liability cash flows, or timing of default events versus different interest rate levels. But when you have cash coming in and going out for all the reasons that it does, and look at a 20-year projection for a block of in force, a

catastrophic default event of 10% which takes place in one year is going to do different things to your year 20 surplus depending on which year it happens.

That would not be true if you looked at a pure asset accumulation of zero coupon investments over a 20-year holding period. However, if you are looking at insurance companies' annual statements, then the timing becomes rather important. As I have already said for valuation actuaries in the companies, the approach ought to permit measurement of the reserves and surplus requirements for C-1 risk exposure. Then for pricing actuaries the approach should enable them to measure risk charges and also to go through the process of reconciling credited rates to book yields, while considering anticipated costs of default. Lastly, the tool for analyzing the investment strategy dimension of asset quality allocations should be able to quantify the risk return effects of different asset quality allocation strategies.

Let me say what these different strategies might look like. For instance, you might say that you are willing to put 20% of your assets in junk bonds and 80% in investment grade. Or, you might say, what if we are only willing to go to 10%? What if we went to 50%? What would happen? In addition to the question of how much money in the aggregate goes into the different quality levels, how much money goes into each individual bond? Would you have a limit of $3 million per bond? What would happen if you let it become $10 million instead? What would happen if you let it become $20 million instead? So now we are ready to take a look at a three-step approach which will try to addresses these requirements and needs.

Step one is, simply because the default rates are unpredictable and variable, to use scenarios with non-constant future default rates. So here what we might do is look at a different picture of the problem rather than assume a flat 2% default rate on junk bonds on a projection, or use something like a 150 basis point reduction to the book yield in order to arrive at a net earned yield for purposes of reconciling spread earnings. Certainly the scenario should vary by asset type, meaning bonds and mortgages would not show exactly the same default experience as current research can demonstrate. Default rates also have to vary by quality because your triple As and your single Bs are not going to default the same way. And rates also vary by industry -- where they have their own

ups and downs as businesses. Also there are different characteristics depending on how concentrated the businesses are.

In Step two, we need a way to approach the effects of diversification. Here what we can try is to use Monte Carlo sampling techniques within the scenarios in order to quantify some of the statistical effects on risk of level of portfolio diversification. Briefly, once we are given a scenario which says year by year what default rate is assumed, rather than assuming that that default rate each year applies to the aggregate principal, what we really own is a series of individual bonds. Each of them is exposed to that assumed environmental default rate. Depending upon how experience works, various bonds will or will not default that year. This is comparable to a portfolio of heterogeneous life insurance lives. These lives will have different ages, different face amounts and different standard or substandard ratings; Monte Carlo techniques are often used to understand what the gain and loss tail can look like.

It has been suggested that mortality and default are very similar phenomena. So we can use actuarial techniques which are fairly well established for looking at the mortality risk and apply those techniques to get a handle on C-1 risk.

Let me briefly review what Monte Carlo methods are. Basically they develop information on very complex distributions by empirical testing in situations where it may be impossible or impractical to derive a closed-form solution. The basic events, in this case the defaults of the bonds, are simulated by "flipping a coin" (i.e., the computer using its random number generator). Then a financial model calculates the results caused by those randomly generated events leading to the big picture, in this case accumulated surplus or whatever.

In Step three, what do we do when we find that individual bonds default? Well, we can sell them for salvage value and reinvest the proceeds. So we can assume that in the model. Salvage value is an assumption. It could be fixed, or vary with interest rates or randomly. Or perhaps it makes sense to just use a flat 40%. Then we take this and we do it within the context of cash flow projections. This means that we project asset and liability cash flows from the existing in-force data bases of assets and liabilities, using appropriate assumptions.

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Once we start getting results, cash flows, full profits, and accumulated surplus,
all items actually reflect the impact of risk exposure. Again, within the sort of
methodology that has evolved for how to approach the C-3, what we are doing
here for C-1 contemplates the same range of results. We are going to have a
range of possible future environments and we are going to get a range of future
financial performances reflecting the different C-1 exposure and loss environ-
ments that we wish to examine or test. In this case we are actually looking at
Monte Carlo runs within scenarios. And we need a fair number of them to get
useful results. But one of the nice things about computers is that we can let
them do all the work. In short, approach the C-1 risk analysis the same as you
would the C-3 risk.

