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Session 9 Seminar **Economic Risk Capital: Part 1**

Tracks: Risk Management, Investment, Financial Reporting

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Panelists: David Hopewell
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Summary: Economic capital is an embedded part of the banking risk management and regulatory framework. The insurance industry has relied on rating agency and regulatory formulas that have been criticized as overcapitalizing and not appropriately differentiating risk drivers in the capital formulation. The emergence of C-3 Phase I and C-3 Phase II have introduced an economic approach to capital to the insurance industry. This half-day seminar takes a detailed look at the subject of economic capital.

The seminar begins with a historical perspective on banking and insurance industry capital. The criticisms of current rating agency and regulatory-based formulas are discussed. Economic capital is then introduced and defined, including different approaches that might be used to determine it. The presenter discusses the case for implementing economic based capital in an insurance company and answers questions such as, "If the regulators cause more capital to be held, why does it make sense to implement economic capital?"

It will then go on with a segment from the rating agency perspective, which will include a discussion of economic capital vs. rating agency capital. In particular, the rating agency representative will provide insights into how rating agencies intend to assess capital adequacy going forward, given the recent changes proposed to the existing risk-based capital requirements for products such as variable annuities and universal life.

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Note: The chart(s) referred to in the text can be downloaded at:
http://handouts.soa.org/conted/cearchive/NewOrleans-May05/009_bk.pdf.

The last segment will cover incorporating credit risk into an economic capital model. Determining economic capital for interest rate, equity and even underwriting risk is a natural extension of much of the work actuaries do. This session explores different techniques for incorporating credit risk into an insurance company economic capital framework.

MR. HUBERT B. MUELLER: I'll be your moderator for the start of a two-part session on economic capital (EC). The first session is more of an outside-in perspective on what's happening with the topic. We have three people who don't work at insurance companies, but who work at either consulting firms or rating agencies, working with companies implementing economic capital. The second part of the session will be more of an inside-out perspective. You're going to hear from two companies that have implemented economic capital approaches. My two co-speakers are David Hopewell with E&Y and Jose Siberon with Standard & Poor's (S&P). I will introduce each of them in more detail as they come forward. I'm with Tillinghast in the Hartford office, and I'm responsible in North America for our financial risk management practice. So I do a lot of work in this area.

First of all, I will start off making a business case. Why is it important to talk about economic capital today? What are companies doing in this area? What are some of the recent trends that we see happening in the marketplace? Jose will then give you a rating agency perspective on how S&P thinks about companies' capital models and the views on capitalization. He has some interesting news as to how S&P will change its approach for capital adequacy going forward. I believe this is the first time that S&P is talking about this publicly. We're actually the first in the industry to hear about S&P's new approach. Last, but not least, we'll have David Hopewell talk to us about how you can incorporate credit risk into calculating economic capital.

In this first section I wanted to give you an overview of what we see happening in the marketplace. What methods are companies using to calculate economic capital? How do we define economic capital? We'll take a look at some recent market trends, and I'll also give you a bit of a perspective of where we see the market heading.

First of all, just to be fair, the concept of economic capital as it is used today was actually developed in the banking sector, not in the insurance sector. So we've got to give credit to the banks. In fact Basel I, which is a regulation that has been in place for about a decade, requires banks to hold appropriate levels of capital for different financial risks. Of course, we've had the NAIC risk-based capital (RBC) in the insurance industry as well, but the banks have had proprietary models in the banking industry for a lot longer than we've had them in the insurance industry. Basel II, which is a recent change in the regulation, expands the capital requirements for banks, also through operational risks. It's not overly sophisticated, but it does require them to report operational risk exposure on a quarterly basis and to hold capital for operational risk. By "operational" I mean broadly all

nonfinancial risks: business, event, technology, people, legal and everything that's nonfinancial. Now we're sort of making the slide over to the insurance industry.

Insurance companies have picked up the concept of economic capital only in the last two or three years, at least in North America. I think in Europe they did it a little earlier. The rating agencies are starting to give credit to internal models, and Jose certainly will talk about that. We see a lot of regulatory changes on the horizon. Some of them are close to adoption, speaking of C-3 Phase II. We will hear about C-3 Phase II in the second session this morning, but there are others, too, such as AXXX, XXX and variable annuity reserving. Ultimately, we're going to do the same for equity-indexed annuities. A lot more of the capital requirements going forward will be based on your company's risks rather than industry models. Certainly the larger companies in the industry, and increasingly also the medium-size and smaller companies, are setting up proprietary financial stochastic models to model the risks in their business, to look at tail risk and to look at earnings volatility. From here on out I will focus my comments on economic capital as it's used in the insurance sector.

Just to give you a bit of market perspective, in Tillinghast we do a survey on companies' enterprise risk management (ERM) practices about every two years. We had about 150 companies worldwide respond to an ERM survey, and we asked them if they calculate economic capital and how they use it. Of those companies responding, 53 percent said, yes, we do. Another 28 percent said that we are planning on it, we're currently implementing it and we'll do it within the next 12 to 18 months. So, roughly 20 percent of the respondents currently have no plans to calculate economic capital. Interestingly, the 53 percent is the life industry percentage. If you looked at property and casualty (P&C) or at reinsurers, the percentages would be slightly higher at least, with P&C at 60 percent and reinsurance at 56 percent. So we're slightly behind the 8-ball here, but not too far.

