

RECORD OF SOCIETY OF ACTUARIES 1988 VOL. 14 NO. 4A

INVESTMENT QUALITY MEASURES REVIEW

Moderator: PETER B. DEAKINS
Panelists: EDWARD I. ALTMAN*
ROBERT P. CLANCY
Recorder: PETER B. DEAKINS

- o Techniques for assessing default risk:
 - Performance by bond quality rating
 - Simulation of default risk and returns on corporate bonds
 - Managing for relative value
 - Sector value differentials
 - Rating classes
 - Securitization
 - Interaction of default and interest rate risks

MR. PETER B. DEAKINS: I've assembled an excellent panel. I've got Dr. Edward I. Altman from the New York University. He's the Max L. Heine professor of finance and chairman of the MBA program there, as well as being a consultant to Merrill Lynch Capital Markets. Dr Altman is renowned, he's published numerous papers; somewhere in his resume I think I saw that it's 70 papers published, and he's published a number of books discussing fixed income securities. He's basically one of the leading experts on fixed income securities. He's been a visiting professor at a number of universities in Paris and Brazil. His credentials are almost too numerous to mention. Dr. Altman is going to be talking about the results of a study he's recently done looking at fixed income performance. I'm really interested in hearing what he has to say.

We also have Robert Clancy who is a portfolio manager at Standish, Ayer and Wood. His responsibilities include general quantitative research and uses of futures and options. Bob is an investment professional, but he's also an actuary so it will be interesting, he can probably speak our somewhat convoluted language and at the same time speak the investment people's somewhat convoluted language. He's going to be talking about relative value and value added trading and how you look at bonds of different qualities and try to decide what you should be buying.

And I'm going to end the session with a little discussion of some simulations I did that tried to look at the interaction of the C-1 and the C-3 Risk-what happens as interest rates change and as bonds default, the kind of interactions you see between those risks.

MR. ROBERT P. CLANCY: I'd like to address two topics. First I'd like to talk about investment quality as a dynamic investment consideration. By that I mean

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a portfolio manager should look at the desired investment quality of a portfolio as something that changes with time and changes with market conditions, rather than the situation where the portfolio manager always buys the same quality investment. The other subject I'd like to address is the impact that securitization has had or is having on the quality of investments. As we'll see later, it's possible to take a block of assets and securitize them and turn them into a combination of both higher and lower quality investments than that of the assets that you start with.

Starting off with quality as a dynamic investment consideration, one obvious end of the spectrum of quality considerations is that of junk bonds. Dr. Altman is going to talk about that with a lot more authority than I will, but it dawned on me in the last few weeks as I was thinking about this, that junk brings a certain honesty to the portfolio management process in insurance companies that other investments don't necessarily have. Just as a brief review for those of you that aren't familiar with quality considerations, there are investment grade securities and we'll talk more about that in a few minutes, and then there are below investment grade securities, which are sometimes referred to as no bonds. Depending on whether the bonds meet one of two tests that the NAIC uses or whether it fails those tests altogether, it can have one of those categorizations shown on the slide, no with 1 star, no with 2 stars, or no with no stars. Now it's these no bonds that really bring an honesty to the process. You might view these as the junkier junk, the ones that are already in default, the ones that are really a mess. The reason that I like these is that these happen to be valued for annual statement purposes at NAIC value. The NAIC value is really an approximation to market value. What that means is that if the portfolio manager goes out and sells this security in this situation, it really doesn't have any impact on surplus or on assets other than perhaps a slight impact due to tax considerations. In contrast, with other types of securities that are higher quality that are allowed to be accounted for at book value, the portfolio manager may feel constrained about going out and incurring a book loss and having an effect on surplus and assets. So in this situation, the portfolio manager's decision to sell or not to sell such a security is really motivated by economics -- what is this bond's perceived value and what does he or she expect that it's going to do in the future versus other alternative investments that can be made. So the portfolio manager is really making the decision to sell or not to sell for the right reasons and that's based on a projected return.

This projection of return over some time period, or total return as it's referred to in the investment business, is a very appropriate framework for analyzing most if not all fixed income investments and not just the junk bonds I've been referring to here. Indeed, there are a number of insurance companies that are increasingly looking at their bond portfolio on a total return basis. For those of you that aren't familiar with this methodology, it consists of three parts: First, you pick a time horizon which is typically six months or one year; then for a particular investment, you project the payments that you are going to get over that time period. You also estimate what earnings you can get from reinvesting the payments that you get from this bond over the one year period, and lastly you estimate what the investment that remains at the end of a year would be worth if you went and sold it at that time.

So to look at a quick example, suppose we have a 10% ten-year par bond that you pay \$1,000 for. You would get coupons over the course of a year of \$100. If we take our \$50 coupon in six months and reinvest that at an assumed rate of 7%, we would earn \$1.75 over the course of the year. If for illustration

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purposes, we assume a scenario where the end is at a 9% rate, then we would be able to sell it at \$1,060.80 and if we add all that up, the total value at our horizon date would be \$1,162.55. If we relate that back to the initial \$1,000 investment, we see that we earned 16.26% on an annual basis. If you prefer to speak in bond speak or the way that investment people tend to speak, they'd call that a 15.64% bond equivalent yield. For those of you who remember compound interest theory, this is simply an i upper 2.

Now before I get to the heart of what I consider to be quality considerations, I'd like to introduce a couple of definitions. First of all, quality ratings in general are generally promulgated by major rating agencies, Moody's or Standard & Poor's. You also have government guarantees where the full faith of the U.S. government is standing behind the issue, and you have agency backed paper as well, where there's an indirect government guarantee. Some of the agencies that popularly issue bonds are Federal National Mortgage Association (FNMA), Federal Home Loan Bank, Student Loan Marketing Association, Fed Farm Credits and so on. Among corporate bonds, the highest rating of AAA indicates that default is highly unlikely, but I do know of many insurance companies that bought Penn Central bonds back when they were rated AAA and subsequently saw that there's no guarantee that the bonds won't ultimately go into default. The AA and A ratings generally represent high quality corporations, but as you've all been reading in the paper in the last week, there's an increasing fear that such corporations can effectively get all junked up. RJR Nabisco last week announced plans for a huge potential buy out which will greatly increase their debt, greatly increase their leverage, and probably lower their ratings and prices commensurately. And then there's BAA ratings which are the lowest ratings that are still investment grade.

