RECORD OF SOCIETY OF ACTUARIES
1990 VOL. 16 NO. 3

MODELING INVESTMENTS FOR PRICING PURPOSES

Moderator: ROBERT J. LALONDE
Panelists: ROBERT M. BEUERLEIN
DENNIS A. BLUME*
PAUL A. HEKMAN
Recorder: ROBERT J. LALONDE

- Modeling certain securities is not as straightforward as it may seem. This session will provide:
  - -- Modeling techniques
  - -- Appropriate use for pricing
  - -- Potential testing of different economic scenarios

MR. ROBERT J. LALONDE: I am happy to announce our distinguished panel of speakers. Paul Hekman is a Senior Manager of Actuarial Services of PolySystems, Inc. He will be our leadoff speaker. He will give us some of his observations and experiences prior to joining PolySystems, Inc.

We have Dennis Blume, who is the Director of Portfolio Management Operations for Lincoln National Life. In the process of modeling investments for pricing purposes, we have to make many decisions about what kind of scenarios we're going to test. And so I've asked him to address that.

Bob Beuerlein is filling for Bob Hopson, who could not make it. We really appreciate his being able to do this for us. He is a consultant with Tillinghast, a Towers Perrin Company. Bob is located in the Dallas office and has had a wide range of experiences which will benefit us all in his discussion. He is going to talk about the implications of modeling collateralized mortgage obligations, CMOs, and it should be a very interesting session.

We had an excellent luncheon speaker talk about artificial intelligence and expert systems. Leave it to the Japanese, however, to apply something that's even more interesting. The Japanese have resurrected a mathematical concept called "fuzzy logic." Fuzzy logic is an arcane form of mathematics developed in 1965 at Stanford University. The Japanese have adopted it lately to help them improve the quality of their products. For example, Sony has a television with a XBR television tube based on fuzzy logic. The XBR tube has 40 sampling points on the screen and it adjusts the quality of the screen based on those 40 sampling points. Fuzzy logic makes decisions based on approximations rather than based on exact equalities. There are no bright line crossover points in fuzzy logic; rather, conclusions are made based on the qualities of a number of decision points.

* Mr. Blume, not a member of the sponsoring organizations, is Senior Vice President of Lincoln National Investment Management Company in Fort Wayne, Indiana.

Our luncheon speaker gave us an equation for artificial intelligence. The artificial intelligence equation is experience plus facts plus strategies equals answers. This, too, sounds like fuzzy logic.

When we model investments, we work with a lot of facts which we feed into a computer. We want to evaluate scenarios, assets, and liabilities to try to reach conclusions. Yet when we try to pull together experience, and we try to pull together strategy, we are too bright-line oriented. Fuzzy logic may be an approach we could use. It requires special computer chips and a special kind of logic.

I don't know that we'll have any direct applications of fuzzy logic here. So let's get to the program.

MR. PAUL A. HEKMAN: Aren't these postluncheon sessions great? I thought rather than kick all of your brains into high gear right away, we'd start off with some fundamentals and give you a little time to get up to speed. I want to focus on four things in my brief talk. One is, what is the point of what we're about today? Second, and somewhat related, is, what is it about our particular kinds of business that causes a group this large of normally intelligent people to be in a darkened room on a nice summer afternoon? Given that there are some problems that you're trying to address here, what's an appropriate response within our industry and within our own companies to the problems that we'll be talking about? And then to close, I will have specific pricing suggestions that arise out of my own experience in the business.

We have here something which I think is probably near and dear to all of us. This is called a balance sheet. There are two particular problems about balance sheets that I want to address for a little while. One of these is best illustrated by a story that I picked up yesterday from Dave Montgomery. He didn't have an opportunity to tell it in the annuity session, so I thought it would fit in well here.

Picture if you would, an individual who is about to go on vacation to the Bahamas. And we'll call this person the vacationer. Vacationer goes next door to his or her neighbor and says, "I have a little favor to ask of you. While I'm gone, would you please stop in my house about once a day and just check on my cat. She doesn't need much attention, but if you just make sure there's a little food in the dish and a little water, she'll be happy."

The neighbor says, "Sure, I'll be glad to do that."

"One of the requests that I'd like to make is while you're on your way back from checking the cat, would you check on my Grandma's house across the street? She's getting into her eighties and not feeling too well, and I'd appreciate it if you'd just stop in and make sure she's okay."

"Sure, I'll be happy to do that. You've always been good to me when I've been gone. I'd be glad to do that for you."

So the vacationer goes off and a couple days pass. Later a phone call comes back to the neighbor and the vacationer says, "Well, how are things going?"

And the neighbor says, "Well, the cat's dead." There's a long silence at the end of the phone, and the vacationer hangs up and that's the end of the conversation.

The next day, the vacationer calls back and says to the neighbor, "Say, I really couldn't sleep well last night because I thought you were terribly tactless about telling me about what happened to the cat."

The neighbor says, "Well, you know, it was dead, what else could I say?"

The vacationer says, "Well, you could have said something like, the cat got out and it's up on the roof and the fire department is getting it down. But it's going to work out all right, don't worry about it. And then the next day I could have called and you could have said, the cat fell off the roof, but it's at the vet and it's okay. You see the point here? You could have spread this out a little bit and made life a little easier for me in terms of getting used to this."

The neighbor says, "Yeah, I gotta admit, you're right. I really was kind of tactless about that."

The vacationer says, "By the way, how's Grandmother?"

Of course, you know what the next line is. "Well, Grandma's up on the roof, and . . . ." This is how balance sheets work.

Balance sheets in normal statutory and GAAP reporting contain a lot of shock absorbers. And a balance sheet has a lot of deficiencies in terms of telling you what your company is really worth today because of all of the shock absorbers that are built into the accounting systems.

As a result, I think in all of the work that we do here, and as we talk about modeling assets and so forth, the thing that we're really trying to focus on should not be the statutory or the GAAP balance sheet.

We should be looking at balance sheets that measure economic, or if you will, market value. I suppose you could define that as the market value of the assets minus the market value of the liabilities. There might be an addition, of course, some other values there, such as goodwill, or the value of your agency force. But what we really need to be focusing on in all of this asset liability work that we do, is what is the real market value of the company? Not only today, but what happens to that market value with the new products that we issue? And what happens to that market value of this particular organization as shocks move through the economy and interest rates move up and down?

Those are the critical questions. The statutory and the GAAP balance sheets are not very good surrogates, sometimes, for that real market value. Think in terms of what you

would be willing to pay for your company, not in terms always of what you normally work on a quarterly basis.

The other aspect of the balance sheet that I want to talk about briefly has to do with a quotation that I read in Charles Dickens' wonderful novel, *David Copperfield*. There's a fine character in there named Mr. Micawber.

Mr. Micawber is always out of work and consistently in debt, but has some very, very fine observations to make about that process. And one of the comments he makes to young David is to say, "David," he says, "20 pounds annual income, 19 pounds, six pence annual expenditure, result happiness. Twenty pounds annual income, 20 and six annual expenditure, result misery."

The point of that here is that the surplus in most of our companies is very, very small relative to the liabilities and the assets, in some cases getting smaller perhaps. And since the surplus is defined as the difference between the two, it is very important that the two track together, the assets and the liabilities, in different kinds of economic environments. If you get mistracked, then you have problems with your real economic surplus. That's really what we're trying to manage in this type of session. What happens to economic surplus under a variety of conditions?

Let's suppose that on this particular balance sheet, we pick a fairly simple policy reserve structure. Let's suppose that we have one product or series of products which consists of simply a single premium immediate annuity, 20 years of payments, level payments, no options to cash out under any circumstances. It's just a guaranteed set of payments. What's a good asset to cover this product?

Some of you might conclude that maybe the best thing to do would be to buy a single premium annuity from one of your favorite competitors who's offering a higher rate than you are.

Another would be a mortgage, of course, which would provide an exact match to the payment, so that in addition to a duration match, you might even have an exact cash flow match. That would truly be a wonderful situation, one, of course, that we never ever find ourselves in. However, if you had that situation, and then graphed the value of either the asset or the liability under a variety of interest rate scenarios, you might end up with a nice looking graph. This graph could represent both the assets and the liabilities under a variety of interest rate environments. Since they lie exactly on top of each other, then you can sleep nights. Because then, of course, you know that if the interest environment changes, it has no impact on your surplus, because these are exactly parallel to each other.

Now in the real world, of course, things seldom work out that way. And that's why we're all here. What tends to happen is that on both the asset and the liability side, you have these terrible things called options.

Let's suppose that on your single premium immediate annuity, for some marketing reason, you offered the policyholder the right to get the commuted value, and that would

be computed at a constant interest rate, which was perhaps set at the original pricing rate, maybe 10%. What tends to happen is that if interest rates go up, the policyholders tend to take commuted values and try to invest it someplace else to pick up a little more money.

But what happens then is that on the liability side, the cash flows begin to shorten up a little bit as you go into the higher interest rate environment. That tends to put a floor under the curve at the upper end there.

On the asset side, of course, you're familiar with prepayments and calls. And we'll hear, I'm sure, a lot more about that.

If you have an asset with prepayments, that has the opposite effect. When the interest rates drop, you get the prepayments as people refinance the mortgages. And that tends to put a ceiling on the market value of the assets on the other end of the curve. So, if you go ahead and graph the two separate pieces, you end up with just a subtle divergence here between the assets and the liabilities and it looks like it's almost immaterial. Doesn't look like there's much of a difference at all.

However, if you subtract one from the other and put it on the scale of your surplus, you end up with a really interesting curve in terms of what happens to your surplus. And you see that if you give options to both of your policyholders and to your asset sellers, you end up in kind of an uncomfortable situation in which you're going to lose market value of the surplus no matter if interest rates go up or down. Now this, as a matter of fact, is a common situation in the industry.

I would say that there's a good chance that if you look at 1,200 companies, you'd find more companies in this position than are not in it. It's a very common situation to be in.

And the problem isn't really the duration.

Because at the time that we started this whole process, we were in a 10% environment, and we were matched in terms of cash flows and durations in that particular environment. So what's really happening here is that you've got convexity differences between your assets and your liabilities. And it's the convexity that does you in here because the curves move in different directions as you move out on the yield curves.

Now, how do we get into this position?

As the Ford Motor Company discovered with the Edsel a number of years ago, if the consumer doesn't like it, it ain't going to sell. And as a result, you've got to provide ways to jazz up the product so the product sells. So you put options in there. You provide ways for people to get their money out. The consumers like this because they don't always entirely trust insurance companies anyway. And the agents like it because they can move the money around. As the money comes out, you can put it back in someplace else. So, for a variety of needs, we end up with options in contracts.

Competition effectively does the same thing to us. If one of your competitors does something that you consider highly irresponsible, it puts you in the position of having to make a very difficult choice between prudence and survival. It's one thing to say, "Well, we're not going to play those kind of games." But it's another thing to watch your agency forces begin to melt away, and that's a factor here in your economic value. The size and quality of your agency force -- and these are people that you need to retain.

I think regulators sometimes put us in this position, as well. The path of least resistance in terms of filing products and frequently also buying assets, is frequently a situation that puts us in the short straddle position. Where we have options on both the products themselves and the assets, those are the easiest assets to buy, they're the easiest ones to put on the books, they're the easiest products to administer, and as a result, the regulatory environment again tempts us to go along with products which have these convexity problems.

In summary, then, this is the business we're in. We're selling financial products with positive convexities. And we're covering them with, mostly, assets with less positive convexity, or sometimes, even negative convexity depending on where in the yield curve you're sitting. This is, as I say, the business we're in, and it's our chosen business. So rather than belabor this, we need to get on and talk about what needs to be done about the situation.

Your given quantities are going to vary from company to company. Contract design, obviously, plays a factor here. But the contracts you've issued are the ones that you've issued, like it or not, and they're the ones that you have in force. You're working on new ones. But I would guess that, for the most part, they're not going to differ dramatically from the ones that you already have. Your contract designs, however, will vary from one another, simply, again, for competitive reasons. You like to have a new wrinkle in your own contracts.