Now to get started, since this was a C-1 risk research project, a constant yield
curve was assumed to isolate results to the pure C-1 risk. However, the model-
ing that was used is based on existing C-3 risk modeling programming, and it
was modified as necessary to carry out the three steps described. There are
plans later to look at the combination of C-1 and C-3 risks, and this can be
done by using multirisk scenarios. By that we mean scenarios that specify a se-
quence of default rates along with the sequence of interest rate paths and
something that can be an asset adequacy model, which is using scenarios and
making cash flow projections.

Now I would like to touch on a couple of finer points and ways that you might
address C-1 risk analysis using these models, or things that you might like to
see if you were using this approach.

First, there is a question about whether a company can actively monitor credit
quality and sell off investments before they ever get to the stage of defaulting.
Technically you could assume there is a certain rate at which levels of credit
deterioration occur. And there is going to be some sort of rule as to when you
are going to sell off deteriorating investments. A simple rule might be, if a
bond deteriorates to 75% of what otherwise similar bonds are selling for at the
time, you will sell it, for its 75% salvage value. Then there is the question of
credit upgrades, "fallen angels" and downgrades, and investments that experi-
ence a reduced rating as time goes by. You can address this in one of two
ways. With a "grayness" in the boundaries between the different asset classes,
you might argue that to a certain degree the Monte Carlo sampling process itself

covers that. For instance, you will have some defaults because of sampling error even among your A-grade bonds. You might argue that these have to be "fallen angels." On the other hand, you may have some good experience with some of your high-yield bonds where they don't default, and you could argue that this represents permanent or temporary credit upgrades.

The handout presents some results for sample test runs using this technique which were for pure zero-coupon investments over a 20-year period. The conclusions that came out of that initial analysis were that the impact of diversification, the way it is being reflected here, on the uncertainty of future profits, is substantial.

It is also interesting to compare some of our conclusions to those of a study done at Morgan Stanley as to the effects of diversification on the gain versus loss tail. The Morgan Stanley study found that diversification actually truncates the loss tail more than the gain tail. In other words, if you thought of a distribution of wealth at the end of twenty years for different levels of diversification, as you increased the diversification you squeezed more to the right, chopping off the loss tail of the distribution function by more than you gave up on your upside potential. This suggests that in fact: (a) this whole approach is giving us some useful results in the real world validated independently; and (b) the Monte Carlo sampling part of the model may be worthwhile.

Diversification is one thing that we don't have to do for C-3, because C-3 risk is not inherently diversifiable the way C-1 is. However, given the fact that it is a different risk, it suggests an additional approach.

There is the question of the size of the individual bonds that you buy. Taking a look at the actual dispersion, including statistical noise, of wealth at the end of twenty years, there were some results with relatively undiversified portfolios to this effect. At the underlying constant default rate scenario of 2%, the wealth was actually below what it was in some of the Monte Carlo samples where the external environment was assumed to be a constant flat 4% rate. I think that is interesting because again this addresses the extent to which assuming a flat constant aggregate rate may understate the level of risk or profit volatility for different asset allocation strategies.

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Now just let me briefly mention the Mandatory Securities Valuation Reserve
(MSVR). It might be interesting to put these two approaches together and see
what they tell us. The work there is in a very preliminary stage, and I think
it is too early to guess where it might be leading. But there is an NAIC
Advisory Committee which has a subcommittee that has been charged with looking
at the MSVR. So all of these things are being brought together gradually.

The next thing after this relatively simple test case, was to take a look at an
actual product example. This was a universal life block of in force. The
statistical results are not summarized here, but we looked at an in-force block of
universal life business and made up six default rate scenarios, showing a
recession ten years from now, a depression, a saw-toothed pattern and boom
time. On some other work we had found that forty Monte Carlo samples for a
given scenario gave reasonably credible results, so we ran that number. In
other words there were a total of 240 individual projections, forty Monte Carlos
for each of the six scenarios. We assumed a constant 40% of par salvage value.

It is interesting to see qualitatively what preliminary results came out of that
analysis. First, the introduction of the Monte Carlo sampling as a way to
represent some of the effects of diversification, showed an increase in the range
of ending surplus after a twenty-year projection by from 25% to over 100%,
depending on the level of portfolio diversification. The next thing that I think
is particularly relevant to valuation actuaries is that the worst cases derived
without using Monte Carlo samplings were roughly equal to the tenth percentile
results with the sampling having been introduced.