What I really want to talk about are spreads, which is what investing in corporate bonds is all about. Spreads are simply the additional yield that an investor demands over Treasury bond yields to compensate the investor for the additional risk. As some examples of such spreads as of several weeks ago, one major investment banking firm estimated that for new ten year bonds that were being issued in the marketplace at that time in September, an AAA industrial bond might have required about 40 basis points additional yield compared to a ten year Treasury bond, AA industrial 50 basis points, A industrial 60 basis points, and BAA industrial 100 basis points. Obviously, the lower the rating, the higher the yield and the higher the spread. Not all comparably rated bonds necessarily require the same spread. For example, in a different sector such as utility bonds, an A utility bond might require 70 basis points of additional spread, or a BAA 95 basis points. Perhaps an easier way to see this would be a single A bank and finance bond, which would require say 90 basis points as opposed to the single A industrials which required 60 basis points at that time. This is a reflection of the fact that in the bank and finance sector, these corporations or entities are more prone to problems with third world or lesser developed countries' debt problems. You could also have bonds from corporations that are in the oil sector, and might be subject to the volatility of changes in oil prices.

Let's take a look at an example of how a portfolio manager might look at a corporate bond and an alternative. In this case, the Marriott 8 7/8 coupon of May 1997 has a rating A and as of October 13th, had a price a little over \$96, which would have resulted in a yield to maturity of 9.55%. A comparable Treasury bond that we'll call our benchmark would have been the 8.5% coupon of May 1997 and at that time, it would have been yielding about 8.84%. The difference in

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yields between these two bonds is 71 basis points and this is the spread. This spread is compensating the investor for not only the risks of the business in general and the sector that the Marriott business is in, but it is also compensating the investor for the risks inherent to the Marriott Corporation in particular and its own financial situation.

The next thing we can do is try to project what the total return would be for these two bonds and let's look at the very simple interest rate scenario where there's no change in interest rates. For the Treasury bonds on the top line, let's assume that we can sell this bond at the end of one year at a yield of 8.84% which is the same as our original purchase yield. If we assume that we can reinvest the payments that we get over the course of the year at a rate of 8%, the total return on this bond would be 8.79%. For the Marriott bond, if we assume we can sell it at a rate of 9.55%, the same yield that we bought it at, and we can reinvest our payments at a rate of 8%, then the total return over the course of a year would be 9.46% which is 67 basis points more than the Treasury bond's total return over the one year horizon, which is consistent with the starting yield spread of 71 basis points.

Now consider that for some reason, whether it's because suddenly Marriott is rumored to be a takeover candidate or for some other reason, suppose Treasury yields haven't changed in a year so our projection of total return on the Treasury is the same, but that for the Marriott bond, the yield spread has increased another 14 basis points so that at the end of a year, we estimate that we would have to sell this bond at a yield of 9.69% rather than 9.55%. In this scenario, we would earn a total return of 8.79% which is exactly the same as the total return on the Treasury of 85 basis points, 14 basis points more than the starting yield spread of 71 basis points, as a break-even yield spread. Another observation here would be that if this yield spread increased even more so that we had to sell the Marriott bond at the end of a year at a rate even higher than 9.69%, then our total return would be even lower than 8.79% and in fact, this corporate bond would underperform the Treasury bond over the holding period. In that situation, the portfolio manager would be better off buying a Treasury bond and ultimately selling it, and then buying the Marriott bond or something else at the end of a year. Thus, the manager would be better off having bought a lower yielding Treasury up front than he or she would have been buying the higher yielding corporate up front. One point that I'm trying to make is that spread changes are important, even if interest rates in general are remaining relatively flat. Our next question is what about interest rates changing, since interest rates not changing is a pretty unrealistic scenario. We could do the same kind of analysis that we just had up there for different scenarios. If you focus on the right-hand most column (a one year horizon), and you see that if interest rates don't shift for Treasury rates, then our break-even yield spread is 85 basis points, as we just calculated. We could calculate what the total return would be at different horizon yields for the Marriott bonds for different scenarios and figure out what the yield has to be on the Marriott bond in order to produce the same total return as the Treasury bond. If interest rates are up 50 basis points, over the course of the year, then the break-even yield spread would go from 85 to 87 basis points, and if interest rates are down 50 basis points the break-even yield spread would be 83 basis points. The point here is that this break-even yield spread is relatively independent of changes in interest rates; it's not greatly influenced by changes in interest rates. We can also do the same kind of analysis for different horizons; we don't just have to look at a one year horizon, we could look at a six month or a three month horizon as well. You'll notice that the shorter the horizon, the lower the

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break-even yield spread is. Another way to look at this is to say, for the unchanged interest rate scenario, that if the yield spread goes to 85 basis points in six or nine months rather than one year, then over that six or nine months, the fact that the yield spread has increased more than the break-even spread that's shown here for six months would mean that the corporate bond would have underperformed the Treasury bond.

So what does all this mean? First of all, the ability to predict or anticipate spread changes is very important and can often lead a portfolio manager to not always buy the highest yielding investment. The manager may, in fact, figure that buying a Treasury bond in the near term is a better bet than buying a higher yielding corporate bond. This begs the obvious question; can investment people really predict the direction of spread changes any better than they can predict interest rates in general? I'd argue that investment people in general cannot predict interest rates very well at all. In the long term I'd say that they can't do it and if they have any success in the short term, I'd probably attribute it to luck. As for spreads, though, I would probably say as an investment professional that many of them do have successful track records at this, that yes I think that they can somewhat predict spreads, either the direction that spreads will go or how spreads on a particular instrument or sector might change relative to other sectors. Another reason why you might believe that people can successfully predict spreads on a sector or a corporate bond is that's what credit analysts get paid to do; that's their job. They try to look at the financials of a particular company and find out whether this is perhaps a particularly strong or weak financial situation relative to the rating that the bond has and relative to the price that the bond has in the marketplace. If the analysts do their homework, they can also get a feel for the risks of the industry that the corporation is in.