So your contract design, although sometimes similar to other people's, will have probably some unique features in it, which only you can deal with. Your sales force, again, is the sales force that you have. Companies have occasionally tried to make major changes in it, but it's expensive and difficult and takes quite a bit of time. So, again, this tends to be a given factor for today's balance sheet.

Your policyholders, likewise, are what they are. You've acquired them over the years, and they may or may not be rate-sensitive people. I don't think we necessarily need to assume that because a product doesn't have a credited interest rate, it isn't an interest-sensitive product. I think a lot of companies discovered that particularly whole life can be very, very interest-sensitive. And it was very much so in the early 1980s. So I don't think we necessarily need to focus only on the so-called interest-sensitive products here. I think we need to evaluate all the products that we've got in the light of this.

But some people are very, very rate sensitive. My mother loves putting a little bit of money in CDs and she'll drive all over town for a quarter of a point. I think companies that are issuing CD annuities are beginning to discover the same thing. It's a different population. And you need to know, and I presume do know, what kind of a population

base you have in your particular group of policyholders. These three things together will be a unique combination for your company. And the point that I want to make here, is that since this is unique for your company, there's nobody such as myself that can stand up here and say for you what your particular durations and convexities are. You've got to figure those out for yourself. There's no substitute for that.

We can provide software to help you with that. We can provide advice and suggestions in terms of how to go about it. But ultimately, it's each company's responsibility to work this out and to know what these things are. You have to know what they are, otherwise you'd never know whether your balance sheet is telling you the truth or not. How do you do this?

Well, if you're looking at assets and determining the market value of assets, the option theory is pretty well developed. And if you're done with exams and are looking for new fields to conquer, it's fascinating stuff.

Option theory on the liability side is, shall we say, in its infancy, and probably not even that far. The only real way that we have to look at what options are worth in insurance contracts usually is to run simulations. And this means you do projections of your cash flows. You have to make a lot of assumptions, and we can get into lengthy discussions here about how many projections ought to be made. But generally, the consensus is lots of them. And you're not testing only the scenarios. The other thing that you're testing, of course, when you do the projections, is that you need to test your assumptions. Because the results are no better than the assumptions that go in. It's the old garbage in, garbage out.

You're really after three things. You want to know what the duration is, of course, of your assets -- of your liabilities. But you want to know also what the convexity is, how does the duration change with different interest rates? Does the cash flow pattern stay the same? Or do you expect it to stay the same? Or do you not, as the interest rate changes?

The other thing that you're really after, and we'll get back to this in a moment, is what happens to a particular contract if you remove a particular option?

If you change an interest rate from fixed, for example, to dynamic, and make some reasonable assumptions about what that does, what impact does that have? You need to know things like that if you're really going to handle the types of products that we sell in an interest environment as sophisticated as the one that we're moving into.

I will go so far as to say that if we're not doing this kind of testing with our portfolios at large, we're not really in control of our companies. It just needs to be done. The problem, of course, and I've been there, is simply that it just takes so much manpower to do it. It's a lot of work, and yet the fact is that it has to be done, if you're going to know where you're at in terms of this yield curve situation.

A lot of successful marketing companies, such as Proctor and Gamble, do a lot of test marketing. Frequently we get into product situations where we sell products and we

really don't know what the policyholder response is going to be under a given set of circumstances. We make a lot of assumptions and guesses in terms of the scenarios that we project, but we actually don't know. And I really think that there's nothing terribly wrong with testing it a little bit. Next time interest rates go up, would there be anything terribly wrong about taking one group of policyholders and not raising the rates and letting it stick, and taking another group and giving them a rate increase?

There's a little problem of equity there, I suppose. But at the same time, what you're really trying to do is test your company, and it's a solvency issue. And I think solvency is important to policyholders, too. Certainly, it ought to be.

I suppose the example that comes to mind of testing is a canoe that I once used to have. I used to use it for fishing a lot. And I never tried testing it to its limits. But I bought it because it was unsinkable, I was told. And so I used it for a number of years, and it seemed reasonably stable, and reasonably unsinkable. But as I say, I never really tried to find out for sure.

So one day, I was out swimming and we had the canoe along. And I said to my wife, "Let's take the canoe out and see how unsinkable this thing really is here." So we took it out in about four feet of water and then started rocking it back and forth. And we discovered two things. One was good and the other was bad.

The good news was that the canoe was truly unsinkable. No matter what we did, we could not make the thing go down. The bad news was that as soon as it got half full of water, its stable position was inverted. And if you were in it at that point, it promptly turned over and put you at the bottom instead of at the top. Well, that considerably changed my emergency plans if I ever had to make a decision about what I was going to do if I swamped it. And I think the same thing happens with companies. I think we need to test our liabilities a little bit from time to time in a controlled environment.

If you're not sure about a new agency group that you've got, is there anything wrong with testing their response to not raising a rate when they'd like you to do so? Maybe the time to find out is under a controlled condition rather than in a panic scenario.

Another suggestion is that I really think that we as an industry have got to get more into immunization/hedging kinds of things. We've got a lot of assets, particularly if you have pension funds. I think if you add the life insurers and the pension funds together, there's just a tremendous quantity of assets. I think I saw some statistics a while back, or heard some, that the insurance industry in the United States purchased over 100% of the securities issued in the United States last year, which meant that some of that stuff, of course, was coming from overseas.

It seems to me that if we, as an industry, make a concerted move to define the kind of assets that we need and we want, that those assets will be available. If we need assets with particular convexities and particular duration, it's a free country. Somebody will manufacture those assets and put them together for us to buy. And if we need security and protection from defaults, I think that will be there too.

Everything has its price in the U.S. But the other thing I was going to say is that if the cost of an appropriate asset is more than an inappropriate asset, then that additional cost has to be built into the pricing of the product itself. And this is something I suspect we're not doing a lot of right now. And I think it's something that as an actuarial group, we need to get into much more.

Some specific suggestions, then, in connection with the pricing of products, and observations as well.

First is the one I just mentioned. Put a cost on the options. Know what the policyholder options cost. Know what the asset options cost. So often, we are accused by marketing people, and I think justifiably, of being automatically negative. The field force comes up with a hot new idea and says, "We've got this new product, and instead of making surrenders available, we'd like to issue checks to the policyholders, so they can just write a check on their annuity." The typical actuarial response to that is, "Well, that's kind of a dumb idea." And it may very well be. But this isn't necessarily the best way to present it.

I've discovered over the years that probably a better way to approach the issue is to say, "I think that's a great idea. Let me take a look here and see what it would cost in terms of yield or spread or whatever you want." And if you can come up with a cost on these, even on an approximate basis, it at least moves you out of the Dr. Death scenario, and into a more constructive discussion environment.

Another suggestion is that when you're pricing products, don't overlook the fact that sometimes money, particularly with new products and with new marketing companies, can come in much more rapidly than your asset people can invest the cash. In one of my prior companies, which I will call "troubled company #3," we developed a CD annuity. We had, if my memory serves me correctly, something like $250 million coming in the first six months. And we only had commitments for maybe a third of that. And most of that money sat around in short term paper for a good part of that period. Well, this had not ever been part of the pricing process.

What happens to your product yields if some of that money sits in short term paper for a while? In most companies, it usually does. You need to know.

Look at surplus relief. You've got some long-term guarantees going and you're getting surplus relief. With the paper thin margins that are often present on modern investment products, the cost of surplus relief can sometimes be pretty surprising. I've seen it take, sometimes, as much as a third of the profit margin away.

If you're using real assets in doing your pricing on new products, I think it's a good idea. But the problem that usually emerges is what gets bought is not the assets you priced. I suppose there are a couple of reasons for that. One is that companies tend to invest net cash flows rather than just new money. So, in effect, what you're doing is selling the old assets to the new policyholders rather than cashing them in to cover the surrenders. That has some kind of subtle balance sheet effects. And those of you who are heavily into segmentation of assets know the kind of gyrations that you have to do to account for

that kind of situation. But don't overlook the possibility that some of your existing assets are going to end up with some of your new policyholders, and be sure to test those as well.

The final observation I am going to make is don't overlook the C-4 risk. This is the one I call the quantum theory of ruin. We talk a lot about C-1, C-2, C-3, and so on. These are very important. And I think they can do you in on kind of a microeconomic, day by day basis. But I would say that all of the severe problems I've had in the troubled companies I've been in have been more of a C-4 in nature. I would define these as "bumps in the night." I guess if you're a native of San Francisco you get used to that. In the insurance industry, we don't like those kinds of things. But they do come along.

What happens, for example, to your in force block if you lose a major marketing group? Usually, these partings are not real amicable. Frequently, they have the ability to take the entire block of business with them. Sometimes this can cause major damage. One of the companies that I was in (this is troubled company #2), a comparatively minor problem became a really major problem when a local newspaper did a hatchet job on the company, totally unexpected to us.

I think, in part, the junk bond fiasco of last fall was sort of a C-4 risk in that it wasn't really the problem with many of the bonds themselves. Some of them were perfectly fine. It was the liquidity problem in the market, where even if you had some good ones, you couldn't sell them because the orderly market disappeared.

We have rating systems. They can cause major problems. Here's a true story. Let's suppose that you have a new asset manager and he's trying to impress you. He, along towards November, runs across a really good deal, and like most of us, good deals are hard to pass up. So he buys this particular asset, and it turns out to be a little bit on the large side. And so after you turn your statement in at the end of the year, the rating agency takes a look at your asset portfolio and says, "Oh, you guys are not very well diversified here." We're going to have to reduce your rating from an "A" to an "A minus," and meanwhile, your marketing division has gone out and sold the product to the pension plan for employees of a near by state. Unknown to your asset guy, the pension plan has a blanket requirement that none of this money will be placed in any company that has less than a solid "A" rating. And suddenly what was kind of a comedy of errors becomes a major problem.

And so, don't overlook the fact that these things can happen. You can't really test for these, but be alert to the possibility that they can happen and look for them. Look for situations where you're vulnerable to these things. I think what really happens is sometimes the little nibbling that the C-1 to C-3 risk does can make you vulnerable to the C-4. If you've got lots of surplus, then you can survive the C-4s. But if you allow the C-1 to C-3s to nibble away at your market value, then a C-4 can really do you in.

In conclusion, I would like to just mention four points. First of all, focus on the economic value of your organization, and not just the statutory and GAAP book value. Number two, the economic surplus is a valuable commodity, and it's the only survival tool you have. Guard it well, see to it that it increases. Number three, know your

company, know your business, know your policyholders and how they react in specific situations. And number four, price for all of your policy characteristics, not just the credited rate.

MR. DENNIS A. BLUME: I want to start out by talking about interest rate volatility. But in any discussion of interest rate volatility, we have to put in perspective what portfolio managers do for a living. Portfolio managers, in Portfolio Management 101, learn that there's two types of risk to take. One is interest rate risk, the other is credit risk. As we look back at the 1980s, certainly interest rate risk was evident during the first part of the 1980s. In the 1980s was an unprecedented level of volatility in interest rates. But what we've really seen in the last couple of years, and really 2.5 years in particular, is a reduction in interest rate volatility. Interest rates have not been very volatile in the last couple of years. And basically, portfolio managers' attention and focus has turned to credit risk during that period of time.

I think it behooves your jobs to really wake up the portfolio managers at this particular point in time. I don't want to belittle my own profession, but I think we're being lulled into thinking there's not going to be any interest rate volatility in the next few years. I really don't think that's going to be the case.

As an example, Paul mentioned pricing of option values in assets. In my opinion, its gotten a little bit out of control at this point in time. Basically noncallable and callable bonds are trading roughly at the same yields. Sure, there's a differentiation, but nothing to the extent that there should be. People are turning to yield at this particular point in time. And I think they're downplaying the importance of interest rate risk.