When companies calculate economic capital, the typical and most broadly used definition that I've seen in the marketplace is that they generate risk profile curves along the ones that you see in Mueller Chart 5, and then economic capital would be broadly defined as sufficient surplus capital to cover potential losses at a given risk tolerance level. So you see that there is some broad flexibility in the use of the term because risk tolerances will vary. The typical risk tolerance level that a company will use tends to be more doctrinated by the outside world. If they have a certain financial strength rating, then the rating agencies will hold them to a certain risk tolerance level consistent with if you treated the company as a corporate bond.

Here is a very simple example to illustrate this. If you have a AA S&P rating or a AA Moody's rating, then that would equate roughly to a 10 basis point annual default cost if you were a corporate bond. Then you take that and essentially multiply it or compound it with the duration of the underlying business. Let's say the duration is 10 years, and you have that AA rating that's 10 basis points. That roughly means that the rating agencies will hold you to the 99th percentile. This is because if you

did 0.999, 1 minus the 10 basis points to the power 10, you'd get roughly about a 99th percentile. It's very simple math. Rather than using a CTE 90 approach, the rating agencies will hold you to a higher standard if your financial strength rating, in fact, is better than BBB. Remember, C-3 Phase II, CTE 90 and all that good stuff is if you're a BBB company. That's 100 percent RBC. If you have a higher financial strength rating, clearly rating agencies are going to hold you to a higher standard.

When companies calculate economic capital, they typically include all sorts of financial risks and increasingly also nonfinancial risks. You see interest rate risk, pricing risk, credit risk, equity market risk and liquidity risk included. Those are all the terms that the banks know as well, probably with the exception of pricing risk. They don't have that much pricing risk. Operational risk is increasingly used as well. There are some fairly large companies in the industry today that have very sophisticated operational risk models. Many companies in the industry have nothing on operational risk. If you look at the failures in the industry, a lot of them were actually caused by operational risk, so it's not something to be taken lightly.

As shown in Mueller Chart 7, when determining EC, various risk tolerance measures are used. We talk about percentiles and risk tolerance levels. I specify percentile. A lot of companies seem to be using a specified percentile, again consistent with financial strength rating, whether it's the 98th or 99th percentile. Some companies use a multiple of standard deviation. That, of course, assumes that the distribution is normal, which in reality, I would contend, it hardly ever is. The tail is always worse. I think you'll find that when you do tail risk analysis. Two years ago, CTE was only used by 15 percent. I'm sure that percentage has gone up a lot. It's becoming a much more accepted term, in particular because of C-3 Phase II. This is becoming an industry standard now. There are some others.

Some companies, in fact, use value-at-risk (VAR), which is also used in the banking world, of course. The one thing you have to know about these risk measures is that not all of them are coherent. Actuarial literature shows that VAR is not a coherent risk measure. Basically the risk is the principle of diversification, which is if you combine two risks, the risk from combining them is less than or equal to the risk from each separately. That does not hold when you do value-at-risk, and I think that's why it's not used that much in the insurance industry.

There are a variety of approaches in place for measuring economic capital. The typical ones that you see are a number of economic scenarios and particular stress tests. For example, in the German insurance market, companies have to do an annual solvency test where they have to assume that interest rates spike up by 2 percent and equities drop by 30 percent. Using this, they have to show that they're solvent at the end of the year, which has been a challenge recently for quite a few companies. That's typically a one-year—a much shorter horizon. When companies calculate economic capital, we've seen time horizons anywhere from one year to 10, 20 or 30 years. Of course there is a lot of stochastic modeling going on. Typically real world is used by real world, like best expectations for equities and

bonds. That tends to be used when you do valuation models or best estimates. Increasingly, risk-neutral stochastic models are used for pricing capital market-consistent analyses and for incorporating hedging in the calculation.

As I said before, the analysis increasingly includes operational risk. Typically—if you take one thing away from this session—economic capital tends to be based on the probability of ruin. You look at how much capital you have to hold such that your probability of ruin is below a certain target level. Again, this also tends to be the preferred method by the rating agencies. As shown in Mueller Chart 9, it's like if you know your probability of ruin without economic capital, you want to get it down to a target level of P , whether it's 1 percent or 5 percent or whatever the number is, by holding a certain amount of economic capital. That is a very simplistic graphic.

When we asked companies how they calculate economic capital, we got results similar to those from an audience poll about a year ago at a Society seminar, shown in Mueller Chart 10. Sixty percent of the companies, first of all, were calculating economic capital. There might have been a bit of a bias because it was a financial modeling seminar. I think the percentage in there was probably higher than you'd find in the industry at large, but 40 percent of people at the seminar said that they're calculating economic capital both at a line-of-business (LOB) basis and at a total-company basis and compare the two (we'll get to that). Some people only calculated either on a line-of-business or a company basis. From those that didn't, there were quite a few that were planning on implementing it.

If you look at the example in Mueller Chart 12, you'll find something that you might see if you have various lines of business. You might have several lines, maybe three or five or 10, and then you get the total company level. As you see, on the right there is a diversification benefit from combining risks. Whenever you combine, for example, equity-indexed annuities and variable annuities or any annuity and universal life, you're going to see that your combined capital requirement is lower than if you modeled each on its own. This makes sense because there will be some offsetting factors.