For example, some oil companies might be very vulnerable to changes in oil prices, while other oil companies that have more diversified business might not be as vulnerable to changes in oil prices. In practice, a portfolio manager probably wouldn't decide to buy a Treasury bond if he or she felt that this yield spread was not wide enough compensation for buying the Marriott bond. The manager would probably buy a different corporate bond where he or she felt that the yield spread was relatively fair in the marketplace at the time. He or she might buy single A bank paper with a higher yield spread, or the manager might buy a BBB industrial bond. If the spread on the bond that the manager purchased narrows relative to the spread on this Marriott bond that he or she thought not to buy, then he or she made the right decision.

In short, what I'm suggesting is that this strategy of looking at different qualities and sectors and trying to analyze what's the best value at a point in time, which is called "Sector Rotation," can add value. It suggests that portfolio managers shouldn't always buy a single A rated bond or whatever the target quality is for an insurance portfolio. Sector rotation does require some trading but you can always superimpose some limits on the amount of trading that you're willing to tolerate so that you can still get the benefit of this kind of strategy without necessarily destabilizing surplus. Total return provides a framework for analyzing corporate bonds and quality risk. I would note that the insurance industry is becoming increasingly more total return oriented. One basis for that statement is that most of the major insurance companies now have in place a compensation scheme which, at least in part, compensates the portfolio manager based on their total return on the portfolio versus some benchmark. That benchmark may be a customized index that's constructed or it may be a

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published index like the Shearson Lehman corporate index or it could be a custom constructed analysis of the liabilities where you're trying to get at what a market value based profit of the product line might be over a time horizon. So, the bottom line here is that I would like people to view investment quality as an opportunity and not just a risk and that portfolio quality should be dynamic.

The second topic I want to discuss briefly is securitization and the impact that it can have on quality. Assets, as you may know, can be packaged together and effectively securitized and sold off. There are a number of securitization packages around. These include mortgage backed securities you've all heard of Government National Mortgage Association or GNMA bonds. There are collateralized mortgage obligations or CMOs. There are asset backed securities which include debts secured by car loans or credit card receivables; very recently there was one secured by boat loans which has been referred to as a "Marina Mac." Policy loans were sold earlier this year; commercial mortgages and private placements also have been packaged together in these kinds of deals. What relevance do these securities have? The relevance is that if you go back in time, it wasn't very exciting to think about quality considerations for securitized packages. In the old mortgage backed security days, all you really had to look at was the underlying collateral; what are the mortgages that are underlying this package and what degree of extra collateral got put into the package to make it extra secure. These securities generally got an AAA rating and that was all you needed to know. Well it's not quite so simple any more.

Now there's a possibility in some situations that if a number of loans end up in a problem situation that the issuer can substitute new securities, new collateral. There's a possibility in fact that an issuer might be able to substitute junk bonds in place of some mortgages that have gone into default, so the holder of these securities can end up with underlying collateral being very different from what was anticipated. The language in new deals is being written carefully to preclude such possibilities. But what I think is the interesting development is the increasing complexity of the structure of these kinds of deals and the ramifications of that complexity.

Consider the following situation where we take a bunch of below investment grade bonds, say BA rated bonds, and suppose we're going to divide the collateral up into pieces or tranches consisting of five, seven, and ten year notes. Suppose we structure this in such a way that all of the payments that come in from this underlying collateral of BA bonds goes first towards taking care of the interest and principal payments of the first tranche, the A1 tranche. Then any payments that are leftover go towards satisfying the obligations of the second tranche. Anything that's leftover after that goes towards satisfying obligations of the third tranche, and so on. Chances are, depending on how this is structured, that this first tranche would end up with a very, very high rating; there is probably a very small probability that all of the bonds in this package, in the underlying collateral, are going to default. So the first class may have a triple A rating, the second class might end up with an AA rating, the third class may have a single A rating, and that gets you to thinking about the fourth class. The fourth class is certainly not the kind of class that's going to leave you with a warm cozy feeling going home at night. The point here is that it is possible to create securities that are rated both higher and lower than the underlying collateral through some of the increasingly complex techniques that there are available for structuring these deals.

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In conclusion, I'm trying to make the point that there are opportunities for improving investment performance and that one opportunity is to rotate on a dynamic basis the quality and sectors of the portfolios under management. There are also new and increasingly complex vehicles which present opportunity in the marketplace. To take advantage of these opportunities you need good investment personnel, not only to find the opportunities but to put up with the increasing complexities that the marketplace throws at them. My current boss openly admits that it's better to be lucky than skillful in managing bond portfolios, but says that if you're not there behind your desk to be looking for the opportunities and getting the phone calls, you're never going to be lucky.

A total return framework is a valid framework and is increasingly useful for analyzing the increasingly complex world of investments. The last thought I'd like to leave you with is to suggest that I'd like to see more insurance companies focus more on maximizing long term surplus and maybe a little less on trying to just stabilize surplus in the near term. Thank you very much.

DR. EDWARD I. ALTMAN: I think we should also acknowledge the moderator of our session who introduces us, but nobody introduces him, it's a thankless job. I've done it before, I'm sure you all probably either have done it or sympathize with it. Peter Deakins is our moderator from the firm of Milliman & Robertson, consulting actuaries. I'm very pleased to be here this morning and I would like to thank Pete and Art Djang from Merrill Lynch for recommending that I talk up here.

This is my first talk at a Society of Actuaries session, and probably it's the most appropriate talk that I could have given for such a group because in the paper that I'm going to discuss this morning, I borrow from actuarial techniques in order to assess the default risk, the C-1 risk of insurance corporations, in the fixed income security market and I had no idea when I started doing this research that I would get a chance to talk to a group such as this. Let me give you a little background on some of my work, and how it led up to what I'm going to talk about this morning. For about two decades, I've been doing research in the general area of investments and finance, but in particular, one of the areas that I've done a fair amount of work in is the area of predicting corporate bankruptcies, using mathematical and statistical models to assess the credit worthiness of companies. So when Bob Clancy talked about credit risk and having a lot of people around, or at least some good people around, to look at that for a particular situation, I'm very much in tune with that, and in fact, a number of the models that I've built address that issue directly. About four years ago, I was asked by one of the investment banks in New York to look at a new industry that they wanted to get into known as "high yield junk bonds." That is, fixed income, straight securities that promise very high rates of return, high yields, to investors; but of course the investors take on a higher risk as a result. Traditionally, over the last ten years, the yield spread, that's the promised yield spread, what companies promise to pay investors, has averaged close to 400 basis points above Treasuries. So the numbers that you saw earlier are small in comparison to the high yield junk bonds spreads which have been available and that spread is probably close to 400 basis points today. That's the average for high yield junk which is rated below investment grade.