I'll get to a few numbers in a minute which will show you why people's attention has focused away from interest rate risk. Again, the idea is interest rate risk in the last 2.5 years has been much less than it was in the early 1980s. But I also would like to leave you with another thought. As a portfolio manager, what should you dwell on? Would you dwell on interest rate risk or credit risk? Which is the most important to a portfolio manager?

I'm going to contend that credit risk is much more important than interest rate risk. How's the portfolio manager going to lose his or her job? It's probably not going to be by taking an undue amount of interest rate risk. It's going to be by buying a few investments that go down the tubes right after having bought them.

So, the focus of portfolio managers is on credit risk. I'm not going to contend that they completely eliminate interest rate risk, that's clearly overstating it. But certainly in the period we're in now, there is virtually no interest rate volatility, having started the year at 8% interest rates and we're now at 8.40-8.50% on the long Treasury yields. We've seen virtually no volatility, and we were at 8.00% a couple years ago. So we've had a little bit of interim volatility, but significant interest rate volatility has been very minimal.

In addition, we've had isolated pockets of serious credit concerns. A couple of years ago, we had a pick-up in the LBO (leveraged buyout) phenomenon. And I'm not too ashamed to tell you that the two largest losses at Lincoln that we've had in the last

couple of years in our bond portfolio have been on bonds before the first coupon was paid. One was Quantum Chemical Company, a company which was LBOs virtually a week after an investment grade issue hit the market. LBO risk has devastated portfolio managers in the last couple of years. Now with the junk bond default phenomenon having hit and junk bond new issuance being low, the LBO risk has died down either temporarily or permanently, only time will tell. But certainly in the late 1987 period and beginning of 1988, LBO risk certainly annihilated a few portfolios.

You were waking up to find your par bonds that were issued last week, were trading at 60 or 70 cents on the dollar. That happened to us in Quantum Chemical, R.J. Reynolds, and Time. LBO situations were devastating. And now what's happening?

Now the focus is on bank capital notes. We had the S&L problem, which is going over to the bank area. Certain bank capital notes that involved companies which are not very well diversified in their asset portfolio, in particular overweighed in mortgage loans, and maybe not very well diversified in their mortgage portfolios, those bonds are under extreme duress at this period of time.

The Bank of New England had a $300 million new issue in the fall of last year, and before the end of the year, halfway before the first coupon payment, the bond was actually trading as low as five cents on the dollar.

You can't make enough good interest rate calls to make up for that credit loss. So that's why portfolio managers focus on credit concerns rather than interest rate concerns. I contend there's a legitimate reason for it. That's why I also think going forward, credit risk is not going to be the name of the game. People are so paranoid on taking credit risk right now that basically most portfolios are going to turn into high quality portfolios going down the road.

The next game is going to be interest rate volatility. When I reflect on interest rate volatility, and as I've told you in the last 2.5 years we've had virtually none, I think back to the last time I spoke in front of this group. It was a very disturbing time for me. In fact, the company sent me to an open communications course a couple of weeks ago, and I want to tell you that I'm supposed to be honest. I won't say I don't like any of you people in the audience. But the last time I spoke to the Society of Actuaries was on October 20, 1987.

It was in Montreal. At the time, I was managing a mutual fund for the Lincoln. We had accumulated a pretty decent track record for about a 2.5 year period of time. Through 1986, if you'll recall, interest rates decreased very dramatically as a result of oil prices going down, and inflation being under control. The Japanese were big buyers of our bonds at that particular point in time. Our portfolios were basically long through the 1986 period.

We started out 1987 with low interest rate periods. Towards the end of the first quarter, comments started coming in about the problems with the budget deficit, problems with our trade deficit and interest rates started to rise. We shortened up the portfolio. We played the market very well. Throughout the summer, we had a very short portfolio and

it performed well. I was short on October 19. As I was taking the plane from Fort Wayne to Montreal, I stopped. We had a layover in Detroit. I can remember as clear as day calling the office and saying, "Where are our long Treasury yields?" They had closed the prior Friday about 10.25%. That was not a good day for the stock market either, the 16th. When I called the office, they had gotten up to 10.45%, and so we were short. We were making a ton of money. I said, "This is going to be great. This is hunky dory."

Then I got very ill in Montreal. I spent a very sleepless night, woke up, picked up the paper, and saw what had happened on the 19, and I couldn't believe it -- no way, stocks don't go down 500 points! Interest rates don't go from 10.45-9.5% in one day while you're sitting there virtually in cash. This can't happen.

So basically, the problem with interest rate volatility is it comes up and grabs you quickly. And that's why I contend that the average portfolio manager really isn't very well positioned for that happenstance again. Hopefully, there won't be any more Society of Actuaries' meetings on Black Monday. I think that should be outlawed.

Let me spend a few minutes here and take you through the handouts. I think Bob started out by saying at the end we'll have "Stump the Panelist." I've got a couple things in here you can take back and stump your investment people.

The first chart I want to take a look at is 10-year Treasury rate measurements (Table 1). Over the past 10-years, 10-year Treasury rates have moved at least the amount shown going down the left side over the periods at the right side. And you can see their respective percentages in there. So, 10-year Treasury rates have moved at least 50 basis points virtually 100% of the time in a one-year period of time. Now, this is not from the beginning of the period to the end of the period. This is the range during that period of time. So interest rates moved at least 50 basis points during a one-year period of time, virtually 100% of the time in the 1980s.

TABLE 1

10 Year Treasury Rate Movements

Past 10 Years			
Maximum Rate Move At Least	3-Month Period	6-Month Period	1-Year Period
50 bp	82.5%	92.3%	99.1%
75	56.7	81.2	97.3
100	46.7	72.6	91.9
150	19.2	49.6	78.4
200	7.5	27.4	59.5

And if you go down that column, you'll see some pretty staggering numbers. Again, what I'm showing you here is that interest rates really move more than you think that they do.

FROM THE FLOOR: How many one-year periods do you have here in the 1980s? Is it annual or monthly?

MR. BLUME: These are monthly. These are data at the beginning of each month during the 1980s. Going down that column you can see that interest rates moved at least 100 basis points 92% of the time during a one-year period of time. I would contend the average portfolio manager would find that hard to believe. Again, this shows that interest rates do move more than you think they do. And these numbers show that you better be prepared for interest rate volatility. Even over a three-month period of time, you can see that interest rates move at least 100 basis points virtually half the time. And over a six-month period of time, they move at least 100 basis points three quarters of the time.

Moving on to Table 2, you can see that even over the past five years, volatility has been high. I'm comparing the top chart as the past 10 years, which we looked at in the previous page, and the bottom chart is the past five years, where you can see volatility has mitigated a little bit during that period of time, but still is very, very high; 98% of the time, interest rates moved at least 50 basis points during a one-year period. And again, over 80% of the time, they moved 100 basis points. I contend this is very significant.

TABLE 2

10 Year Treasury Rate Movement

Maximum Rate Move At Least	3-Month Period	6-Month Period	1-Year Period
Past 10 Years			
50 bp	82.5%	92.3%	99.1%
75	56.7	81.2	97.3
100	46.7	72.6	91.9
150	19.2	49.6	78.4
200	7.5	27.4	59.5
Past 5 Years			
50 bp	75.0%	86.0%	98.0%
75	43.3	71.9	94.1
100	30.0	56.1	82.4
150	10.0	35.1	60.8
200	1.7	12.3	41.2

If you're in a meeting with your investment people, take that first chart out and ask them the question, "With respect to 10-year Treasury rate movements during a one-year period of time, what percentage of the time did they move 100 basis points in the last 10 years?" And the response that you'll see will be staggering. I would contend that maybe one out of ten of them would correctly say 92% of the time.

Let's turn for a second to Table 3. Even over the past three years, the period that I contend volatility was quite minimal, you can see that the numbers still stand out. Over a one-year period of time, they moved 50 basis points 96% of the time. Eight to nine percent of the time, during a one-year period of time, they moved 75 basis points. This was still very high. Even 100 basis point movement at 70% is something you better be prepared for. Look at a six-month period, it moved at least 75 basis points two thirds of the time during a six-month period of time.

TABLE 3

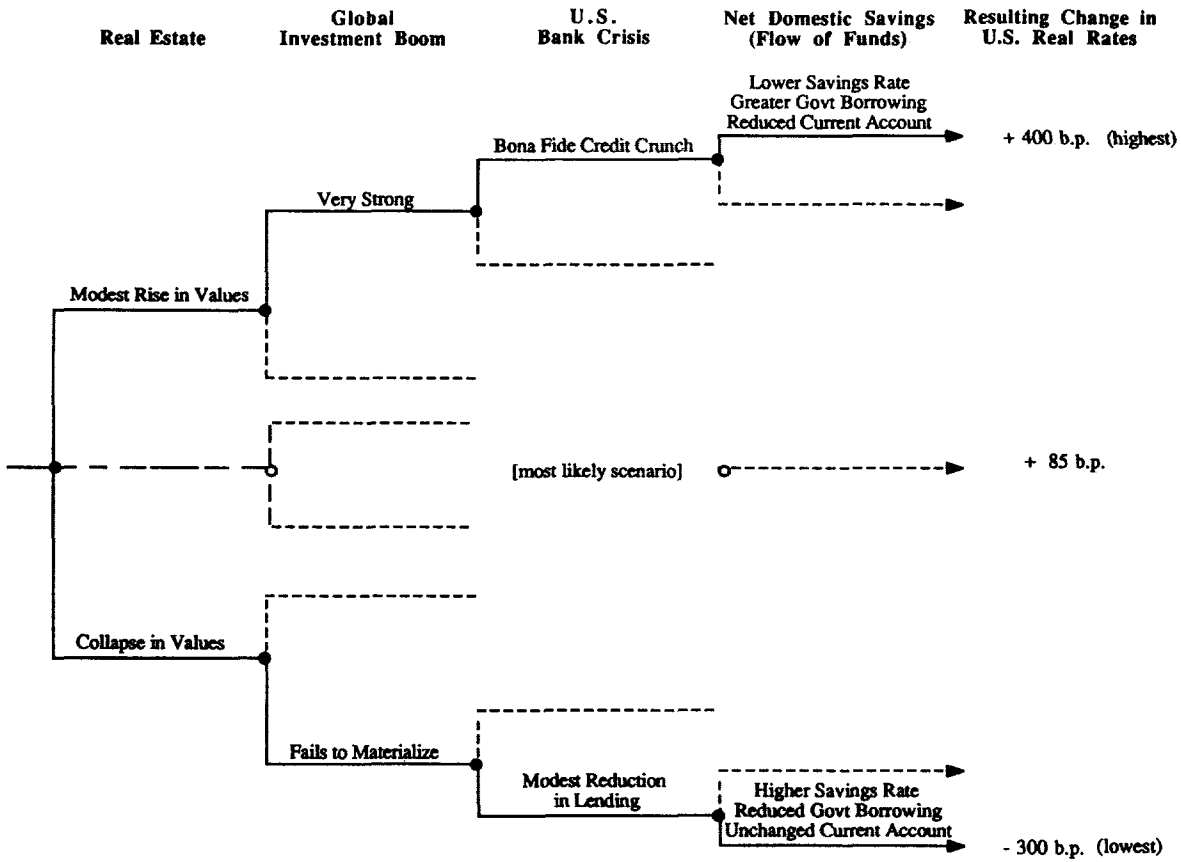
10 Year Treasury Rate Movement

Maximum Rate Move At Least	3-Month Period	6-Month Period	1-Year Period
Past 10 Years			
50 bp	82.5%	92.3%	99.1%
75	56.7	81.2	97.3
100	46.7	72.6	91.9
150	19.2	49.6	78.4
200	7.5	27.4	59.5
Past 5 Years			
50 bp	75.0%	86.0%	98.0%
75	43.3	71.9	94.1
100	30.0	56.1	82.4
150	10.0	35.1	60.8
200	1.7	12.3	41.2
Past 3 Years			
50 bp	75.0%	84.3%	96.3%
75	38.9	66.7	88.9
100	25.0	48.5	70.4
150	2.8	27.3	40.7
200	0.0	3.0	14.8

Interest rate volatility is present, even though we don't think so if we merely look at interest rates from period to period. Interest rates were at 8% two years ago, and they're at 8% now, so we didn't have any volatility. The point is, the way you make money off interest rate volatility in investments isn't where you start at point X and look at point Y, if there's significant volatility in the interim period of time, there's ways to make money, or lose money.