What does all this really means about the reserves? It is conceivable that you
might like to have a reserve that guarantees a level of solvency of 90%. In
other words, nine times out of ten you would like to see solvency at the end of
your testing period and 10% of the time you are willing to tolerate insolvency.
You might do a range of calculations and see how much surplus is needed at the
beginning to end up with the right sort of result in the end. If you are using
the approach of taking the default rates and applying them deterministically to
your aggregate principal each year, you are going to get a result that is under-
conservative to a potentially significant degree.

QUANTIFYING THE C-1 RISK

Let me wrap-up with a precis of what we have done before and then a look at the work that lies ahead, which I think is very extensive. First, we have seen a modeling approach to studying the C-1 risk that seems to be cost effective and practical. A justification for the "cost effective and practical" statement is that the work to develop this model and to get to the point where we could actually put real live products in and run them was all achieved in the last several months.

The work was done by making relatively straightforward modifications to an existing software package which is explicitly designed to handle the C-3 risk. But because this approach to modeling C-1 is consistent with cash flow scenario testing, and was in fact derived by modifying C-3 risk cash flow simulation models, I am suggesting that we might be closer than we think to being able to apply C-1 evaluation methods without that much added expense.

The broad conclusion that we might like to think about is that a practical method for valuing reserves and surplus should reflect diversification's impact on risk exposure. Monte Carlo sampling provides such a method in part, however the output you get from this sort of testing is critically dependent on the choice of the default rate scenarios. In fact the correlation of experience within an industry or across industries that results from a slump in airline companies, or a major depression or "stagflation" is something you need to take into account. This process is sometimes called "contagion," which means that one claim isn't independent of another but a whole bunch of them come along together. This is something that can be addressed through the proper choice of the scenarios. However doing it is by no means a simple process.

Speaking of scenarios and areas for future research, I think that the choice of the default rate scenarios is an area that is going to need a lot of attention for quite some time. The reason is that we need to make a distinction, as the Committee on Valuation and Related Areas has made, between a model or method- ology and assumptions. A model is like a schematic representation of the real world. It is a series of mechanical processes; you put things into it and other things come out of it. What comes out are the results, what goes in are the assumptions. What I have presented here really is just a description of what a method or model is. We would want to select the assumptions by carefully looking at some of the research that has been done and by taking a look at

alternative approaches, such as the handmade scenarios that are referred to in New York Regulation 126.

In the realm of the random walk, or stochastic, scenarios there is a very important question as to what distributions might be appropriate. Some of the C-3 risk or asset liability modeling software vendors have discussed the different distribution processes used to generate the stochastic interest rate scenarios came up. You can ask some of the same questions and I think some of the models used for the interest rates are not that appropriate for default rates, because in some ways they are very different phenomena.

Eventually we need to get a handle on combining the C-1 and C-3 risks. This could possibly be done by using a cash flow simulations model which makes use of scenarios that are in a sense multirisk. They look at the default and the interest rate dimensions of risk at the same time. This would enable us to develop what you might call a combined asset adequacy model.

The work presented here was the summation of review and research done by a number of other people and conversations which took place over the course of this year. Some of the research and conversations involved members of our entire panel and also a number of people in the audience. Also contributing were some published references by Rick Sega, Jim Tilley, the combination of risk task force that was chaired by Mike Mateja, and many others. So I would like to express my thanks to them.

MR. RONALD S. LEVIN: I have a couple of questions for Bob Callahan. First, Bob, could you go over the proposed restrictions that are contained in Regulation 130?

MR. CALLAHAN: I think that Terry Lennon should answer that.

MR. TERRY LENNON*: The regulation that is probably going to be signed by the Superintendent basically has a 20% limitation on junk bonds, with the exclusion of small private placements. This gets a little more complicated

*   Mr. Lennon, not a member of the Society, is Chief Insurance Examiner with
        the New York State Insurance Department in New York, New York.

because the definition of junk bonds in the regulation is basically what the valuation office rates them because that becomes the lowest common denominator. So really it covers junk bonds, as measured by the valuation office. There is no restriction on private placements below $50 million. More or less everything else has a 20% of assets limitation before you need the prior approval of the superintendent. So even the 20% is not a strict limit; you just have to come in and justify anything further. There is also a requirement now in the regulation that the board of directors of any company that invests in junk bonds must adopt a plan in writing that sets out all the parameters of the investing practice and management of those investments. I think that thumbnails the regulation.