I started doing research in this area and came up with a number of papers in this area and particularly emphasized one aspect of the market, namely the default risk potential of companies which is so important when looking at this industry. I began to get a lot of calls from investors after this work came out.

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Insurance companies, indeed, called quite often because insurance companies are probably the largest investors in junk bonds today. We estimate that insurance companies make up over 30%, of the industry, and the industry today in high yield junk bonds is close to \$200 billion in size. So if we talk about over 30%, that's \$60 billion of junk bonds that are held by insurance companies and the potential is even greater, not only in the United States, but abroad as well. Insurance companies said, "I would like you to look at default risk, not so much lumping all junk bonds together, that's BB, B, and CCC categories together as given by Standard and Poor's and Moody, but I'd like you to dichotomize it or separate it further into particular quality groups; BB alone, B alone, CCC alone. Have you done that?" And I said, "No I haven't. I don't think anybody's done that." They were saying also I'm interested not only in the bankruptcy and default potential of securities but I'm interested in how long it takes for a bond at birth to be extinguished, to die, to have mortality or not to have mortality. This started me to think that that's very similar to the way insurance actuaries look at people: What's the probability of a male born in the United States today to live for one year, for two years, for five years, for ten years? They get an average, 72 to 73 years for the average male born in the United States today, maybe a little higher, but also we're interested in the marginal mortality from year to year and the cumulative mortality over time. So I said this might be an interesting area to research as no one's done it yet and I'd like to try it. So that's the genesis of the paper that I'm going to talk about.

Very quickly, let me tell you a little bit about the high yield junk bond industry. Junk as we all know is a pejorative term given to something that you should stay away from or at least be careful. The genesis comes from the first type of companies which make up the high yield junk bond industry, the so-called fallen angels. A fallen angel is a company that was issued, received an investment grade rating, AAA, AA, A or BBB at birth, and due to credit deterioration dropped from investment grade to noninvestment grade. Bob Clancy talked about credit qualities and spreads and the like and he referred to these bonds, although not by the name fallen angels. I must tell you that in the last few days in the United States, we have seen a major scare to the corporate debt markets coming about by what's happened with the RJR-Nabisco leveraged buy out proposal and now a take over attempt by KKR, and the prior week, it was Phillip Morris trying to take over Kraft. The point of this is, that when you're investment grade and you issue a bond and it sells at perhaps 50 to 100 basis points above Treasury, the risk is far greater than that AAA rating implies. You can only go in one direction -- down -- in terms of your bond rating. Any time you go down, that means a drop in price and a higher yield. So the promised yield always was based on the idea that these really wouldn't default so you're going to get that 50 to 100 basis points from now until maturity. Now it's quite clear that this is no longer the case. In fact, I have some data at home which take a look at the drift in bond ratings from AAA down to CCC over time and I think that's an important area as well. Anyway, the fallen angels probably make up 25 to 30% of the market and maybe more if in fact, RJR and Kraft and Philip Morris and the others get down-rated. That would be an example of a different type of fallen angel. That's an example of a company which didn't have credit deterioration based on its product but had a major restructuring take place. This represents something called "Event Risk," that being the takeover attempt, and I think you'll see this term being used a lot more in the media. The concept of event risk has always been in the academic literature; an M&A (merger and acquisition) or some bad news coming. This is a

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one shot deal which can move a firm from a single A rating down to a BB or a single B overnight and that's a type of fallen angel.

The second type of bonds in this market are emerging growth companies; this is the one that the major investment banks would love you to understand as the reason for this market to be and also why it's so important to the United States. That's a company which ten or 15 years ago did not have access to the financial market directly; if they needed debt financing, they went to insurance companies and private placements and commercial banks for loans. Now they have the opportunity to go directly to the public market, issue debt and because they're emerging, they're smaller, they're unseasoned, and they get a low rating as a result and have to pay maybe 300 to 500 basis points above Treasuries, but still they prefer that to their other options.

The third type of bond in this market is bonds used for financial reorganization. In 1988, these have been about 70 to 75% of the market. These bonds include leveraged buy outs, leveraged recaps, mergers and acquisitions, hostile takeovers and the like. These are very controversial, they cause the blood pressure of regulators, of managers, and of investors to fluctuate dramatically, just as prices do.

Mutual funds, insurance companies, pension funds, and thrift institutions are the four main types of financial institutes that invest in high yield debt. They are also the main types that invest in high quality debt. Today in the United States, it sounds surprising to some people, but we have almost 100 mutual funds dedicated to investing only in high yield junk bonds. About \$33 to 35 billion worth of mutual funds, many of which are not called junk bond funds, they're called high yield or high current yield or whatever, but it's the same animal. My brother, who lives in this area, called me up about a year ago when he started reading my work on junk bonds and he said, "Edward, I think my daughter's money is in junk bonds. Now what should I do? I didn't know that I bought Fidelity's high yield fund. A couple years ago when I thought high yield, I didn't know it was junk. What am I supposed to do?" I said don't do anything. Don't put all your money in that area either. Just like common equities, you don't want it all to be in junk bonds.

Enough said on the background of the industry. I could talk for hours and hours on the industry itself, but I'm really more interested in talking about the C-1 risk, default. Not only default risk and how you measure it, but can you use these concepts of measurement in order to assess the fixed income performance of all corporate debt. So I will not only be concerned in this paper and this presentation with high yield junk bonds, but I'll be concerned with all corporate debt from AAA down to CCC.

First let's go over the traditional way that people in the finance industry and in other industries measure default risk. It's a very simple concept. All that has been done up till now is you look at some period, like a calendar year, you look at the dollar amounts of debt that have defaulted, the par value of debt that has defaulted, and divide it by the population of bonds that were outstanding that could have defaulted. It's almost like a survival rate, those that have survived and those that have not survived over that calendar year period. So for example, over the last decade, these data show the dollar amount of debt that was outstanding as of June 30 of each year, the par value of the debt that defaulted, and dividing the one into the other you get the annual default rate.