Moving on, we talked a little bit about the decision process that I think you need to go through to determine what kind of interest rate scenarios are realistic. Chart 1 out of a publication that's put together by a company called Strategic Economic Decisions. And I think it's an interesting chart because it sets up a framework to look at how you feel

U.S. REAL INTEREST RATES IN THE EARLY 1990s



Reprinted with permission from Strategic Economic Decisions, Inc., in Menlo Park, California.

interest rates might work over a period of time. This is interest rates in the next five years.

The author is contending that the range of interest rates will probably be in the up 400 basis points from today's levels to down 300 basis points. And it depends on what happens in certain different areas of the economy. As an example, a lot of focus, as I mentioned before, is being placed now on real estate. And you can see that a modest rise in values would have the result of an upward pressure on interest rates and a collapse in values would have the result of a downward pressure on interest rates. I think if you ask most economists right now, they would think that maybe we won't reach a collapse in values, but certainly the trend is probably down.

FROM THE FLOOR: Is the swing measured in real or nominal rates?

MR. BLUME: These are real rates. These are not nominal rates.

The downward swing is based on the economist's belief that overbuilding and the demographic considerations in the residential market will probably form a downward pressure on real estate values over the next few years. Conversely, certainly with what's going on overseas, there's no question there's going to be a global investment boom of some kind of magnitude which would have a very strong upward pressure on rates.

Now the key with the global investment boom, which the author didn't even go into much, is it doesn't necessarily have to affect your specific country. Remember that worldwide rates would probably increase. As an example, suppose the United States would not participate in the global investment boom. Then suppose products are being manufactured in Japan and being exported to Germany. There would be very little effect from that on U.S. rates, but it may result in corresponding increase in rates worldwide as the global investment boom takes off. So it really depends on who's participating.

Now third, we're undergoing a mini credit crunch right now. I don't think it's by any stretch of the imagination a bona fide credit crunch. But really the difference, I think, between what we're experiencing now and a bona fide credit crunch is a bona fide credit crunch really affects everybody. What we're really seeing now is the smaller companies having difficulty raising money. The bigger companies, however you want to define that, can still raise money and raise money at very attractive interest rates. What's really happening now are the banks are tightening down on their lending policies and the small or medium size companies have no access to credit right now.

Again, with the other problems plaguing the banking industry right now, they're trying to minimize credit problems, not unlike the insurance industry, incidentally. The only difference is that we're trying to minimize credit concerns in our bond portfolio, and mortgage portfolios for that matter. Those are the two areas where they're showing up the most.

And then you can see the final one which brings in a basic economics textbook where you can see the lower savings rate or greater government borrowing will lead to

increased interest rates. The only reason I'm showing you this chart is I think it's very good to get in your own mind what you feel the factors are that are going to affect rates in the future. And once you look at those and try to capsulize how much each of them can move, or the impact, you can get an idea in your own mind about what scenarios you ought to draw up.

Interestingly enough, it's difficult to interpret this because you can have offsetting things. I would contend that the average economist you talk to would think that real estate values will probably decrease over the next few years, but conversely the second and third criteria, global investment boom and credit crunch, are probably going to get more severe, which in turn would lead to higher rates.

So the $64,000 question is, how much are rates going to rise by the latter two versus how much they're going to fall by the first? What's the net effect of those three phenomena? It isn't necessary that you have to put them all in combination to come up with the real value.

I want to spend a couple minutes now on collateralized mortgage obligations (CMO). I know Bob Beuerlein is going to conclude with some talks about CMOs, but I want to give you an idea of how we look at interest rate risk in our mortgage securities portfolio. But first, a look at our portfolio in its entirety.

Our mortgage portfolio, as a whole, has an average coupon of 8.46% (Table 4). The average life is 10.5 years. There's duration numbers. The average price is 91 cents on the dollar. There's the yield and corresponding Treasury levels at the date that this was printed over there at the bottom. I think the importance of this is, in talking about interest rate scenario testing, I think it's very, very important to note that mortgage portfolios are the kind of portfolios that the only way you're really going to get a good handle around them is if you have discount portfolios.

It's extremely difficult to know how mortgage-backed securities are going to perform once they get to a premium. Let me give you a real world example. Some of you may recall and I can remember this perfectly, in late 1985, there was a big Wall Street pitch. You saw all kinds of research reports come out on why you ought to back five year GICs with current coupon pass-through securities, such as Ginny Mae's and Freddy Mac's. At that particular point in time, the duration of current coupon pass-through was five years. So they were contending you ought to write five year GICs against straight pass-through securities.

Now what happened was we had the oil situation in early 1986 when all of a sudden oil prices went down to nine bucks a barrel, interest rates went down to seven and a quarter, and prepayments picked up beyond anyone's wildest imagination. Everybody who wrote those five year GICs was basically sitting there with their money back, having now a huge reinvestment risk, with prepayment experience.

The summer of 1986 was beyond anyone's wildest dreams because of what was going on with interest rates. People thought of that as a temporary blip in interest rates down to seven and a quarter. They thought this was their one time opportunity to refinance their

TABLE 4

LINCOLN NATIONAL INVESTMENT MGMT
MBS PORTFOLIO PROXY
DATE: APR 19 1990

WEIGHT	BOND	COUP	AVG LIFE	MOD DUR	EFF DUR	PRICE	YIELD
0.06	GNMA 9	9.00	11.2	5.9	5.3	94.656	10.07
0.16	FHLMC 8.5	8.50	9.8	5.5	5.2	91.656	10.05
0.14	DWARF 8.5	8.50	6.5	4.3	4.0	94.625	9.86
0.05	RMSC 90-1 B 3 SEQ AAA	9.70	3.9	2.7	2.3	98.840	10.14
0.05	FHLMC 14 B 10 TAC	9.00	9.5	5.9	5.7	93.910	10.09
0.06	FN 90-5 G 10 PAC	7.75	11.3	6.8	6.6	86.220	9.90
0.05	RYL 89 D 10 PAC	8.87	9.7	6.1	5.9	93.666	9.90
0.06	FHLMC 50 H 10 PAC	8.00	10.0	6.4	6.2	88.596	9.88
0.05	FN 89-70 10 PAC	8.25	10.8	6.6	6.4	89.548	9.95
0.07	PB 8 G 20 RTAC	7.96	18.1	8.2	7.7	83.880	10.04
0.05	FN 90-3 E 20 PAC	8.50	17.8	8.2	7.7	88.716	9.99
0.05	FN 89-48 H 20 PAC	8.00	16.5	8.1	7.6	84.889	10.01
0.04	FHLMC 37 D 20 PAC	9.00	16.5	7.8	7.3	91.960	10.12
0.04	FN 89-72 D 7 PAC	8.90	6.4	4.6	4.5	95.905	9.83
0.05	FHLMC 85 B 5 PAC	8.50	5.4	4.1	3.9	94.840	9.76
0.01	FN T56 A	6.00	9.5	4.8	4.8	80.586	10.05
0.01	MLT 8 D	5.00	10.4	7.1	7.1	69.207	9.95
1.00		8.46	10.5	5.9	5.6	91.185	9.97

APR 19 1990 TREAS LEVELS:

5YR	8.81
7YR	8.87
10YR	8.85
30YR	8.84

homes. Everybody refinanced their homes and insurance companies, as investors as well as other investors, were sitting there with their money back at very low interest rate periods of time.

In fact, at that period of time in the summer of 1986, I was quoted in *Business Week* as saying that Wall Street was trying to pull some shenanigans in late 1985. They presented mortgaged-backed securities as a window of opportunity without giving full disclosure to investors as to the risks that were inherent in buying current coupon Fanny Mae's. Believe me, I wasn't a real big hit on Wall Street at the time. A number of people called me up, and I got all kind of threats, but so be it.

The point I want to make here is being in discount mortgaged-backed securities, in my opinion, is a way to go.

If you look at Table 5, you'll see a little scenario testing of our portfolio in up and down 300 interest rate period of time. This pretty much coincides, if you'll recall, with the expectation levels that I talked to you about. And the total return is about half way down the page for our portfolio in those periods. You can see it compared to Treasury securities. You can see the outperformance or underperformance of our portfolio versus Treasuries in the different interest rate environments.

In most mortgage-backed securities portfolios, in an extreme rally, they will underperform Treasuries as prepayment experience picks up. I might also add that you can see this portfolio only starts to significantly underperform Treasuries at down 300 basis points. Recall that at the interest rate periods that we're talking here, that's under 6% Treasuries. So, although that certainly can happen, that's probably a worst case scenario. I've also just shown at the bottom here something that you might find interesting. This is a part of a CMO called a pack support bond. A CMO is basically trying to carve up a pass-through security to make it more like a noncallable bond, although it's certainly not noncallable. A pack support is a corresponding piece, a shock absorber piece, which basically takes away most of the prepayment risk in any CMO. The reason I'm showing this is, although we don't play those, a lot of insurance companies and a lot of big money managers like those a lot.

A lot of people are really turning back, unfortunately in my opinion, to current yield. You can see that this particular security performs very well if interest rates don't move. At 10.44%, it's a very high current yield security. Now, unfortunately, interest rates better not move, because if they move, it starts to underperform rather significantly, both if interest rates go up or if interest rates go down. It's not a very good security in volatile interest rate periods of time.

As you can see, even at down 200 basis points, the average life of that security goes all the way down to a half a year. So if you were to have bought this thing with a standstill duration of six years, it gets back to the convexity issue that Paul was talking about, and all of a sudden, you wake up and you realize that your duration is now less than a half a year, and you have some significant reinvestment problems. The problem that we all find in that situation is that we tend to double up, as all good money managers do. If you make a mistake in mid-1986, when a lot of GIC portfolio managers made the

TABLE 5

.INCOLN NATIONAL INVESTMENT MGMT
4BS PORTFOLIO PROXY
)ATE: APR 19 1990

			ONE YEAR TOTAL RATE OF RETURN							EXP RET	EXP RET
			-300	-200	-100	0	100	200	300	15%	11%
WEIGHT	BOND	PROBS 15% VOL	0.9%	8.4%	24.7%	31.4%	21.6%	9.4%	3.8%	VOL	VOL
		PROBS 11% VOL	0.1%	4.0%	25.2%	40.3%	23.2%	6.2%	1.0%		
0.06	GNMA 9		20.30	17.20	14.03	9.95	4.87	0.29	-4.53	9.12	9.36
0.16	FHLMC 8.5		20.10	17.45	14.20	9.75	5.49	1.04	-3.36	9.37	9.53
0.14	DWARF 8.5		17.15	15.23	12.71	9.91	6.72	3.46	0.43	9.48	9.60
0.05	RMSC 90-1 B 3 SEQ AAA		12.43	12.58	11.64	10.07	7.65	4.94	2.01	9.40	9.61
0.05	FHLMC 14 B 10 TAC		20.20	18.65	14.43	10.02	4.47	-1.29	-6.90	9.04	9.33
0.06	FN 90-5 G 10 PAC		25.20	20.93	15.59	9.87	4.17	-1.22	-6.57	9.47	9.59
0.05	RYL 89 D 10 PAC		21.90	18.69	14.62	9.88	4.82	0.00	-4.82	9.34	9.51
0.06	FHLMC 50 H 10 PAC		23.08	19.54	14.95	9.84	4.39	-0.64	-5.67	9.30	9.46
0.05	FN 89-70 10 PAC		23.38	19.95	15.38	9.94	4.5	-0.64	-5.76	9.50	9.65
0.07	PB 8 G 20 RTAC		27.96	23.01	17.19	9.97	2.92	-3.48	-9.37	9.51	9.67
0.05	FN 90-3 E 20 PAC		26.37	21.64	16.25	9.91	2.57	-3.78	-9.63	9.01	9.25
0.05	FN 89-48 H 20 PAC		27.33	22.37	16.59	10.01	2.84	-3.43	-9.23	9.31	9.49
0.04	FHLMC 37 D 20 PAC		24.50	20.54	15.88	10.05	3.56	-2.56	-8.24	9.24	9.48
0.04	FN 89-72 D 7 PAC		20.32	16.39	13.36	10.01	6.38	2.69	-0.87	9.60	9.71
0.05	FHLMC 85 B 5 PAC		16.43	15.13	12.54	9.78	6.62	3.45	0.37	9.36	9.48
0.01	FN T56 A		23.69	19.83	15.33	9.91	5.31	-0.24	-4.92	9.71	9.84
0.01	MLT 8 D		38.22	30.66	19.14	9.88	2.42	-5.99	-14.52	10.16	10.11
1.00			21.50	18.43	14.52	9.91	4.98	0.22	-4.40	9.37	9.53
		7YR 5.1 DUR	22.60	17.85	13.28	8.86	4.61	0.50	-3.46	8.68	8.72
		10YR 6.4 DUR	27.22	20.77	14.65	8.84	3.32	-1.92	-6.90	8.66	8.69
		5.5 DUR COM	23.99	18.73	13.69	8.85	4.22	-0.23	-4.49	8.67	8.71
		MBS +/-	-2.48	-0.30	0.82	1.05	0.75	0.44	0.10	0.69	0.82
	10 yr. PAC Support		12.18	12.69	13.35	10.44	4.24	-1.32	-6.66		
	Ave. L.		.3	.5	3.0	9.5	13.9	14.5	15.1		