The question is, what do you do with the diversification benefit? First of all, it goes back to if you combine risks, the risk should be less than or equal to the risk from each of them separately, and it does work for coherent risk measures. When you're at a company level and you've got this economic capital for each line, yet in total it's less, the question becomes, what do you do with the difference? There are a lot of different things going on. Some companies will not use the economic capital requirements that they come up with and just use the total and ratio it back down to the line. So if their aggregate is higher, they don't use any diversification benefit. It's the simplest and most conservative method, of course. Some companies use leveraging, or they'll use financial reinsurance or letter of credit to actually leverage some of it out at the corporate level and hold the lines only to the lower amount of economic capital.

The implication relates to if you do pricing. Of course, capital costs you when you have a target return, right? If you're pricing for a 12, 13 or 15 percent ROE, and you're earning 3 percent after tax on capital, every dollar of capital is a drag on your return. The lower your capital at the line, the lower your profitability and the higher the profitability of the actual product has to be to get to a target return. Companies have taken increasingly sophisticated approaches to figure out what to do with the difference. Then, of course, you have people like Jose and others from the rating agencies who say that they have their own view of your total capital, too. That might be higher or lower than what you come up with. It depends on you, whether you want to share it with them or not. If it's higher, then somewhere else in corporate you have to hold that difference as additional capital so that you get your total rating agency capital. Then you have the regulators, too, as a third party.

When companies publish embedded value (that's another interesting topic), they tend to use either internal capital models or rating agency factors. It's probably about 50/50 right now. Some companies will use the AA financial strength capital that we're held to by the rating agencies. Increasingly, companies have their own internal capital model that will be a different amount, and then they'll show a sensitivity using the rating agency capital.

For what do companies use economic capital? Well, first of all, over the last several years, capital has become a somewhat scarce resource, and everybody wants to be very lenient about managing capital. After you've laid off people, you've got to be very good about managing capital so you don't have further actions to take in that sense. In general, capital management has taken much more priority in the insurance industry determining the right level of capital or to more appropriately allocate capital to different lines. That's usually where the concept of economic capital comes into play.

Let's look at some market trends. I talked about Basel II already. Solvency II is another interesting one. It comes out of Europe, but has implications for this marketplace as well. It's essentially a three-pillar approach that is being implemented, probably by 2006 or 2007, in a lot of places outside North America and probably also in Canada, for figuring out how much solvency capital a company has to hold. Essentially it becomes a company-specific approach. Companies have to do stochastic models based on their risks, and based on certain risk tolerances they're going to have to come up with the right level of capital. The supervisors are currently discussing how they would review these things, just like we're discussing that in the United States. All types of risks are to be included. In the three-pillar process, Pillar 1 is you run your model. Pillar 2 is a supervisory review in which they might adjust your numbers because they don't like them. Pillar 3 is sort of developing best practices in the marketplace for certain lines of business that could then become a benchmark. It's essentially a total balance sheet approach, and of course it's going to tie into the development about the international financial reporting standards, which are also gradually having their impact on this marketplace.

In Canada, the regulator Office of the Superintendent of Financial Institutions (OSFI) has put a capital model in place for segregated funds, which is essentially the equivalent of our variable annuity product, for the last four years. The C-3 Phase II model that we're using in the United States going forward is almost a mirror image of what Canada did and their OSFI regulation, with just some variations that are market-specific. Of course we have the same issue on reserving. Variable annuity (VA) and universal life (UL) are going to be specific to our lines of business. We have GAAP SOP. Of course that requires reserves for guarantees. You have to perform stochastic models for that. From the practical experience it seems that with the GAAP regulation there are less prescriptive requirements as to exactly how you have to do it. More judgment is involved.

There's a general need to perform risk profiles and hedging analyses. Pricing increasingly tends to be on a stochastic basis, and increasingly it also becomes more capital market consistent. I would say that the large companies are almost all using it already in one fashion or another, and the other companies are in the process of catching up.

I think we talked about this, but Mueller Chart 20 is an example of a tail-risk analysis, to give you an idea of what this could look like. It's a variable annuity block of business and the different lines here are essentially if you layer on different types of guarantees. One line is just the variable annuity with no guarantee. Then we layered on a guaranteed minimum death benefit (GMDB). One line actually offset some of that because we had it in an enhanced earnings death benefit. Those of you who work in that marketplace would know that those two tend to offset each other. You get the fees for both, but the risks offset each other. That's a very smart product. The last one, which again exacerbates the tail, is if you add on a living benefit like a guaranteed minimum income benefit (GMIB). Those of you who have done C-3 Phase II-type analysis will have figured out by now that GMIBs can be very costly in terms of capital requirement.

Now we get to the views of regulators and rating agencies versus economic capital. Of course, companies' internal models reflect the proprietary risks of the company. They tend to be specific to the company's risks, to include some judgment and to be prospective methods. You project forward, and you look at the tail risk. Regulatory capital tends to be based on industry factors and a large number of industry data. That's used to come up with factors that are deemed to be representative. As actuaries know, that's an average, so roughly half the companies are going to be better and half the companies are going to be worse. Very often, because of diversification, it tends to be that the larger companies tend to be better and the smaller companies tend to be worse. It's no surprise that the large companies are leading the charge to develop more proprietary economic capital models.