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Then you average the annual default rate over some period like ten years and you get the average annual default rate in terms of percentages.

So for example, in 1986, \$3.1 billion of corporate debt defaulted, all of it, of course, rated in the high yield junk bond or low grade sector prior to default so everything was relevant in terms of that. There were \$93 billion of high yield issues outstanding and \$3.1 billion of defaults, so 3.39% was the default rate in 1986. In 1987 that rate was 5.46%. I call 1987 "the year of the asterisk," and that asterisk is Texaco. Texaco defaulted, as you know, based on their big battle in court they went bankrupt as a business strategy and they defaulted with over \$5 billion of public debt. That skewed the data for that year dramatically. If you include Texaco, the default rate was 5.46%, without it, the rate was 1.34%. So far in 1988, the default rate has been about 2%. Now what does that default rate tell you? The way analysts generally look at the default rate, they say: "Well let's see now. I'm promised a certain yield spread and for junk bonds it's about 400 basis points or 4%, above Treasuries. Maybe it's less or more depending on the time period and I've got data on it. Let's say 400 basis points. I expect based on historical results (and the average is for a period of 78-88) around a 1.87% default rate. That's the average annual default rate. So if I subtract one from the other, I should get my expected yield." Promised yield minus default should give me the expected assuming no change in interest rates and Bob Clancy talked about how interest rate changes may or may not be important. But that's a problem by the way that I believe Pete Deakins is going to talk about; interest rate risk is your C-3 risk and is something that all fixed income securities, including Treasuries, have. So if you just subtract 1.87% from 4%, you'll get a little over 2% as your net or expected return. However most analysts will say no, it isn't the default rate that's important but the default loss. What investors lost from defaults, rather than the rate. And the reason why the loss is different from the rate is that on average, corporate bonds sell at about 40% of par value after default. In other words, they're not worthless. In fact, this is one of the major attractive aspects of the corporate bond market compared to the private placement market. There is liquidity after default and usually that rate is around 40 to 45% above par. So how do you calculate that? This is 1988 to date. If you're an investor in junk bonds in 1988 so far the default rate is about 2% as I said. The average loss of principal has been 54%, on a weighted average basis in 1988 and therefore the loss of principal has been 54% of 2% or 1.08%. You lost 108 basis points so far in 1988 from default plus what else do you lose when you have a default? The other thing you lose is a coupon payment that you would have collected if it didn't default. Most bonds default when a coupon payment is coming due -- when an interest payment is coming due. The exception to that is when you have a big bankruptcy and all the bonds outstanding are defaulted at exactly the same time. But most bonds default when they have a six month, seven payment to make, and actually they have a 30 day grace period after the six month payment. If they don't make it during that 30 day period, this is a legal default. But even before that the rating agencies move them down. So you must also add in the loss or the opportunity cost of the lost interest in 1988 that was 12 basis points, giving you for 1988 so far 1.19%, or 1.2%, you've lost from default which turns out to be pretty much the average over the last 15 years. Not always, some years are higher, some years lower. What happened in 1987 with Texaco? Even though there was a 5.46% default rate, because Texaco bonds sold in the 80s, or over 80% of par after default, your loss rate was relatively low. That's why it's very important to look at loss rates as well as default rates. This number is important, this 1.2%. The reason why it's important is if you went to look at the promised yields from junk bonds, say it's 400 basis points, and on average

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you would have lost 1.2% a year from defaults you net that out. Assuming no changes in interest rates, your net return should be quite attractive, over 2.5% per year net return from investments in high yield bonds. I'm not going to talk about this, but certainly a criticism of this analysis is the fact that: "Yes, but that was the past. What's going to happen in the future? What's going to happen when we have the next great recession or depression? Then aren't you really going to go down the tubes?" And the answer is, certainly you're going to have a tough year or several years, and you're going to do a lot worse in equities by the way than you will in bonds. So people who say that shouldn't be as concerned with their bond portfolios as with their stock portfolios.

The last thing I want to talk about before I get into the new research is the genesis of defaults. Our analysis shows that 32% of all defaults were originally rated investment grade. This is another reason not to be complacent about the investment grade rating. And indeed, five of them were AAA. Those were all Texaco bonds, by the way. Bob mentioned Penn Central, but that's not in my data base because that was issued prior to 1970. This data base includes debt issued since 1970. It would be in there otherwise. Thirty two percent were investment grade, that makes 68%, which were noninvestment grade at birth. One year prior to default, about 6.7% were investment grade and six months prior, less than 2%, were investment grade. Now for the tough question, "Can we do two things?" One, can we look at default rates and losses, not lumping everything together into the junk bond category or investment grade, but by bond rating. So the cohort group we'll be looking at are bond ratings at birth, AAA, AA, A and so on. Because that's the way your portfolio reads. Your portfolio does not read junk or investment grade, it reads much more finely than that. The second thing is can we say anything about these probabilities of default over time. One year after birth, two years after birth, five years and so on. The current state of the art says nothing about that. All it says is junk bonds on average default at about 2%, or 1.87%. It doesn't say the age of the bonds and it doesn't say the bond rating class. So that is what our objective is in this analysis. To look at bond ratings as cohort groups and also to look at the time it takes and the losses that you incur.

Finally, and the bottom line to this whole analysis, can you use those estimates of losses from defaults over time by bond rating category in order to get the net spread that you would have earned by investing in different portfolios? And here we include the very important and dynamic element known as compound interest. We all know that's what drives fixed income securities. The question is can you isolate from that compound interest the losses from default by bond rating over time. And that's the objective in our analysis. Let me go directly to the methodology which, as I said at the beginning, borrows from actuarial science in some ways.

We have two measures that we'll be looking at. One is called the marginal mortality rate and the other is the cumulative mortality rate. The marginal mortality rate of bonds is very similar to the traditional way of measuring it. It's the total value of defaulting debt in a year relative to what was available in the beginning of the year. The cumulative mortality rate (which is somewhat on the new side) takes a look at one minus the product of the marginal survival rates. For example, if you have a 1% default rate in the first year, the survival rate was 99%,. If you had a 2%, default rate in the second year, the survival rate was 98%,. You take the product of the .99 x .98 and subtract it from 1 to get the cumulative mortality rate.