mistake in current coupon Ginny Mae's, that we tend to figure out what bet should we make there to compensate for the bet that we took that we lost. This is exactly the wrong thing to do. So these are good securities to stay away from.

Just a quick look at Chart 2 shows you how our mortgage-backed securities portfolio looks like versus total rates of return on Treasury securities. You can see that it outperforms in all scenarios with the exception of significant decline in rates that I talked about.

Now Table 6 I think you'll find it very interesting. This is one that you have to study. I'll try to capsulize it. It's a piggybacking on what Paul had to say about pricing options in assets. This is some work that our mortgage-backed securities people put together at the Lincoln on trying to analyze the option adjusted spread on certain mortgage-backed securities. I've whited out the names of the Wall Street firms at the top to protect the innocent and replaced them with letters. But on June 19, 1989, the chart shows the option adjusted spreads on the different mortgage-backed securities that you see listed. Let's take a couple of them and look at them. Federal Home Loan Mortgage Corporation (FHLMC) is a third of the way down. The 8% coupon, Freddy Mac pass-through securities had a nominal spread of 119 basis points over Treasury's.

Now Paul mentioned that we have to figure out what the option adjusted values of these are because of the prepayment risk phenomena of these, and try to get an idea of what the true yield is.

How in the world do you price an insurance product off of these data? Is the option adjusted spread 108, as firm A says, or is it 32, as firm C says. These are actual numbers -- I did not make these up, by the way. So the question is, how in the world do you use this to price an insurance product? Well, I don't have an answer to that. Remember also Freddy Mac eights are significant discount bonds at this particular point in time, which you would think lessen the value of the option.

Let's take a look at ten and a halves under Freddy Mac-149 is the nominal spread that you see here, and at this particular point in time, firm A has it 59 off; firm C, 37; and firm E, 112 off. So your portfolio manager may have bought this security and priced it at something like 112 off on an option adjusted basis, assuming that particular person bought into the prepayment and volatility assumptions at that particular Wall Street firm.

My point is, in most insurance products, you can't price a product this way. The spreads on GIC products may be 25 or 35 basis points, and maybe wiped out if the numbers don't hold true as they're shown here.

Conversely, at 37 off, there's got to be something wrong with that number, too. It's too low. The average person would shy away from that, and of course, if you look down, I've tried to show you some of the assumptions that went into that number. If you look under volatility assumption, about two thirds of the way down the chart, firm C was using a 16% volatility assumption, which on an historical basis, is the widest level.

CHART 2

Mortgage-backed Securities Vs. Treasury Securities
Total Rates of Return

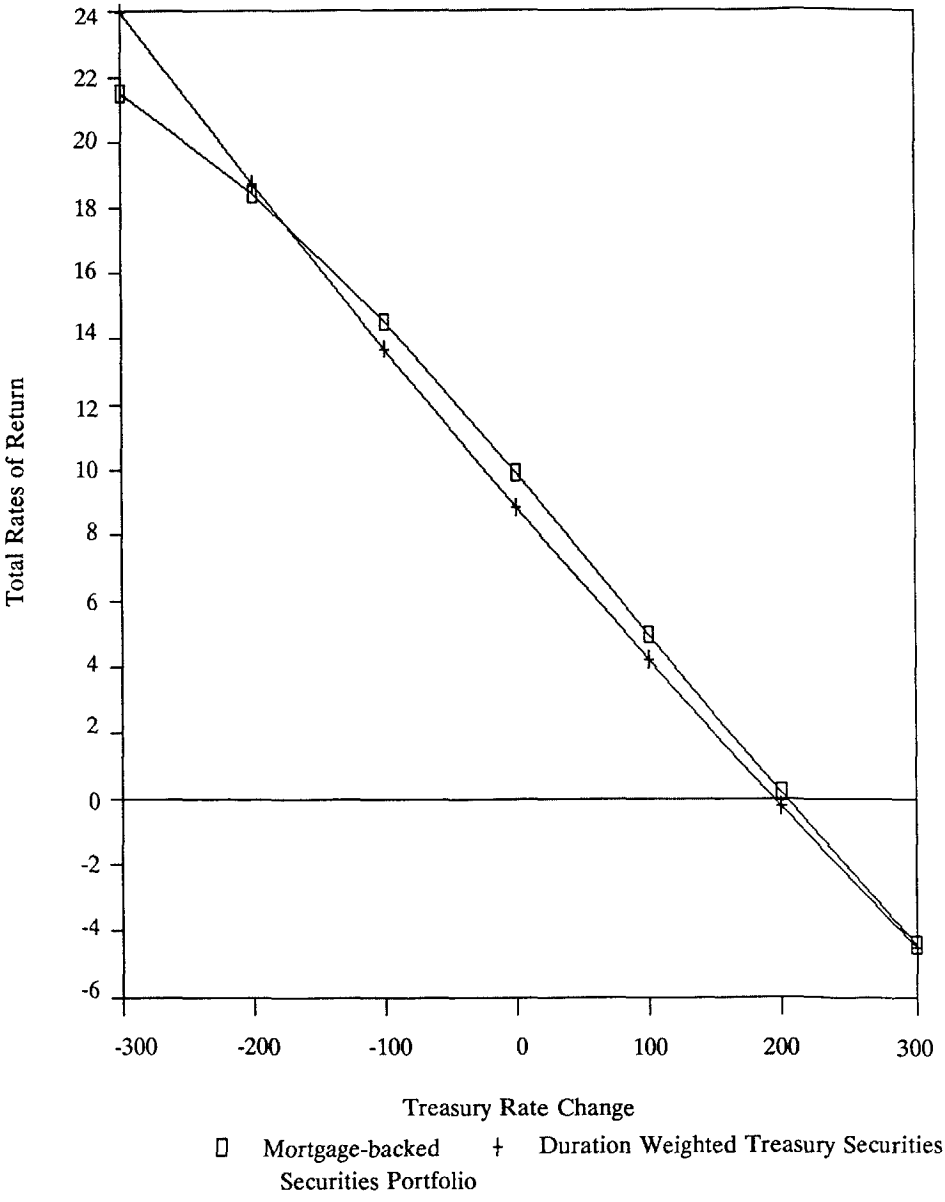


TABLE 6

OAS COMPARISON — JUNE 19, 1989 (REVISED)

		NOMINAL SPREAD	OAS: A	B	C	D	E	F	G	H	AVE
GNMA	8	105	65	82	26	50	67	81	78	51	63
	8.5	121	74	90	38	61	79	90	84	50	71
	9	134	69	92	37	65	86	89	81	44	70
	9.5	148	68	93	39	64	92	88	81	40	71
	10	160	66	90	41	65	100	88	80	35	71
	10.5	169	59	79	39	64	104	80	78	29	67
FHLMC	8 ←	(119)	[108]	104	[32]	70	90	92	92	76	83
	8.5	129	105	105	40	77	101	94	94	72	86
	9	137	85	101	36	73	104	95	88	63	81
	9.5	149	79	102	40	73	103	94	89	62	80
	10	158	70	99	40	71	107	100	89	60	80
	10.5 ←	(149)	[59]	94	[37]	66	[112]	101	94	62	78
FNMA	8	120	111	107	30	74	92	96	94	74	85
	8.5	131	107	107	39	79	104	97	96	68	87
	9	141	90	106	38	78	110	100	91	64	85
	9.5	150	81	102	38	75	106	96	93	58	81
	10	158	69	96	33	71	111	91	90	50	76
	10.5	149	58	87	32	67	111	97	94	54	75
BEST			FN 8	FN 8	GN 10	FN 8.5	FH 10.5	FH 10.5	FN 8.5	FH 8 FN 8.5	
SECOND BEST			FH 8	FN 8.5	FH 8.5 FH 9.5	FN 9	FN 10 FN 10.5	FH 10 FN 9 FH 10.5	FN 8.5	FN 8 FH 8.5	
VOLATILITY ASSUMPTION			15.3% 10 YR 21.1% 3 MO	10% LONG 15% SHORT	16% YIELD VOL.	13.5% MTG VOL 16.0% ONE YR	10% YIELD VOL.	15%	15% ONE YR	10.45% YIELD VOL.	

		NOMINAL SPREAD	OAS: A	B	C	D	E	F	G	H	AVE
MIDGET	8.5	94	57	73	35	69	63		64	26	55
	9	82	44	53	20	60	64		63	21	46
GNOME	8.5	102	56	83	46	73	84			46	65
	9	102	40	73	34	66	82			45	57
	9.5	115	44	77	38	79	92			48	63
DWARF	8	99	73	89	50	82	84		102	39	74
	8.5	110	72	92	45	77	86		103	42	74
	9	113	62	85	41	75	89		86	47	69
	9.5	118	62	79	39	78	98		87	46	70
BEST			DW 8	DW 8.5	DW 8	DW 8	DW 9.5		DW 8.5	GO 9.5	DW 8
SECOND BEST			DW 8.5	DW 8	GO 8.5	GO 9.5	GO 9.5		DW 8	DW 9	DW 8.5

So, most people now are using in the tenish kind of percent level. So, because of the significant yield volatility, or interest rate volatility that firm C was expecting to materialize over a period of time, their option adjusted numbers were low. But these are actual numbers.

Table 7 shows these numbers on May 10, 1990. Here you can see, even though interest rate volatility has been very low over the last year, and actually over the last 2.5 years, that the range in the option adjusted spreads is much narrower. There are some with very wide spread in certain cases.

Ginny Mae eights, a very low coupon security, is the first one listed there. You can see that MS says that they are 78 off on an option adjusted basis and the other circled numbers have 49 off. Again, that's a significant differential. Or, looking down to more current coupon numbers, if you look at Ginnie Maes, that's what the GM stands for, the nine and a halves is the one that's most close to par or current coupon. You can see that you can buy those at 134 off nominal spread. You can see there is a difference in the option adjusted spread all the way from 100-66.

Even though volatility's been low for such a long period of time, you would think Wall Street firms would get their act together and these option adjusted spreads would tend to cluster around each other, or the range be very narrow. The difference between 100 and 66 is 34 basis points. That's still significantly wide. That could wipe out your entire profit margins on that product. So even though interest rate volatility is low, it can still come back to haunt you.