Now, the reconciliation might actually come through the rating agencies, and I think that's helping propel the development. I don't want to steal Jose's thunder

here, but historically I think the rating agencies have tended to have a retrospective view as well. There's much more of a trend with all of them right now toward evaluating companies' capital requirements on more proprietary models, and, in fact, all of them are either coming out or have come out with enhanced capital adequacy models. Standard & Poor's is already applying an economic capital-type approach in its financial products model. Moody's is coming out with a new capital adequacy model for the life sector. It has already come out with one for the P&C industry, and it's working on the one for the life sector. A.M. Best is enhancing its Best's Capital Adequacy Ratio (BCAR) model to allow for correlation of risks. Fitch is also working on a new capital adequacy model. All of them are working on this.

In terms of an outlook, I think economic capital is here to stay. We are already developing material on it for the education of future actuaries. I'm part of the Risk Management Section, and we're currently enhancing the education requirements so that the people that come through the ranks learn about economic capital. We talk about it at all the industry meetings. If you're very interested, on the Society Web site there is a specialty guide on economic capital under what used to be called the Risk Management Task Force. Now it's on the Risk Management Section. It's a little bit of a search, but you'll find it if you put it in as a keyword.

Mueller Chart 25 gives you an idea how companies typically look at this. If you look at the middle bar, companies tend to have a portfolio of risks and a portfolio of capital resources. If you think about economic capital, how does that fit in here or how does it fit in versus value creation? The risks that you hold—if you start from the left middle and go down—essentially determine how much capital you need. The portfolio of capital resources essentially asks, what type of capital instruments are you currently holding? How does value come into play? You're creating value if your return on the risks that you're taking is greater than the cost of capital that you're incurring. It's the old risk-adjusted return-on-capital (RAROC) concept applied in an insurance context. This is how the different things come into play, and visually it relates risk capital and value together.

Mueller Chart 26 is just one more outlook in terms of where companies are going with this. A last question from our ERM survey was looking at what companies need to implement an ERM. What comes to mind? Eighty-seven percent of the companies said that they had plans for improvement, which is not surprising because we're not there yet. Of those companies that indicated that they have plans for improvement, 71 percent said that they were looking to improve the application of economic capital. So there's a clear trend here that we've gone part of the way, but we're certainly not there yet.

With that, I'm going to lead over to Jose. Jose works in New York City as a director at Standard & Poor's. He joined Standard & Poor's in the fall of 2000. His primary responsibilities there include analyzing and rating large insurance companies and structured finance transactions that contain life insurance risks. So for all the good

stuff, like XXX or AXXX securitizations, Jose is there. He's also in charge of maintaining and updating the proprietary life insurance capital adequacy model. Before he was at S&P, he spent a number of years at Prudential.

MR. JOSE SIBERON: At the American Academy of Actuaries' spring meeting, I presented a story that was related to risk management, but I think it applies here, too. It's about a monastery that was sitting very high on a cliff. In order to get up there, they had a basket that was pulled with a rope by several monks on the top. When visitors came in, they got into the basket with a monk, and they started pulling them up. One visitor, halfway up the cliff, saw the rope and said to the monk, "I notice that the rope is very weak. It's old. How often do you replace it?" The monk thought for a second and said, "Whenever it breaks." How does this story relate to economic capital? Well, those companies that treat risk like that probably should have more capital as a safety cushion, just in case the rope breaks. You have to cover all the losses.

My agenda for today is to talk a little about capital and our criteria on capital. I'm going to talk about the new look of the capital model. This is an exclusive. For the first time, we will talk about this coming criteria change. This is a project on which we've been working. We've been leading the way in trying to bring a little more consistency across the globe. We have different capital models in Europe, Asia, Australia, the United States and Latin America, and different parts of the company have been growing apart in terms of the view of capital. We're trying to make sure that we stay consistent. In doing that, we're also going to be reviewing what we have done with the capital model and looking to see what kind of evolution we can create with our view on capital. This is very high-level. More details will come in the next few months. Given that the session is on economic capital, I'm going to present our views on that subject.

In general, our definition is similar to everybody's. Standard & Poor's applies models to a company to determine the amount of capital and liquidity that we expect the company to hold against potential losses that could be incurred for the financial market, credit, insurance, operational risk exposure and liquidity risk relating to a specified business activity or "book."

As Hubert presented it, capital should serve as a cushion for a rainy day. If something bad happened to the company, at least you have capital. Most companies, like Hubert said, don't fail because of capital, so I guess the insurance industry has been doing a good job so far of holding the companies to a high-level standard for the capitalization. It's with the other parts of the industry that we have to do a lot more work on, such as the ERM process, operational risk and other areas of risk management.

My experience the last five years working on this suggests that it's a very complex formula, and that no one model or area will tell you how much capital you need. That's why a lot of companies are spending a lot more time and resources to view

capitalization and to understand that better. As companies develop their view internally and put more resources in it, I suggest that you open your internal discussions with the rating agency because it builds on credibility and also opens up a lot of discussions and understanding of the company.