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I believe that's very similar to the way it's done for individuals although it oversimplifies it a little bit. Again in this analysis, everybody's the same, you're either BB or BBB but you're all the same within that category.

Let me give you a quick example. Let's suppose we're talking about BB rated bonds issued in 1981. There was \$1.5 billion issued. In that year \$50 million defaulted, \$100 million was called and \$20 million was retired by sinking funds. By the way, in corporate death, unlike human death, there's good death as well as bad deaths. I don't know, it's kind of a morbid way to look at it, but bonds can die without losses to investors, through calls, sinking funds, defeasance, and other types of extinguishments. As a result, when we look at these survival rate data (this took a lot of time, a lot of grunt work), we had to go back and look at not only the defaults over time by bond rating class, but calls and sinking funds. Any of you who've gotten your hands dirty with that data know it's not much fun. Fortunately it wasn't my hands. In one point in my career it was. We had \$175 million that was extinguished from \$1.5 billion, leaving \$1,325 million at the end of the first year. In the second year (these are hypothetical numbers by the way), another \$100 million defaulted, \$200 million was called and \$40 million was sunk, a total of \$340 million went out of existence in the second year reducing the population to \$985 million. We calculate the first marginal mortality rate as \$50 million defaults divided by the beginning amount of \$1.5 billion, or 3.3%. In the second year, \$100 million defaulted divided by \$1,325 million which was outstanding at the beginning of the year, giving us a 7.5% default rate. Then what's necessary is to put it all together with respect to all the BBs issued over some sample period. In our study, the sample period was 1970 to 1987. I don't know if it's clear, but it was a lot of data. In other words, you have to take a look at what was issued in (let's suppose the sample period was only four years) 1981 to 1984. We had to take a look at all the BBs that were issued over that period and look at the one year experience, two year experience, three year experience and so on. We don't just take one particular year. So then we cumulate all the one year experiences, divide the amount defaulting into the amount that was outstanding to get the mortality rate of 1% in this case, but for all the one year experiences over the 17 year sample period. We had to do the same for the two year experiences, and so on. Obviously, as you go further out into time, 10 or 15 years out, the number of observations diminishes for a given sample period. Now let's get to the results.

I'll leave out the amount issued. This is the cumulative mortality rate by bond rating class over a ten year horizon. You probably have this in your notes as well. This is .13% for AAA; 2.46% for AAs, that's pretty high -- that's mainly due to a lot of Texaco bonds; .93% for single A; 2.12% for BBB; 6.64% for BB; and 31.91% for single Bs. This surprises a lot of people. They say, "My God, we had a cumulative mortality rate of almost one third in the single B rated class. Isn't that terrible. I'm going to stay away from that. That's horrible." Well, it's only part of the picture. The next step is to see what were the losses from these defaults. So if we take a look to the ten year experience again these are the losses. Only .01% for AAA; .5% for AAs; .26% for single As; for single Bs, 24.89% would have been lost. Remember that the mortality rate was about 32%, but 24.89% is the loss rate for single Bs in ten years. The point is how bad is that. The answer is we don't know yet. What you need to do is build an algorithm in your portfolio to include those loss rates and compare it with your net interest rate spread that you earned over risk-free Treasuries in that period. And that's the bottom line in the analysis.

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If you're looking at average yield spreads, I find for 1970 to 1987, we find 50 basis points for AAA; this is the yield spread over Treasuries at birth; 87 for AAs, 116 for single As, and 404 for single Bs. These numbers are going to be very important because in our algorithm we actually look at real live return spreads over time. This is the bottom line of the analysis. If you had invested in various bond rating classes over the period 1970 to 1987, these are the basis points compound return you would have earned over ten years after adjusting for default losses. So for example, you would have earned over ten years 1245 basis points if you were in AAAs, 2028 in AAs, 2885 in As, 4577 in BBBs, 7637 in BBs and then 4467 in single Bs. So far the results show over a long horizon the best bond rating class to be in was the BBs. I call that the quality junk segment of the junk bond portfolio, the highest rated of the junk bond portfolio. You had a higher return there than either BBBs or single Bs because the mortality rate was much higher for the single Bs, but still the return spread is quite positive for single Bs.

Pete Deakins is going to talk a little bit about integrating interest rate risk with the default rate risk, but this analysis does not attempt to do that. I'm not smart enough and I don't think anybody's really smart enough to play the interest rate game for long periods of time and do better than anyone else. I would much prefer to concentrate on the performance over long periods of time with respect to default rates, losses, and mortality.

A final note: How can you use this data. Obviously, the investment manager can use this data in looking at various portfolios. For insurance companies, if you're worried about such things as adequate reserves for default losses, at least two companies are using this analysis to set up default loss reserves based on those mortality loss statistics. I think that's a much more attractive way to do it than ad hoc choices for reserves based on some numbers which have nothing to do with the characteristics of your portfolio.

MR. DEAKINS: Basically, what I tried to do was see what happens if you vary interest rates when you have defaults. I looked at a bunch of different default assumptions, although I was trying very simple ones. I was not looking at the kind of stuff that Ed was just talking about where you move from one bond class to another. I just said bonds are going to default at .25% a year and I would look at that as an expected default cost layering in an assumption about how much you recover at that at the point of default. I also looked at what happens if you just use that as a fixed default cost and what happens if you look at that on a stochastic basis where you look at the impact of diversification. Then I also looked at what happens if you start layering in economic scenarios. I was just trying to get a feel for all of this. This is preliminary stuff so I'm not sure yet what conclusions I'm reaching.

One of the things I've concluded though, is that with the uncertainties that most people feel as to what future default rates are going to be, it seems to me that you should only do very fancy analyses if you're in the high yield or BBB areas where the expected defaults are big enough to justify doing it. When I looked at what happened with 25 basis points expected defaults and compared that to the magnitude of the C-3 risk, or the interest rate risk, I found that the C-1 risk was very small relative to the C-3 risk for the products I was looking at, even if the portfolio was not highly diversified or if there was a volatile economic environment. When I looked at 250 basis points of default expected default cost, which might be consistent with a very low grade junk bond, I found that the default risk and the fluctuations in the default risk due to

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diversification or due to economic scenarios could have a tremendous impact on conclusions you would reach, either for valuation actuary work or for pricing work.