On a historical basis, when people talk about interest rate volatility, they're usually talking about parallel shifts in the yield curve. Some of the newer models deal with yield curve shifts, which is the correct way to look at it. Because I contend over a long period of time, and this may be a minority view, I think yield curve movements are probably easier to predict than aggregate interest rate calls over a particular period of time. As a result, I think that some of the newer models that take yield curve shifts in them are going to turn out to be very advantageous in the long run.

In Table 8, you can see the yield curve based on May 9, 1990 and you can see that the yield curve at the time was basically flat. This shows you, based on historical patterns of where interest rates lie in both positively sloped and negatively sloped yield curves, what kind of total returns you'd see over a one-year time horizon if the yield curve went from its flat position to a more historical yield curve scenario. But the point is, you can see that there's a significant difference in total returns here, based on yield curve movement. Another part of a portfolio manager's job as well as asset liability work in general is to determine where you think interest rates may go in terms of both aggregate levels and yield curve movements so that you can make some of these determinations.

Finally, I'll show you Table 9 that we go over at Lincoln periodically, which is taking a look at different sectors of the market to determine where we ought to be putting our money. We look at both the nominal spreads and the option adjusted spreads for those particular sectors. We look at a point in time, as well as the range for the last 12 months and we try to put in perspective where spreads are currently in comparison to

PANEL DISCUSSION

TABLE 7

May 10, 1990

30 Year		Price	Nominal Spread	OAS A	B	C	D	E	Average
GN	8	88-16	94	78	72	49	60	73	66
	8 1/2	91-01	109	88	83	55	68	79	75
	9	93-18	124	75	93	62	68	70	74
	9 1/2	96-05	134	92	100	66	71	77	81
	10	98-24	137	93	101	66	72	79	82
	10 1/2	101-02	139	80	101	66	70	83	80
	12	107-09	74	87	74	56	77	62	71
FH	8	88-25	110	104	83	75	72	95	86
	8 1/2	90-28	119	109	92	77	82	104	93
	9	93-12	123	98	95	76	69	86	85
	9 1/2	95-31	123	96	94	71	66	84	82
	10	98-09	128	79	95	71	84	83	82
	10 1/2	100-08	129	76	98	70	68	84	79
	12	105-17	85	88	105	59	64	61	75
FN15:									
	8	92-09	102	89	88	81	97	73	86
	8 1/2	93-31	105	81	90	74	76	76	79
	9	95-28	103	81	90	77	75	80	81
	9 1/2	97-24	111	83	91	76	78	81	82

F16100

TABLE 8

EFFECT OF POSITIVE OR INVERTED YIELD CURVE

	2 yr.	3 yr.	4 yr.	5 yr.	7 yr.	10 yr.	30 yr.
Previous Yield Curve (04/25/90)	8.96%	9.01%	9.03%	9.00%	9.05%	9.00%	8.98%
Current Yield Curve (05/09/90)	8.70%	8.75%	8.79%	8.79%	8.85%	8.83%	8.84%
Total 1 Yr. Return Expected from Positive Curve*	9.74%	10.52%	10.97%	11.01%	10.52%	9.88%	8.84%
Total 1 Yr. Return Expected from Inverted Curve*	8.24%	8.11%	7.76%	8.03%	7.67%	7.68%	8.84%

* Theoretical returns based on normalized movement in the yield curve.

TABLE 9

RELATIVE VALUE
MAY 9, 1990

		NOMINAL SPREADS		OPTION ADJUSTED SPREADS		
		As of 5/8	Range 12 mths.	As of 5/8	Change From Last Report of 4/25	Range 12 Months
CORPORATES						
Intermediate:						
Industrials	Aa	86	64-136	74	-3	40-94
	A	113	83-142	90	-4	61-115
	Baa	201	105-201	192	+3	94-192
Utilities	Aa	90	53-95	53	-8	18-62
	A	92	75-116	92	0	48-103
	Baa	126	96-155	125	0	66-128
Banks/Finance	Aa	90	71-110	90	+1	47-106
	A	129	80-139	129	-1	70-139
Long:						
Industrials	Aa	109	74-129	52	-8	22-73
	A	146	119-172	89	-4	34-111
	Baa	207	180-254	137	-4	101-182
Utilities	Aa	120	67-137	40	-5	10-45
	A	131	84-168	48	-5	12-75
	Baa	157	154-205	88	-1	60-107
Banks/Finance	Aa	151	96-155	94	-1	70-110
High Yield		718	340-752	--	+29 (Nom.)	--
MORTGAGE-BACKED						
GNMA	8.00	94	75-115	66	-1	50-92
	9.00	124	109-149	74	+3	51-95
	9.50	134	120-170	81	+8	43-93
	12.00	74	74-171	71	+1	30-105
FHLMC	8.00	110	79-129	86	+2	60-103
	8.50	119	91-149	93	+4	60-110
	9.50	123	121-172	82	+3	50-105
	12.00	85	83-205	75	0	20-135
CMO PAC	10 yrs.	100	92-130	85	0	77-115
	20 yrs.	110	110-137	90	0	90-120

where they've been over the last year to get an idea of relative values. Some of the numbers you'll look at here may be reasonably intuitive, based on some of the things I've said and some of the things that you've read about in the press. You can see that the lower quality sectors of each of the markets, the BAA industrial, the BAA utility, A rated bank of finance, are all trading on an option adjusted basis at the wider end of their historical option adjusted range. That stands to reason.

Obviously, we're in a period of time where credit quality is under extreme concern to all portfolio managers right now, and they have to be paid to buy lower quality investments or they're going to stick with quality. So, that's rather intuitive based on what we see going on.

We don't know that the credit crunch will actually materialize. However, most portfolio managers are starting to position themselves with higher quality numbers. You can see the high yield numbers in the middle of the chart there. On a nominal basis, the spreads are at 718 bp, compared to over the last 12 months at 340 bp to 752 bp, you can see they're at the higher end of the range, and I'll say parenthetically that we at Lincoln feel that high yield securities are going to be very good value over both an intermediate and longer term period of time.

Certainly, the supply pressures are lower, and as long as you stay in the higher quality part of the junk bond market, I think you're going to fare pretty well over a longer period of time. I think you'll fare pretty well in the very low quality junk over a short period of time. But, if you buy them with any kind of a longer term horizon, I think you've got to stay with quality in that environment.

In fact, Lincoln's high yield portfolio has performed as well as its investment grade portfolio over the last year. Now, that's rather staggering. That's kind of atypical, although our high yield portfolio is in the highest quality junk. It's basically BB paper, and a few very high quality B names. It's really the low quality Bs and the triple Cs that have gotten hammered in the last year, and that's really what's caught on with the press.

Mortgage-backed securities that you see at the bottom of the chart there are basically in the middle of the range right now. Mortgage-backed securities are not undervalued or overvalued. I think it's interesting to note that 20-year-long mortgage-backed securities paper have a 110 nominal spread now, or 90 option adjusted, which is the narrowest part of the range.

This is because the natural buyers of this paper are insurance companies. Insurance companies write a lot of the deferred annuity business and pension plan termination business. These are long duration insurance products and are usually covered by this kind of paper. What we've seen in this paper has been bid up rather significantly recently by insurance companies who have left the corporate bond market. They had been buyers of long BAA utility and long BAA industrial paper.

Let me conclude with just a couple comments about where I see the financial markets going in the near future in terms of taking a look at some of these numbers. I alluded to

this earlier but I'll say it again, I think we're overemphasizing credit risk right now, although some of it's justified.

Certainly, those of us in the insurance industry know that we've got to be careful what we do with lower quality investments right now because we're ripe to be picked at right now by the press. Not unlike these S&Ls and banks prior to us, it's probably not a good time to take a lot of credit risk. But certainly, from a relative value standpoint, I think we're overreacting to the credit problems that are probably going to happen down the road.

Conversely, we're underreacting to interest rate volatility. Some of the offerings that I see come across my desk from Wall Street make no sense. Some of the option adjusted values that we're seeing on the asset side make no sense either. Basically, we're positioning ourselves for very little volatility going forward. And I guess I challenge you people when you go back, and I'm sure you've done a lot of this work, to be very careful of the asset portfolios in terms of interest rate risk. I think most of the portfolios are ill-positioned.

Those of you who use mortgage-backed securities to a large extent know that you can't really make a science out of it. It is a pure art. You can think you know what prepayments are going to do under certain circumstances. Generally speaking, it's difficult for those expectations to actually materialize. That's why I think it's important to build for a future interest rate risk right now, because it's a cheap time to do it.

By definition, if current coupon mortgage-backed securities and discount ones are trading at reasonably close to the same spread, there's very little give up right now in yield for getting additional interest rate protection. I think this is the time to do it. So I urge all of you to shake your portfolio managers, and tell them to quit worrying so much about credit risk and start worrying about interest rate risk.

MR. ROBERT M. BEUERLEIN: I'm going to get away a little bit from numbers and into a little bit more description. I'd like to discuss some items which you may wish to consider in modeling current day assets for pricing purposes. In particular, I'd like to concentrate on collateralized mortgage obligations, CMOs. Dennis has told us a little bit about them. I'd like to get a little bit back to basics. In a nonscientific survey which I took of several people around here, the knowledge about CMOs varied from zero to clear on the other end of the spectrum. So I'd like to shore up that diversity a little bit today, and explain a little bit about CMOs and what you might want to think about them in the pricing process.

Before getting into the specifics of CMOs, though, I'd like to briefly look at a few historical events over the past 60-70 years which led to the development of mortgage-backed securities, and more specifically, CMOs. Next, I'd like to discuss some methods used to evaluate cash flows from these relatively exotic assets. And finally, with a basic understanding of mortgage-backed securities, we can look at CMOs, what they are, what they look like, and things to consider when including them in pricing insurance products.

To begin our brief historical summary, we go back to the days before the Great Depression. At that time, it was not uncommon for residential loans to be interest only loans over a short time period. For example, a homeowner might take out a five year interest only loan, which he would either pay off or refinance at the end of the period. But with the onset of the Great Depression in the early 1930s, many homeowners were unable to refinance their loans, or sometimes even make the interest payments on their loans. And many times, they had to default. Of course, this was a cause of the failure of financial institutions during this time.

In 1932, the Federal Government enacted the Federal Home Loan Bank Act of 1932. This Act instituted the Federal Home Loan Bank System which allowed thrifts to receive advances from district banks in exchange for pledges of mortgage assets as collateral. The Federal Home Loan Bank Board imposed strict regulations which included investment by thrifts in long term fixed loans. Other events occurred in subsequent years, including the creation of the Federal National Mortgage Association, Fanny Mae, in 1933. However, it wasn't until 1968 that the next major development in the evolution of CMOs occurred.

The National Housing Act of 1968 split FNMA (Fanny Mae) into FNMA (Fanny Mae) and GNMA (Ginny Mae), the Government National Mortgage Association. And this Act had the effect of privatizing Fanny Mae and keeping Ginny Mae as a government-owned corporation, which was charged with guaranteeing special assistance housing loans and privately issued securities backed by market rate, FHA, and VA loans. This led to the development of the Ginny Mae pass-through in 1970.

I'm sure that most of you are familiar with the mechanics of a Ginny Mae pass-through. Briefly, they're classified as bonds in Schedule D of the annual statements. They have monthly payments which reflect payments of principal, interest and prepayments on the pool of mortgages. Thus, your book value and your par value normally go down each year in Schedule D.

As a final stop on our brief journey through history, we come to the Tax Reform Act of 1986. While CMOs had been in existence prior to 1986, the 1986 Tax Act created a new tax reporting entity called REMIC. And this had the effect of making CMOs more attractive to issuers and investors. One report which I read stated that outstanding amounts of CMOs jumped from $13 billion at the end of 1985, to $73 billion at the end of 1986. For tax nuts, that's in Section 860A of the Internal Revenue Tax Code. Now that we've had a brief flavor for the evolution of CMOs, let's move on to items to consider in projecting cash flows.