In general you have many views, as is shown on Siberon Chart 1, page 2. There are probably more that you can add to it. The multi-view of capital adequacy analysis is the best approach. We start with a static model and maybe a review of the economic capital models that you're building internally. We then look at trends, just to keep it in perspective, and how much of your assets to liability are growing or the ratio of assets to surplus. Why hasn't your capital and surplus grown over the years? Sometimes you divest companies, so it lowered your capital. But in general, if you haven't done any mergers and acquisitions, we would expect your capital to grow over time as you grow the company.

The other area where many companies fail, and I guess it's an area where we need more understanding, is concentration risk. Rating agencies hate concentration, no matter if it's asset, liability or company concentrations in different geographic areas or products. We just don't like concentration because it has been proven that it's a flag for failure. The other area is financial flexibility and capital planning. It's an area that, if you're a public company, is very tricky because it's very hard to understand how flexible you are going to be in the marketplace. It's like policyholder behavior. You try to measure certain probability based on historical behavior, but in general your company could really be in trouble if you lose that financial flexibility in the marketplace and could go down very quickly after that. It's difficult to measure that into capital. You have to interview the company and interview the management. Many of you are getting involved in the development and implementation of the different things in the company. We are also comparing companies to companies to see who has the best practice and who is falling behind the curve.

As I said, capital analysis is a tool, but it's not the only tool we use, and often it's just to make sure that it satisfies the rating level. It's not the area that we're going to give much credit to in the analysis. So capital analysis is more a constraint to the rating. You cannot buy ratings with capital. A number of insurance companies can say they have AA or AAA capital, but they're not AAA. Interactive rating and ongoing concern analysis are a bit different from structured finance analysis, and capital does not prove to be a pure offset for the risk of failure. We would try to use risk-based capital analysis as one point in the analysis. We want to make sure that you have enough capital, but having extra capital doesn't always increase your rating. It's very good to understand that because in managing capital of the company, sometimes you don't want too much excess capital. From our point of view, it doesn't add to the ratings. You should use it somewhere else, and you should understand how much excess capital you have.

We've been looking at companies that are developing economic capital models. There are a number of different dynamics going on in different companies. It's very hard for us at this point to say what the best economic capital model is that you should use. We're going to be analyzing the methodologies and assumptions because it's a growing area, and there are a lot of complexities and a lot of different inconsistent assumptions across companies. It's similar to embedded value that has been developed in Europe and in the United States. Different task forces are working on clarifying a lot of the inconsistencies, and if we move in that direction, we probably will get into a more consistent economic capital to minimize some of the model risk.

What are we working on right now? Every year we meet with some global analysts. We put them in one room and start talking about what we have to do in our criteria, which is kind of like our underwriting guideline. We also look at how the world is evolving and what we have to do to keep up with the world. One of the areas that we wanted to analyze was our static risk-based capital model. We have tried to think of how we can make that static model more flexible for future implementations of economic capital or for future ways where we can get more data from the companies to plug into our view of capital. We're going to be redefining the formula, which I'm going to talk about soon. We are recalibrating some of the factors from data that we can find internally or asking actuaries how the policyholders have behaved or how the mortality has behaved. Not to be too harsh on the American Academy of Actuaries, but a lot of those factors were developed 10 to 15 years ago and haven't been reviewed since. We are also using our own S&P database on credit default and other studies of market risk and other types of risks, to see if we can review it ourselves with our own data or obtain external data and see if we can update it and have more flexibility and also implement any new ideas that come up. Some of them will be implemented now, and others will be implemented through the years as we learn more. We will also try to close down the inconsistencies across the globe.

What is changing? We will try to move into an area where we will not have the capital adequacy ratios. S&P has different benchmarks for different ratings categories. Instead we will try to calculate something like a VAR. I know that Hubert said that VAR is not a good measure, but we're not assuming any correlation. We try to minimize some of that issue. We will calculate the required capital using various percentiles of different risk, based on different distributions. We will then compare it to the actual capital that you hold. At the end we'll have more discussions about the absolute amount of capital, how much excess capital the company has or how deficient your capital is for your target rating, so the company knows exactly where it stands in terms of ratings. We will determine if it's a constraint to the company, if they want to increase capital and how much they need to increase it or if they're going to be in the range that they're targeting.

That doesn't mean that they're going to get that rating. There are a lot of things they have to get to do that. As is illustrated in Siberon Chart 2, page 3, the old

benchmark was 100 percent capital adequacy ratio, and that formula was total adjusted capital minus C1, which is asset risk, divided by all of the other risks. Now we're going to be kind of moving C1, the asset risk, to the denominator, so you have capital compared to all of the risks together, which means that we had to really recalibrate all the asset risk factors again. When you divide the z-score for a normal distribution of the 99.9 over 96.5, you end up with about 1.75. The same thing happens with 99.5 and so on. Back 15 years ago when S&P developed this benchmark, I guess they thought about the normal distribution and similar percentiles. Where did the percentiles come from? They came from, as Hubert mentioned, the credit default metrics of global corporate credits. If you look at the five-year cumulative corporate default, for a BBB it's close to 3.5. We round it to 3.5. If you look at a single A, for a five-year cumulative default, it's about 0.7 percent or 0.8 percent. We round it to 1 percent, and so on. So these percentiles come directly from the five-year cumulative default metrics. Why five years? Because we thought that our rating outlook and rating knowledge goes as far as probably three to five years. Anything beyond that is very hard to project.