MR. FREDERICK S. TOWNSEND, JR.: With respect to the future, I'm wondering how well we can draw upon the past. For example, I noted that from 1982 to 1985 the number of outstanding issues tripled, and from 1985 to 1988, the number tripled again, so in actuarial jargon, I guess we've got a lot of business in the select period -- the very early years -- where your default rates are probably less and these bonds have not been tested over time. Secondly, the last six years, when the market has grown, have been a relatively good business period, so again we haven't been through a period of stress in the business world. Thirdly, we have the phenomenon which I call the circle of friends: A buys \$50 million of junk bonds in B and then B buys the same amount in A. B buys some in C and C buys it in B, then A buys bonds in C and C buys them in A. So if one of these members in the circle has trouble, what happens to everybody else in the circle? I wonder if either of you would address these issues.

DR. ALTMAN: Well, let me try to address a number of them. I think you're very kind to use the term circle of friends. I've heard it referred to in a lot more flamboyant terms, washing each other's dirty laundry, or something of that nature. But I think the most important point you made is: Can we look at the historical data in making assessments about the future since the market has grown so much and maybe even the issuers have changed from what they were before. The way I'd like to answer that is not as directly as I would prefer to do. I couldn't tell you for example, "Yes you can be absolutely certain that the average default rate of a little under 2% is going to continue for another 15 years." If you look at the last three years by the way, the default rate is somewhat higher, around 2.5% a year and the default loss about 1.6% instead of 1.2%. So I'll try to answer it this way. First, I believe you and others are absolutely right that in the next major recession you're going to find higher default rates than we've had up to now. I think the higher defaults will last as long as the recession lasts, which might be a year, it might be three years. By the way, are you, in asking that question, also concerned about your equity portfolio performance in that period? Because we know from history, and there history is very close, October 1987; we know what happens to the stock market when the prospect for a recession increases -- the junk bond market went down 7 to 10% and the equity market went down 25 to 30% depending on which index. So, be concerned with other assets, not just with junk bonds, in a recession. I can't tell you what the default rate will be, but let me try to answer it in a different way. Would you say that a 10% default rate is likely to happen in a major recession? If you say that, you're talking about \$20 billion a year in defaults, given the junk bond market today. If you're prepared to say, "Yes, it could be \$20 billion", we're looking at some really big companies going under and wholesale defaults among smaller companies. I don't think it's too likely, but yes it's certainly possible. How bad would a 10% default rate be? Well let's see. If it's a 10% default rate and the average bond sells at 40% after par (by the way I think that's going to continue, Hickman did studies back many many years before the current junk bonds were around during the Depression years and the like, and he found 40%, also. So 40% seems to be a very stable recovery rate over the last century for defaulted bonds), that means that at a 10% default rate you're going to lose 6% from principal and maybe another 30 basis points from lost opportunities and interest. So we're talking about a 6.3% loss from defaults in a very bad year. The yield spreads are going to get higher, but let's suppose they stay at 4%, so you were promised 4%, you lose

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6.3%, that's a net loss of 2.3% compared to Treasuries. You still might actually gain. So I don't think it's all that bad, although it's not a good year and a couple of those years in a row might create some real problems.

A final point that illustrates the real risk of this market, is that under a real negative scenario, with massive defaults due to a major recession, maybe 10 to 15% default rates and loss rates of 6 to 9%, the real risk is massive redemptions on the part of funds which have to sell during this negative scenario period. Those are the institutions that are going to get hit and hit hard. If you have to sell, if you don't have to sell, what's the risk? Your risk is that the companies that you've invested in will still be around to pay off when the bonds mature. That's a lot different from having to sell in a down market. If you can stick it out, then of course your risk is much lower. It also presents some amazing opportunities for investment if you're liquid in that period of time. Of course, not too many institutions were liquid on October the 19th, or wanted to be liquid. They went to the high credits with low risk. That's a bit of a convoluted answer to the question, but I think those are the kind of considerations you should be looking at, rather than to say I'm not going to believe any of the historical data because they're not all that relevant. We just can't cancel out history. I think it's relevant, but it's not going to give you the exact answer.

MR. DONALD D. CODY: I'd like to follow up a bit on some of the implications of the possibility of massive defaults because Dr. Altman has just described an insurance company when he said to be careful if you're subject to massive redemptions. We actuaries have been concerned about the adequacy of total assets under "plausible deviations" (which is jargon) from expected. We split the total assets into reserves and surplus. The reserves are supposed to have margins in them to take care of a much lower level of deviation which we call "reasonable" and I would say, Dr. Altman, that those reasonable deviations should conform to those we've experienced the last ten years. What the defaults would be in an economic upheaval I don't know, but I think they would be very high for these high yield bonds. So, for surplus purposes, we have to consider the C-1 Risk at that higher level. Now we usually attach, at least I usually do, a ruin probability of maybe one in a hundred as a basis of determining the surplus required. C-1 Risk isn't our only risk, there's the C-3 Risk, and we have all the other typical insurance risks referred to as the C-2 Risk and you never know which one's going to occur. The surplus is real for all of them, but when you do the default loss reserves, which is a hunk of your surplus needed, that has a cost which nobody has mentioned and the cost is how much do you expect to earn on your surplus versus the cost of capital. If you have to keep it invested in securities, you earn a typical security market yield, if you invest it in your own business you assume you get something higher, we sometimes talk about 15% as a round number. Now the difference between the 15% and what you're earning on that loss reserve should be a charge to the earnings that you make on the various bond quality levels. Thus, the effective yield on high risk securities should have the cost of the surplus tied up charged against it. I thought I'd mention this and get your reaction because of your vast experience of study in this field; you could probably give us some reactions that would be very valuable in our own thinking.