CMOs have typically traded in yields in excess of Treasuries. What are the additional risks that are inherent in CMOs? I think we heard a little bit earlier about this. But let's look at a few typical measures of risk. First, we have a risk of default. The perception of the investment community is that the risk of default is absent from Treasuries and CMOs. We have liquidity risk. Currently, the secondary market for Treasuries and CMOs is reasonably active, and so the liquidity risk is fairly similar between CMOs and Treasuries. Third is the interest rate risk.

Certain tranches of CMOs have more interest rate risk than others, and Treasury bonds have a rate of risk also at times of movement of interest rates. But the risk that I want to focus on a little bit more, that makes the biggest difference between Treasuries and CMOs, is the risk of prepayment of the mortgage. And, of course, several of the risks involved with prepayments are capital gains and losses, and uncertainty of timing of cash flows, which results in reinvestment risk.

While the scope of this presentation does not encompass option pricing, I'd like to briefly discuss simplified methods that have been used in the recent past to determine prepayments. These methods are being presented mainly to give you a flavor of methods that have been used in the past. They are the fixed life method, the FHA experience, the conditional prepayment rate, CPR and the PSA standard prepayment model. Let's take a look at each.

Chart 3 illustrates one of the oldest mortgage prepayment models. This happens to be the 30-12 model, meaning that is assumed that the borrower will make the required payment on his 30-year mortgage for 11 years, and then will prepay the mortgage in the 12th year. This model is not very dynamic and was subsequently replaced with some of the others which I mentioned. A common actuarial response to that prior slide would be to use prior experience in developing prepayment rates.

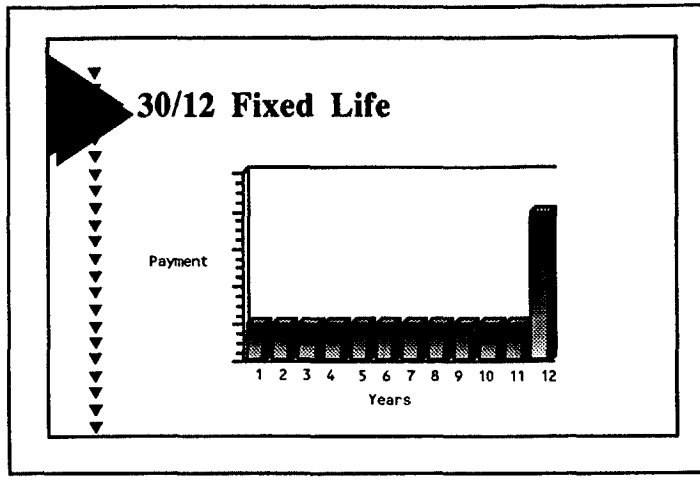
The graph shows a rough representation of experience, which the FHA has compiled based on loans in force in 1970-1984. It measures prepayment rates of loans by the age of the loan. Several theoretical problems exist with this model, too. First, the experience is for specific FHA loans, which may not have the same prepayment patterns, as loans with different characteristics. Also, the graph only tracks loans by the age of the mortgage and does not take items such as coupon and market interest rate, for example, into account.

The conditional prepayment rate, CPR, is similar to a mortality rate to actuaries (Chart 4). For example, the assumption of a level 30% CPR assumes that 30% of the principal will be prepaid in each year. So, a 30% CPR would produce a mortgage with a very, very short average life, 2.8 years, and a 0% CPR assumes no prepayments and produces an average life of the mortgage of slightly less than 23 years.

The fourth method which I mentioned is the PSA standard prepayment model (Chart 5). This will appear in some prospectuses for CMOs that you might see. The model assumes that prepayments are made at a rate which increases by .2% per month for 30 months, and then levels out at 6% thereafter. You might see values in prospectuses in terms of 0%, 125%, 200 and 275% of the PSA. And further factors have been developed subsequent to this that are applied to the base PSA rate, depending on the difference between the note and market rate for different types of securities like Ginnie Mae's and Fanny Mae's.

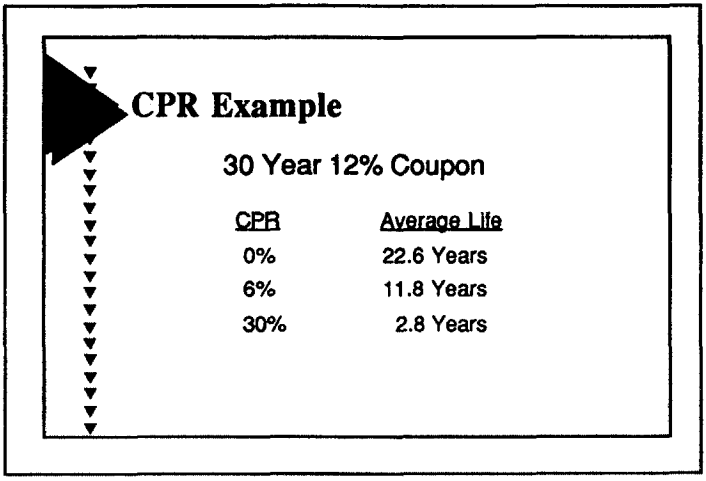
Now, we've talked about prepayment. Let's focus on this a little bit. What factors actually are relevant in determining prepayment patterns? Since we have in this room a lot of people that come from a variety of backgrounds and geographic regions, and

CHART 3



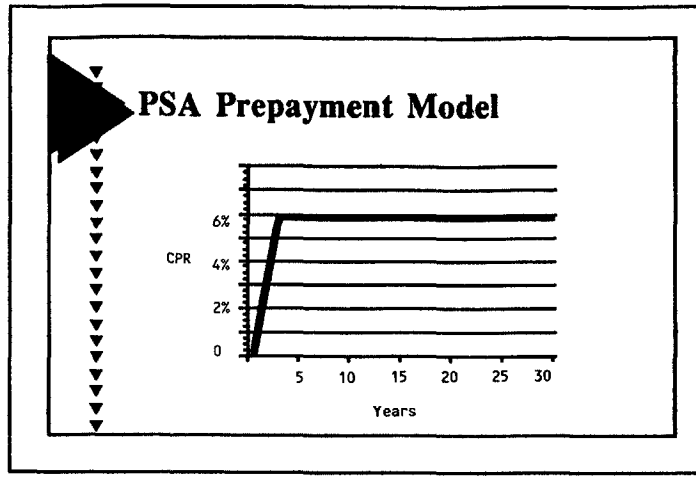
30/12 Fixed Life

CHART 4



CPR Example

CHART 5



PSA Prepayment Model

socioeconomic levels, I would expect to hear a variety of answers to why people prepay mortgages.

There are obvious reasons for mortgage prepayment. The coupon rate is first, and by this I'm referring to the coupon rate relative to the market rate. The age of the mortgage is what the FHA experience was trying to measure. Other reasons include the following: economic conditions, I might parenthetically add regional economic conditions, since I come from Texas; seasonality-depending on the time of the year; and the type of the security, characteristics of the mortgage loan, and people who qualify for the loan.

With the previous background and history behind us, let us look at what a CMO is. A CMO, collateralized mortgage obligation, is a collection of pay through bonds known as tranches. Now tranche happens to be a French word that means slice. These tranches are backed by a single pool of specific mortgage assets, for instance, Ginny Mae pass-throughs. Due to the significant changes in the CMO market in 1986, it is difficult to characterize the typical CMO. Before 1986, the typical CMO was comprised of four to eight tranches, or slices, interest was paid to each tranche, but principal payments from the underlying mortgages were used to pay off each tranche in sequence. For example, no principal payments were made to tranche number two until tranche number one had received all of its principal payments and thus, was gone.

These were known as fixed rate CMOs. CMO floaters were first introduced in 1986, with at least one of the tranches carrying a floating rate, usually related to London Interbank Offered Rate (LIBOR). Floaters have dominated the market since 1986. Floaters normally have fixed and floating rates, and some tranches may be paid off sequentially, while other tranches may receive pro rata principal payments. Essentially, the investment community has taken a pool of mortgages and carved up the cash flows into several slices that have different timing characteristics. The CMO is attractive to some investors because higher yields are available, due to the prepayment risk. And due to the sequential payment structure, investors in the longer payout tranche receive a certain level of prepayment protection which would not be available in just a common Ginny Mae.

Now let's take a look at some of the tranches that we were talking about, or some of the terminology of CMOs. We talked about a tranche, that's just a slice of a total CMO. You can buy a single tranche and not have to buy a whole CMO.

There's floaters, which have interest rates tied to LIBOR and inverse floaters, where interest rates move in opposite directions of LIBOR. We have interest only pieces (IOP) and principal only pieces (PO). There's PACs, planned amortization classes. I think Dennis was telling us about some of his PACs. And residuals, which I'm not sure a lot of insurance companies get into, but they're kind of interesting, so I thought I'd spend a second on them.

Residuals are fairly volatile. Due to national rating agencies AAA requirements, and certain federal tax requirements, it's necessary to have a residual tranche, as they call it. After all the other tranches have received payments to which they are entitled, the

residual tranche receives all further payments. Thus, a residual tranche might have to wait quite a few years before getting any payments of any amount. Due to this uncertainty of when payments will be received, residuals normally carry quite a bit higher yield.

Now let's go back to what the typical CMO looks like. It's not possible to convey to someone what you're investing in by simply saying, "I'm investing in CMOs." A very simplified CMO, issued in two tranches, and assuming no residual, might be structured to make principal and interest payments to tranche number one until the total amount of tranche one principal has been paid off. And in the meantime, tranche two would be receiving interest payments, and would only begin receiving principal payments after tranche one had been paid off. And then to expand on this a little bit, you could have another tranche, make it a third tranche, which was getting LIBOR plus a .5%, or something. And then you could have a residual tranche that didn't get any payments until tranche one, two, and three had been totally paid off.

Now, with this background, how should we take CMOs into account for pricing our life insurance products?

We've discussed several theories about the philosophies of prepayment risk. I think Dennis made this comment before, pricing CMOs is a little bit more of an art than a science. So I really don't want to get too caught up in all this stuff.

To begin with, let me quote from a prospectus of an average CMO:

> The Issuer believes that no available information regarding prepayment experience on mortgage loans generally or pass-through Certificates, such as the Certificates expected to secure the Bonds, provides a reasonable basis for predicting future prepayment experience on the Certificates.

Several years ago, it was not uncommon to price an interest-sensitive life product using static assumptions. You had set interest spreads, fixed lapse rates, and a given pattern of premiums. Sensitivity tests then were run to judge the effect of changes in various assumptions. Over the years, these sensitivity tests have become more complex and related more to interactions on the asset and liability side of the balance sheet with the advent of asset/liability testing. The use of CMOs in the asset portfolio makes some of this a bit more complex.

The first step to modeling a CMO for pricing purposes is to understand the CMO tranche and underlying securities backing the CMO. This will require a concerted effort on the pricing actuary's part to discuss with his investment department the type of CMOs and tranches that are involved in the company investment philosophy. Sometimes the actuary may be on the company's investment committee, in which case he will have been exposed to the investment committee's thought process. A thorough reading of a few prospectuses of recent or currently anticipated purchases of CMOs is also a good idea.

For example, assume that the investment policy happens to call for investing in tranche 2 CMOs from our previous example which are backed by GNMA pass-through certificates.

He would need to understand what this means. Once the characteristics of the underlying securities are understood, it is necessary to determine a formula or rule for determining prepayment rates. This should be as dynamic as possible. For this example, we might want to start with the PSA prepayment model further adjusted for the difference between the note and market rate. I might note that we are leading to some form of scenario testing or else some of these adjustments might not be applicable. The next step is to create some interest scenarios either subjectively or randomly.

You may want to start with something that's easily explainable so you can get your hands around it. Some interest scenarios, maybe a level interest rate scenario, one that's increasing, one that's decreasing, maybe a little combination, but something that you can get your hands around. You don't get all caught up in the projection of rates right away. And then after that, you want to use some randomly generated scenarios that have some volatility.