Some of the consideration of going global is that there's a lot of inconsistency between accounting in the United States and Europe. For example, there's GAAP accounting in Bermuda that is different from U.S. GAAP. There's also U.K. GAAP. There are also statutory capital requirements in different countries that are different from GAAP equity. We're trying to see if we can build models that can work with GAAP numbers but also keep track of the statutory requirements as well. In the United States you still have to hold statutory capital. We cannot just be blindsided and look at the GAAP equity. But in certain regions, such as Bermuda, the regulatory requirement is GAAP-related. Some Bermuda companies are coming to us and saying, "Well, if you treat me as a U.S. company, you ask me to hold "X" amount of capital, and if you treat me as a European company, I have a different amount of capital, "Y." Which one should they hold? We're struggling with some of that answer, because as Bermuda companies or others are sitting in the middle of the world, it's hard to reconcile which accounting regimes or regulatory regimes to use. Some of them don't have a regime, so we kind of become the de facto regulator. It's amazing how much data we have in the United States. We are thankful for that because it helps with the analysis, but if you go to certain parts of Europe, and even Asia, we have to beg companies for data, and companies don't want to give certain information. It's very hard for us to do the analysis and to give any credit if you don't get the data. That provides another challenge.

Another big challenge, believe it or not, with which we've been struggling is defining capital. It's hard to define capital because in different regions people define capital differently. Even banks and insurance companies define capital differently. Regulators and different outside parties define capital differently. This is why it's taken so long to roll over these new changes. We are struggling to figure out what is the best measure of capital, not just for financial strength rating for the operating companies, but also at the holding company to measure its leverage position. How much leverage can be done and what definition of capital should be used to

measure it is a very challenging question. We have variations of how much credit we give for value of in-force (VIF) and deferred acquisition cost (DAC). We don't count goodwill in the operating companies, but in the holding company sometimes there's some level of goodwill credit. With reserving in the P&C, there are different reserve deficiencies for which we adjust, and there are other discounts in the reserves in P&C. There are many other things. We could probably put up a page of 30 items that we could be adjusting to measure and define capital. It's very challenging.

In order to move into what capital is required to cover the risk at a given rating level, we have to look at different statistical methodologies for different risk factors. We're looking at assumptions, distributions, means and volatilities. We look at C-3 Phase II. I personally like the CTE measure. It's unfortunate that we cannot have that amount of information for everything, but if the regulators demand it, it's easier for us to get that information, not globally, but at least in the United States. In C-3 Phase II we will try to translate the CTE into the percentiles, at least at the beginning, until we figure out how we can also have a same benchmark by CTE, or at least variable annuities. Until we understand companies' distributions and how they model and what the output is, we'll probably ask consultants and other people in the industry to tell us to what a CTE 90, for example, translates. Does it translate to the 95th percentile, the 96th percentile and so on? Hubert has been telling me that it's the 96th percentile. So for AA required capital, it will probably be CTE 95 or something in that range. We still don't know how we're going to take into account the regulator's C-3 Phase II deterministic scenario if that comes through.

We hired David Ingram from Milliman to be our ERM specialist last month. He's going to be very involved in the first year trying to understand our rating process, but also trying to understand how companies are evolving in their economic capital and how we can integrate that into our analysis. There's a lot of work to be done in that area. Just as you are moving into this area, we're also trying to keep up with it.

Siberon Chart 3, page 4, is a nice picture of risk. The curves are just for illustration. They don't mean anything. I put a question mark in the operational risk area. We follow the NAIC RBC, which is based on certain percentage of premiums or certain percentage of liabilities, but that doesn't always cover what goes on in the world, and we hope that we can find more information about that.

For each of these risks, the big challenge that we've been facing is that it's hard to determine the time horizon. If you look at an insurance company, the time horizon could be very long, and for a health or life insurance company, it could be very short. Do you determine time horizon to be one year? Do you stress volatility for the next year or do you stress it for the next 10 or 15 years? This is something that we still don't know how we're going to conclude, and we are doing much research on that.

Economic capital, in our view, is something that could be a complement to our static model, but we're always going to have to have a static model. We want to have a one-time view of the company and also be able to compare companies across because, kind of like embedded value, it's going to be very hard to compare Company A with Company B, and what is the rational level of capital if you have different assumptions on the economic capital models? But that doesn't mean that we shouldn't understand a company's internal economic capital models, because they help us understand what the risk is and how that company compares to our industry average. Are you above the average? Are you below the average? There's a lot of credit we've been giving to companies that are showing us that they're below the average. Some of them are quantitative, but more of them are qualitative. Some of the static models have some challenges, but we're trying to provide more transparency and flexibility going forward.

Dynamic models are a good tool not just to manage capital, but a couple of companies have shown me how the economic capital models have added value in product development, for example, like Hubert mentioned, some of the GMIB offsetting GMDB or living benefits in different parts of the guarantees offsetting each other. Showing that with economic capital models demonstrates that you've been thinking a lot about risk and hedging those risks in different ways, and that creates more questions and discussions. There's a lot of product development that can be created by understanding your economic capital implications, plus RAROC. It can be a great discussion and also a demonstration that could have benefits to us and to the company.