MR. LEVIN: My follow-up question is really based on a observation and a contrast between Regulation 126 which addresses interest rate risk and Regulation 130 which addresses credit risk. I think it is pretty clear that between the two risks, interest risk and credit risk, interest rate risk is by far the greater risk. I think you could easily go through a couple of mismatches of duration and go through some severe interest rate swings, which we have seen a number of over the last seven or eight years, to see that the interest rate risk is by far greater than any default experience that we have seen in the first part of the century. Having made that point, Regulation 126 which addresses interest rate risks is quite reasonable and flexible and leaves much to the judgment of the insurance company, particularly the actuary. Whereas it appears that Regulation 130 which, is addressing the lower risk, is taking away that element of flexibility and judgment.

MR. CALLAHAN: Regulation 126 was put out before Regulation 130. It does have a different definition as to what a high-yield asset is, but generally for the vast majority of your assets which will qualify as high-yield, they will be such under either regulation. There is a tremendous overlap even though the definitions are not exact. Now if the yield on junk bonds is 3% higher than on high-quality bonds, there has to be a reason for that. There is the risk of greater default, plus these bonds generally have more call features in them. And they can be called not only in case of interest rate drops, but also in the case of rating increases. Those ratings improve and they can qualify for a lower interest rate.

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I am told that the issuance of junk bonds, and I think Irwin's paper notes this, has increased tremendously in the last few years. Our prior experience with junk bonds was primarily with respect to bonds which were originally investment grade. In recent years issues of bonds which were not investment grade at issue have increased tremendously. I think basically the opening remarks on Regulation 130 said that we do not have sufficient experience on this new animal. In case there is a downturn in the economic cycle, there could be a disaster. If that spread should be 2%, fine. Make it 2%. But don't come in to us with pricing and valuation which ignores the default deduction from gross income altogether. While we have suggested in Regulation 126 reducing income by 2 1/2%, we did allow for other methods. Frankly another method which could be considered might be to use the mandatory security valuation reserve, where generally the charge against junk bond assets is 2% a year to build up the mandatory security valuation reserve. If you make no other deduction to your projected income for these junk bonds, at the very least ledger a 2% charge. And if you don't make provisions one way or another, you can expect to have your Actuarial Opinion and Memorandum rejected. We made it very clear in Regulation 126 that we wanted to have this considered.

Now we also find that there is another problem that has developed. During 1986, a lot of companies traded their high-yielding assets for lower yielding assets, taking the capital gains. While the MSVR is not my primary area of responsibility, in getting ready for this panel I had to look into it. I find that capital gains have to be added to the MSVR reserve unless you are at your maximum MSVR reserve. I also find that this 2% a year can be accelerated to 6% a year if the ratio of the reserve you hold to the maximum is less than a given percentage. We have also said in Regulation 126 that the reserve has to be at least as great as the amount of assets that are required to mature the obliga-tions. Now if for 1982 issues, where the valuation interest rate was 13 1/4% and you had 14% bonds with call protection or deep discount bonds that you could sell and take your capital gains and the bonds you replaced them with are yielding 10%, then Regulation 126 says you have to set up a higher reserve than what you held based on a 13 1/4% asset yield.

MR. LEVIN: My question is why we are not given the same flexibility as we are given in 126 with regard to high-yield bonds?

MR. LENNON: There is no doubt that 130 is somewhat less flexible than 126. I think there is a history behind it. For one thing, 126 is applicable to every company that writes annuity business at this point and will write single premium life within a short time, I think. Everybody has to do it, and it has to be measured.

Let's note very carefully that there is only one company that is affected by 130 that is licensed in New York at this point. The other company that has concentrations in junk bonds is around the 20% level. There is nobody else that is over 10%. So you're really arguing for flexibility in only one company. In point of fact, Regulation 130 might not have come about if each year when that percentage built up and we talked to that company, and they had offered any-thing reasonable. The 57% concentration number was determined based upon the calculation of the MSVR. The MSVR is calculated based upon the valuation rating assigned by the valuation office; a lot of low-grade investments get rated as yes bonds by the valuation office. The real low-grade investment concentra-tion of that company is about 70% of its assets.

So while there is less flexibility, it applies to a very narrow range of companies. I don't think you could argue that we are imposing less flexibility on the entire industry at this point. The point is that we have asked Altman, we have asked Bloom, we have asked many experts and all of them say the same thing. Nobody knows what the new generation of junk bonds that began in the early 1980s, bonds that were not fallen angels but rather junk bonds from the date of issue, will do in a severe downturn. And it is that uncertainty, not any sense of doom about junk bonds, that led us to do what we did.