DR. ALTMAN: I don't think I'm going to venture to try to answer, and I don't think I can unless I studied it a little more closely than I have, all those interactions with respect to the cost of reserves, but I certainly agree with the general principles. There are significant costs to the reserves and I guess

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you're really referring to the opportunity costs. You could use that money elsewhere and you must consider your own cost of capital, and if you're not earning a return greater than the cost of equity and the cost of debt, then you're not doing your stockholders any good or if you're mutual you're probably going to be losing surplus. Let me just try to answer one little part of your question because I really think it's too complex a set of issues to give you a complete answer now. The setting up of reserves is absolutely critical. You want the reserves to reflect the level of diversification. So you have an incentive to be diversified and you want to have good credit assessment as well. The choice of a high reserve figure will hit hardest on those institutions which have the smallest capital base and I think that's exactly the institutions you want it to hit hardest, because those are the ones that are closest to being insolvent or at least having distress. Setting up adequate reserves, which have important costs, is exactly the right way to go. You may quarrel with level of those reserves in terms of my numbers versus the doomsday scenario, but I see no problem with assessing a high cost to those reserves and then only the most able institutions, those who can take advantage of this market, should be in it. Otherwise what you find is abuses, such as institutions right on the brink of distress saying, "What do I have to lose?" This is called a moral hazard problem. This is a critical problem for FDIC and FSLIC insured institutions, but the reserves could help structure the safety of the industry, rather than having ad hoc restriction against investing in this asset class at all.

FROM THE FLOOR: It does seem there has been some flight to quality junk. The spreads on single Bs may be twice the spread on BBs: When you publish your research, isn't that going to change the future in this respect by making that trend even more obvious?

DR. ALTMAN: Yes, that's a risk. I used to say that you can exploit this market with the concept of quality junk, and I was referring not to the bond rating class, but of doing your homework such that you don't necessarily believe what the bond rating agencies tell you. I mean they do a decent job, but not a great job, and I think you can outdo the market by doing your own homework, using models combined with qualitative analysis. What you're pointing out is that as this work gets published and accepted, this will move more individuals toward the BB and away from the single B/CCC area perhaps. I hope, by the way, that it will also move people from the AAA/AA area. I really think that's a negative. I can't understand that strategy, I never could, and in today's market I can't understand it at all. But anyway, I hope they'll be moving away from them because they came out the lowest in terms of net performance.

FROM THE FLOOR: In other words, you make the market more efficient?

DR. ALTMAN: Perhaps. Or let me say it a different way. I don't know if you make it more efficient, but there's a way to look at your portfolio and what spreads are available to you. Let's suppose that the BB spread goes from 3% to 1.5%, which is not impossible, maybe that's what is happening today. Then what you do is you take the algorithm and you simulate what the return would be with a 1.5% spread, based on the mortality losses that have taken place. Then you can get your net performance with a 1.5% spread instead. In fact, I've got some of that data in this monograph I'm writing. I simulate different sensitivities to the yield spreads. If the yield spread is not any more attractive for BBs, you should not be in them.

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MS. JUDITH MARKLAND*: I think each of you have talked about default in terms of net expected yield. We're grappling with defaults in terms of the duration of the bond portfolio. I think each of you has addressed various themes that relate back to that. I wonder if you would try to recast your thoughts and tell us how we might link interest rate changes or volatility back to duration through defaults.

MR. DEAKINS: I have two thoughts on that. First, the less concerned you are with duration, the less concerned you'll be with the impact of defaults on your duration. My feeling on that is that this is like when you're walking down the street and you step on something; you don't know what's there until you pick up your foot and look at the bottom of your shoe. I don't think you can really simplify it. I think you have to go in and do some down and dirty analysis to find out what happens. Duration is an approach that a lot of people are looking to as a shortcut to doing their homework. In the end, you have to do some simulations and find out what happens to your portfolio as interest rates change and as you get defaults and you layer in all the assumptions you have to make and just kind of pick up your shoe and find out what's on the bottom of it.

The other thought I have for you is that unless you're in pretty low grade bonds the defaults aren't going to change your duration that much, particularly compared to their impact on the C-I Risk. You need to remember that duration is not that fine. You're not fine tuning a TV here. When you fine tune your duration, you're really fine tuning with a sledgehammer. If you talk about the duration of GNMA's or callable bonds, that's a very fuzzy number, so that what happens with defaults just makes it slightly more fuzzy. I personally wouldn't be too worried about that, although you can probably tell from my response I'm not a big fan of duration analysis, so that may make me not the greatest person to answer this questions.

DR. ALTMAN: One or two thoughts on duration. First of all, I find that the easiest way to teach and understand duration is to compare high yield bonds with Treasuries. You see the average high yield portfolio has a duration of a little under six years. Treasury might be 8.5 to 9 years. We've actually worked on matching durations and taking a look at the volatility of returns given matching and we find that those volatilities tend to come together. The long term Treasuries have much greater volatility than almost anything because of the lower coupons. There is some work being done by Jerome Fons at the New York Fed on adjusting duration for default risk. You might be interested in that. He's also giving a paper at this NYU conference in December on that very issue: Duration and Default Risk. I believe Jerry Blerwag out at University of Arizona is also doing some work in this area. I tend to think duration is quite important, although with the convexity issues and lots of other things, it gets a little messy to try to match it exactly. I do believe that much of the work on duration assumes no default risk. I think an important improvement, even if you're not a fan, but certainly if you are a fan of duration, would be to see how much of an impact some of the mortality numbers have on duration. Finally, when you mentioned duration did you also refer to the age of the securities or only to the technical measure of duration?

* Ms. Markland, not a member of the Society, is Vice President, Group Pension Guaranteed Product Services with John Hancock Mutual Life Insurance in Boston, Massachusetts.

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MR. CLANCY: As far as relating default risk to duration goes, there's no easy answer to that. If there were, people in your shop and people in other shops would have come up with an easy answer long before now. One thing that most people should be aware of is that some of the simpler models for assessing bond risk that are available from various third party vendors just assume that default risk is a constant spread, regardless of maturity for the same corporation. However, the longer you're exposed to the risk of this corporation, you would intuitively feel that the default risk has got to be greater. So those models are clearly in error. How you'd go about tinkering with those models to make them reflect your view of reality is a more complicated problem. As far as relating spreads to duration, that's a very important consideration and the total return framework that I was looking at does that directly. For example, if you look at some short maturity instruments, maybe you're looking to buy something in the two year maturity range, you'll find that the break-even spread may be that spreads have to go from currently 40 basis points to 150 basis points, something that's clearly outlandish over the course of the year, in order for you to be indifferent between two bonds that you're considering. That's just a reflection of the fact that when this two year bond has only one year to go at the end of a year, the impact of a change of spreads or a change in yields is going to be muted because the thing is only a one year bond rather than a ten year bond. So I do think that the total return framework takes care of that and it does present some interesting opportunities.