The financial product capital model that we have is a more advanced cash-flow base model that we apply to companies that have GICs and funding agreements. We've been applying some of this, expanding the model to annuity blocks, where we do all the Greeks, the delta, the gamma analysis for interest rate risk, measuring the required capital and then adjusting the capital model to reflect your company-specific exposure. We've also been doing a lot of work with trying to create a return on risk-adjusted capital (RAROC) benchmark. For example, for a fixed annuity, let's say the typical capital requirement is 6 to 8 percent. Also, let's assume that the company makes 5 percent on that excess capital above the required capital, or 35 basis points. Then you try to measure your return at approximately 20 to 25 basis points. Your total return is about 55-60 basis points divided by the 6 percent of capital. Then you can get to a 10 percent RAROC. Some of that discussion has been going on with some companies to understand how they really price and how they really measure capital. It's a very helpful discussion.

MR. MUELLER: Our next speaker will be David Hopewell. David joined Ernst & Young after spending about 13 years in the financial services industry, working, as he says, on both sides of the balance sheet for assets and liabilities. His experience ranges from life insurance to institutional structured products and includes product hedging strategies, securitization, and hedge fund manager selection and risk assessment. Before he joined Ernst & Young in its Philadelphia office, David was the

vice president of equity risk management for the annuity division of a leading global financial services institution. He has also served as a senior derivatives strategist for the investment management division of a leading insurer and has spent some time as a pricing and product development actuary. David is going to talk to us about how to incorporate credit risk when calculating economic capital.

MR. DAVID HOPEWELL: I would break the learning objectives down into basically three parts. The first is that there are a number of decision points when you build an economic capital model that you have to face before you start doing anything. These decision points depend on some of the approaches you think you're going to take modeling risks. They're important to think through well before any modeling takes place and probably ought to be part of the methodology document that is put together before a single computer is turned on. The second is, what are some of the issues with modeling credit itself? Credit is a complicated risk. It's associated with an expected return called credit spread. It doesn't happen very often, and so it's hard to estimate. The frequency of which credit risk is experienced is pretty variable, so a given credit rating class may go for a long time with no adverse events and then have a very severe year and then return to the sort of quiet normal. It's pretty difficult to deal with as a time series. Another important part of dealing with credit is that it has a very complicated correlation structure.

When we look at economic capital, we're looking at how much money—sort of good sense, good business reserves—needs to be held against all the things that might happen over a given time period. That depends on how many things happen at once and how bad those things are when they happen together. Particularly because we're talking about doing tail measures here, whether it's CTE or VAR, that presents a challenging problem with respect to picking assumptions on the way things move together and what the world looks like not on average, but rather when things are going wrong. There are also links of credit to other risks that insurance companies take. I think there's a big three that insurance companies take: equity risk, interest rate risk and credit risk. Those things are tied together very tightly in a way that I hope you'll leave this meeting at least recognizing.

Economic capital modeling is being done by rating agencies, by companies and, in a very primitive form, even by regulators today. As RBC comes into play, it will become more widespread. In the past it has been formulaic. There has been a formula to determine your C-1 risk and your C-3 risk. It's not very responsive, and it's not exceptionally realistic. It hasn't been updated for a number of years. The world is going to simulation. I think something that was hinted at was that companies have a lot of options in the form of financial guarantees and in the form of operating strategies and decisions. In order to effectively judge how many financial resources a company needs under stress, an effective assessment of both the cost and the potential benefit of these options is required.

In credit, typically for modeling reasons, at least in the models to which I've been exposed, credit has been modeled as spreads less a charge. That has been a

constant over time. For instance, when I was a pricing actuary, I would look at a sheet, and the sheet said that junk bonds would yield 200 over Treasuries less a default cost or would have the default cost rolled in. That's what I was to use for pricing. There would be a grid, and there was an allowable asset allocation, and that was the number. We know that that's not realistic. If you look at the history of credit risk, the experience of risk tends to come shortly after prices are high and spreads are low, and the benefit from credit risk seems to come at the end when defaults have stopped but spreads are still wide. Now, depending on how you choose your model, that might matter a lot or it might matter less. Particularly if you're using a one-year model, it matters a lot, whether you think you're in the year when spreads are tight and defaults are either very unlikely because things are going great or defaults are likely because spreads are tight and the stock market is going down, or whether you're in a year where things are getting better, but risk premiums are still quite high. In fact, if you calculate the theoretical capital there, it can vary by a factor of two, and, in fact, companies might care about that very much because when spreads are wide and losses are becoming less likely, that tends to be the time when you have the least capital because you just experienced the downside.

Credit will also need to be thought of in these more realistic models as something that is linked tightly to interest rates and equities. There are some market dynamics—I may get a chance to touch on those—that have evolved, particularly over the last, say, five years, with the development of the credit derivatives market, that will link equities, interest rates and credit experience, particularly credit spreads, together. They'll link together because maybe they should, but more importantly, because a lot of players, particularly hedge funds, think they should and will act as if they should. That will make it happen at least until they change their minds and re-position.