The final step in our modeling of the CMOs is to project out the cash flows from the CMOs, along with any other assets that you happen to be modeling along with this. And you want to project out the insurance product liability side, which is being priced.

The details of projecting the liability side are beyond the scope of this presentation. But let's assume that the liabilities are interest-sensitive and have dynamic lapse and premium suspension rates built into the underlying assumptions. Modeling CMOs for pricing purposes is basically an extension of making assets sensitive to external forces. This is quite important for assets as volatile as CMOs. The actual mechanics of doing the CMO projections, from a practical standpoint, may be complex. For instance, to simulate cash flows from tranche two, it's necessary to also project flows from a tranche which is not even in the asset portfolio, maybe tranche one. Cash flows depend not only on the prepayment pattern, which has been assumed with its dynamic adjustments, but also on the other tranche.

The important input parameters to such an asset projection would be the characteristics of the CMO, prepayment rates, and some type of reinvestment information also. A company that lacks the resources to do such a projection can simulate somewhat the effects by using a combination of bonds and positive and negative mortgages, where the positive mortgages encompassing multiple tranches, and the negative mortgages covering tranches for which the company is not invested in. This won't exactly give the correct answer, but it's an improvement over a totally static preset collection of cash flows.

Software is being developed every day which can handle CMOs more directly, but this method I just alluded to is better than nothing. So if you don't have sophisticated software, do something better than nothing. With the cash flows projected, the pricing part is essentially complete. Using the profit measures which your company keys on, the cash flows can be assembled to look at streams of profits in the light which you are used to looking at for all the various scenarios that you might have looked at.

Now, I purposely avoided getting into asset liability matching issues associated with all of this. However, I hope that you have concluded that operating in a vacuum, when pricing with assets such as CMOs, is not wise. We talked earlier about the necessity of the

interaction between the pricing function and the investment function. Saying that you're investing in CMOs does not define anything unless you know the characteristics of the CMOs. Determining the cash flows of the CMO must also have a common thread running through the company. Certain sophistication can be avoided, but a certain amount of consistency in determining prepayment patterns, for example, must be present.

To summarize, this has been a brief overview of the basics of CMOs. We've seen that the mortgage and the mortgage-backed security market has evolved a great deal from the five-year interest only mortgage of the 1920s to the exotic assets of today. The federal government has played a big role in creating this evolution. CMOs are very sophisticated assets, which would not have been possible in past years, but are definitely here today. Some insurance companies have entered into this market thinking that the reward justifies the risk. And other companies have not entered because the converse opinion prevails. Actuaries of companies which invest in CMOs must make every attempt to understand the structure and characteristics of the assets and the volatility which might be involved. This statement, of course, applies to other types of assets, other than CMOs. But armed with this knowledge and with specific company knowledge, actuaries can apply the concepts and examples which we've discussed to model assets in a more efficient manner.

What does the future hold for us? Currently, given a set of parameters and a large enough chunk of money, Wall Street people can construct just about any type of synthetic asset that you can imagine. With regard to CMOs, there may come a time when they're not even thought of as exceedingly exotic assets. A lot of work and research has been done and is still being done to develop more efficient prepayment models. But I take Dennis' point that it looks like it may be more of an art than a science, as other actuarial things are.

Option pricing models are also being developed, and have been developed quite a bit over the last few years. In short, nondynamic methods are becoming less and less acceptable for pricing an insurance product when volatile assets and liabilities are involved.

MR. THOMAS W. REESE: I have a question about how CMOs work. Let's say the CMOs are securitized with a block of mortgages that are all 10%, straight 30 year mortgages. How does the tranche work that pays the floating interest rate based on LIBOR plus .5%?

MR. BLUME: I'll take a shot. Most of the new deals have a floater and an inverse floater in them. So there's offsetting risk. If LIBOR goes up, then the rate for the tranche with the inverse floater goes down, and the rate for the floater tranche goes up. They offset each other. So the way it works, if you're trying to think, "Well, what happens if it's a floating rate and interest rates go through the moon?" if there's an offsetting tranche in each of the CMOs. So somebody gets less under that situation. That's a simplistic answer.

MS. MARY H. STONE: Would you explain what a PAC CMO is? I don't understand that.

MR. BLUME: PAC is an acronym for planned amortization class. It's close to a noncallable corporate bond. A PAC can give you a planned amortization of the mortgage under a wide range of prepayment patterns. When the prepayment rate is within a defined range, the amount of principal you receive is not speeded up or slowed down. It's a way to protect somebody from wild gyrations in prepayment experience.

In other words, let me try to answer it simplistically. In a PAC class bond, basically you are going to know within general parameters what your cash flow is going to be. I mentioned that there's something called a PAC support tranche. That is a cash absorber tranche. That's the one that is the offset to that. In other words, if you're getting your money when you're supposed to get it, but the underlying mortgages aren't paying that way, somebody has to pay the piper for that. The answer to that is very similar to the previous question on floaters. Normally, if there's a bizarre tranche in a CMO, there's going to be an offsetting risk tranche somewhere in that CMO.

MR. LALONDE: The PAC is usually tied to the speed. There's speed protection in a PAC, like anywhere from a speed of 75-200, which means that so long as the mortgage prepayments are within that speed, there's not going to be any acceleration or deceleration to that PAC class. So, in essence, it gives you call protection against acceleration of the maturity date.

MR. RONALD L. ZIEGLER: Seems like CMOs focus on fixed rate mortgages in the pools. Are there similar pools, and what would they be called, that would have the adjustable rates in them?

MR. BEUERLEIN: There are more than Ginny Mae and Fanny Mae CMOs. There's probably a dozen different types of pools that have similar characteristics. They try to get them all together. And ARMs are one type of a pool.

MR. BLUME: Adjustable mortgage CMOs don't have a special name. However, every tranche has a floating rate. Each tranche is usually structured with a cap. The rate floats up to a certain level and caps out at that level, in order to make all the other tranches work. And the problem with those things is as they rise towards their cap, let alone reach the cap, they start to trade pretty funny in the fixed income market. You would theoretically think they're generally going to trade close to par at any point in time. But the reality of the situation is that is not true because of these caps. And if interest rates are at the 10% level and it has a 13% cap, as you start getting close to it, the market starts saying, and the buyer starts saying, "Wait a minute. I'm not going to buy that at 100 cents on the dollar, because I run the risk that if interest rates go up a little bit, I'm capped out."

MR. RODNEY C. WILTON: Dennis, I have a question about your numbers, and it's maybe a sort of trivial question. But on your 10 year Treasury rate movement where you show past 10 years and past five years, it seemed to me that for the 100 basis point movement on the past five years, you show 82.4%, and if the first five years of the ten year period was 100%, then the ten year period would be the half of the 182.4 which is 91.2. You have it bigger than that. I wondered how the mathematics worked out that way?

FROM THE FLOOR: To answer your question, 10 years is actually 109 twelve-month periods, and five years is 49, so there's more than twice as many in 10 years. That may or may not be what actually happened.

MR. LALONDE: Do the graphs mean to say that if at any point in time we looked back a year, you would see that the interest rate is different by 50 basis points?

MR. BLUME: It shows the maximum movement of interest rates during that period of time. Not from beginning to end, but at any point during that period of time. And I wouldn't have the foggiest idea whether the answer from the floor is correct, but it does sound logical to me.

MR. M. LAURIER PERREAULT: I do a lot of asset liability testing and modeling. I thought I knew what I was doing until I heard Dennis speak. I am concerned about the wide difference between the various brokerage houses on those option adjusted spreads. Do you have any feel for how much of that difference is due to simply the assumed volatility in interest rates, and how much of it might be due to different prepayment assumptions that they're using?

MR. BLUME: It is surprising the differences that are there. You would think that with the experiences we've seen and that sort of logic that should pervade in prepayment experience, it could be more of a science than an art. In fact, I hope this number is right, but our mortgage-backed securities people told me a couple months ago that something like 15% of the Ginny Mae 13s that were issued are still outstanding. What I'm trying to dramatize there is that there's a number of factors that enter on prepayment experience. And it just depends on what your beliefs are, what you think they're going to be. As an example, there's a school of thought that says the reason for that is most of these people can't be qualified for a new loan. Something's happened income wise, or something's happened to the value of their property, something disadvantageous has happened in their life and they can't be qualified for a new mortgage.

So, prepayment experience varies widely among firms. I think the reasons for why the option adjusted spreads are narrower now than they were a year ago is that the volatility assumptions were quite wide. Some people used 10%, some people used 16%. There will be a huge difference in the option value, whether you use 10% volatility or 16% volatility. But I think what time has done is that most people are using 10% or 11% volatility now, which is why the ranges are narrow. Another way of saying it is, I think people are still confused about prepayment.

If you could get prepayment down to a science, you'd then see the option adjusted spread significantly narrower. It is interesting to note how people look at prepayment experience in the different firms and how, with all the data that's available, there's still a big difference. Even now a lot of people, the real big sophisticated CMO players and pass-through players, are doing a lot of work in nitty gritty going through the individual loans that make up a pool, for that exact reason. They want to see if they can get a handle on what they think the expected prepayment experience is going to be.

As an example, our mortgage-backed securities person likes to buy pools in areas where he feels the prepayment experience is going to pick up dramatically, and buy them at a big discount, so that he can benefit from the increased prepayment.

There's also a school of thought which ought to lead you to believe that things should average out over a period of time, that if a particular pool picks up speed dramatically over a period of time, it will slow down over the ensuing period of time, sort of a mean reversion kind of thing. And a lot of people believe in that, too.

But there's still a big difference. And a lot of it has to do with just simply the fact that what people thought was going to happen under a certain scenario didn't really happen. Look at, as I mentioned, some 15% of Ginny Mae 13s still outstanding. I mean, if you'd have said that when Ginny Mae 13s came out, you would have gone up to somebody and said, "Do you realize when interest rates get to 8%, there's still going to be 15% of these outstanding." They'd just start laughing hysterically. It's not just interest rate patterns, it's based on a lot of factors.

MR. LALONDE: Dennis, for what kind of insurance liabilities do you favor CMOs? I'd like to hear a little bit more about when we think CMOs are a good asset to have. Is it appropriate for universal life, or annuities, or structured settlements, or pension plan liabilities?

MR. BLUME: Let me try to answer in a couple different ways. I like long CMOs. And the reason I like long CMOs is because you're going to be at the end of a tranche, and the chances of there being a huge average life variability is negligible. And we can't go into the math here, but the converse is true, too. For three year tranches which are short CMOs, there can be a significant average life variability. So, if you're writing a short liability -- say you got a three year GIC and you're trying to cover it with a three year CMO -- huge interest rate risk. Secondarily, if you run out the numbers on a long CMO, or a 20 year CMO, I like them personally, for long deferred annuities versus the other options in the market.

There's not a perfect match, don't get me wrong. But what I like about them is that the average life variability tends to be very, very static. And they still have significantly good yield. One of the numbers I showed you is that 20 year PACs had the 90 basis points over Treasuries on an option adjusted basis, with no credit risk. You could fully price off of that. You don't have to take anything off for credit, you don't have to take anything off for interest rate risk. My own personal opinion is that against annuity buyout kind of monies, I like 20 year PACs. For the three, five, ten year PACs, there's nothing wrong with some of them against universal life or SPDAs or anything fitting in with the prior comment I made, but I like the discount ones in order to keep more of a handle on the prepayment risk of them.

MR. LALONDE: So a long term tranche is one where you're receiving the coupon but you're not receiving any principal payments until the other tranches are paid off.

MR. BLUME: In being the longest part, almost by definition, it's going to be outstanding for a long period of time. Conversely, tie that into the comment that I made about

what's known as mortgage burnout, which is the fact that a substantial amount of high coupon pass-throughs are still outstanding. That is, you will never see a dramatic pick up in speed on those. The point is, you have a situation on those where there's probably always going to be some of them outstanding, regardless of where interest rate levels are. So you don't have that huge average life swing. That's what I like about the long ones.