MR. LEVIN: If you look at what traditional insurance company investments were ten years ago, they were predominately private placements which, were they issued publicly today, would have been junk bonds. We did not see the kind of Regulation 130 restrictions on junk bonds applying to private placements. It seems that we are taking away a part of a traditional insurance company market.

MR. LENNON: Again, I can only add that the private placements are rated by the valuation office, and according to those valuations, which are the same that are applied to the junk bonds, there is nobody in excess of a 10% concentration. I might also add, I have done a percentage distribution of all assets. There is

no company that has any kind of asset concentration, other than a few that deal exclusively in corporate and treasuries, as high as 57%, let alone 70%, in any type of asset which has not had a full history. I think that in this instance we are dealing with a unique situation.

MR. CALLAHAN: I would like to make one comment in connection with the 20% limit. If the junk bond market is 25% of the total bond market, which it was about the end of 1986, then 25% would constitute a level of diversification mirroring the character of the market by quality. If the Department says 20%, then the Department is insisting upon a modest movement away from perfect diversification toward somewhat higher quality. No one to the best of my knowledge has presented a convincing argument as to why diversification for intermediaries, who are in some sense fiduciaries, should be slanted toward lower quality, at least not to any great extent.

MR. STEVEN A. SMITH: What is the average salvage value of a bond that goes into default? Is is down around the 20% range, or is it 40% or 50%? I think Mr. Buff had said that some of your tests involved the 40% assumption. Does the salvage value vary by the quality of bonds? Would something that was AAA have a different salvage value than a junk bond?

MR. BUFF: If we consider all the bonds that defaulted from 1970-1986, the average loss of par value to the time of default was 60%. That is the same as the Hickman study in the earlier period. There was considerable variation in that. Strangely enough, there were some bonds that in fact had a value above par when they defaulted. That was a small percentage. They were convertible bonds. There was at least one large bond, Republic, which had a default and had a more significant loss. Actually in the year in which it defaulted, from January 1 of that year through the default which I think occurred in September, the loss was 75% of value, and that was a large issue. Crystal Oil had a 60% loss of value from January 1 through a July default. So the average loss has been 60% from the par value, but the losses in some particular years on some rather large issues have been substantially greater.

MR. SMITH: Let me just make a slight modification. Do you think that the last fifteen to twenty years worth of history is what we are going to see in the future? Is it still going to be the 60%?

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MR. BUFF: As far as I know we had 60% losses over the last fifteen years, we had 60% losses over the first 85 years of this century on the average. I don't see any reason to believe that this is going to change. During the 1930s there were losses of 80% on the average for that specific decade. But I don't see any evidence that the 1930s are going to reoccur. I think that the last fifteen years is good evidence of the average we are going to see in the future. I look for this. I had a study done of the 280 defaults in the last fifteen years to see how they behaved because I believed that in fact there weren't any investment grade bonds that were really going to collapse completely during a specific calendar year, and yet there were a couple. Republic was a pretty decent-sized company. The bond issue was a decent-sized bond issue. So a lot of variation actually has occurred in specific bonds over the last fifteen years. But the averages I think will be the same in the future.

MR. SHRIRAM MULGUND: I have two questions. In determining the C-1 risk, can one take into account the amount of surplus which is held by the company? The reason I am asking the question is that if the particular portfolio that you are looking at, say accumulation annuities, has some high-risk bonds, then the investment people could move the high-risk bonds into the surplus account and bring some good bonds into the annuity account and thereby the C-1 risk could be reduced. The impact of the C-1 risk, can it depend on the amount of surplus that is held by the company?

The second question is, are these comments which have been made by the panelists related to just one type of investment, which is the bond? There are a lot of other asset types which could be supporting an annuity portfolio and individual life insurance, particularly the participating business, among them real estate, equity stock, preferred stock. Now can anybody make any comments as to how one could assess the C-1 risk for these assets?

MR. BUFF: I guess the issue you are addressing is the surplus that the company has and what that does to its flexibility. Certainly the approach that we talked about takes in your existing assets and liabilities. So by effect it takes account of your surplus if you are starting out with any. And you would certainly want to take that into account. And I guess we would all agree, yes, if you have more surplus, maybe you can afford to take more risk. But just be careful, as a last thought, that moving the same assets around and putting them

somewhere else doesn't seem to change the risk exposure for the company as a whole unless you are also changing some of your management or administrative strategies as a result of moving the assets. So just moving assets around doesn't change the company-wide picture, which is the one that really counts.