Finally, an important part of credit is that, as with all modeling, actuaries have tended to generate scenarios extrapolating from history. I think we probably, at least many of us, have been exposed to the idea that equities go up 10 percent a year. When I do a regression, equities have gone up 10 percent a year. That's a start, but that's probably not adequate when you look at these more dynamic and complex capital models that the rating agencies will be using. We'll be forced to use them if RBC C-3 Phase II passes, and companies will want to use them in managing themselves. In fact, what we can gain from the past is not necessarily that equities go up 10 percent a year, but, rather, that there are certain associations between the way securities move individually and the way they move across classes. When stocks move quickly, something happens in the credit market. When interest rates move quickly, something happens in the credit market. When the shape of the yield curve changes, something happens in the credit and the equity markets. We need to become better at pulling those relationships out. We also need a new generation of scenario-generating capability. I don't want to get too far off-track, but calculating capital stochastically is really a very scenario-intensive activity. It

requires fast models, but it also requires good thinking in the construction of scenarios.

I'll touch briefly on some of the up-front decisions in putting together a capital model. We've already heard the VAR versus CTE discussion. I've seen both of them implemented, incidentally, and the way I've seen it implemented is that VAR is usually used for a short-term, say, a one-year roll-forward of a financial statement. For instance, if you think about statutory solvency or if you think about insolvency as a risk that your statutory balance sheet goes negative, you can look at the expected statutory balance sheet a year forward, calculate it, and there's some distribution. Then you can come up with the probability. Now one of the problems with VAR is that the VAR measures are very far out the tail. For instance, if you do 1,000 scenarios, and you want to be a AAA company, you're setting your capital based on your worst scenario, and how many of us will feel good about that? I think that's a pretty scary thought. That implies many more scenarios typically than we have expected to run. Also, you've got the issue of marking your balance sheet forward, and in the case of some countries, the reserving scheme is more stochastic. In the case of others, it might not be, but you've got to figure out a scheme to calculate a forward reserve under certain market conditions. That's something that's not always easy to do and may require nested stochastic kinds of calculations.

The CTE is a nice approach from the perspective that it uses more of the information of your output. You're using a larger fraction of our scenario output, and so you're a little less sensitive to the scenario count or to an outlier. You're not sensitive to your worst necessarily in isolation. It also lends itself a little more to long-horizon projections. One of the advantages of that is long-horizon projections let you actually run a company out over time as if it were a closed block. If you do that, you can look at just cash flows and not statutory balance sheets. That is important if you're going across multiple countries because, as Jose said, one of the main issues in calculating capital, besides knowing what's allowed to act as capital and what isn't, is that accounting regimes vary so much from country to country. You can get a substantial divergence if you're looking at forward balance sheets under some accounting regime.

My dream is that we all go to mark-to-market and value everything at London Interbank Offered Rate (LIBOR) and create accounts for the difference. Then we can all go home, and we won't have to have quite so many meetings about this. I think there will be a lot of trying and potential success and failure before that happens.

Now I will discuss credit modeling. I've split credit modeling into two pieces. You have to think about what is your smallest piece of credit, and what the distribution of that will be. The standard approach I'll talk about is to break the credit loss into two pieces. What's your default likelihood, and how much do you lose when it

happens? That is a much more flexible framework than fitting a single distribution to credit losses.

The real trick with credit losses is the joint distribution of credit losses. If you have a portfolio that is diversified, and has, say, a lot of A credit and a lot of BBB credit, how bad do you expect a bad credit experience to be? If BBBs go bad, will As still be good? We would guess they probably will not be perfect, not as good as they could be, but how bad will they be? That turns out to be critical because, once again, we're looking at tail measures. We're looking at low frequency events—1 in 50, 1 in 100, 1 in 1,000. They are not very likely things. The worst that can happen is something that we may not have observed, and that's one of the core problems with this.

How do you explain to management that you want to hold capital based on a set of events that have not ever occurred? But that's what we're talking. When we talk about 1 in 100, we're talking about what happened in Japan or what happened in, say, Argentina before World War I or what happened in Germany between World Wars I and II where the economy just evaporated. We don't want to talk about that. Credit gains and losses are also very time-dependent, what we call "state-dependent." Your expectation, especially over shorter time horizons, of the benefit or risk of holding credit-risky assets varies a lot, depending on the observable state of the world today. I'll say it again. Equity, interest rate and yield curve movements are the big noncredit risk drivers.

One of the core issues is, when you do credit are you doing credit risk, that is, losses due to default, or are you doing the credit exposure, that is, the gains and losses from taking a credit-risky position? If you look historically, credit has been systematically profitable. Credit risk has been systematically profitable to insurance companies and to most of the world. That should mean that credit risk is reasonably, over the long run, a good thing to do and should not drive capital up dramatically. Now, if you look at the way credit risk evolves, what happens is that the risks tend to be very large relative to the rewards. In a tail scenario over the first, say, five to seven years of your projection, you'll find that if you have a default event, it tends to overwhelm accumulated spreads. If you don't have a default event in that period, you tend to have accumulated enough credit spreads that it looks like it was still a profitable endeavor. If you work for an insurance company, it has already dividended the money out, so you don't really have that anyway, but until you get to the financial dynamics of the company, that's the way it looks.

A big modeling issue with credit is with deciding to do parametric distributions, but there are other ways to get to the same effect, and that is to use nonparametric types of statistical procedures. The advantage of those is that they can use data directly rather than have some judgmental assumption of what is the underlying curve. They require techniques different from what some of us are used to, but it

boils down to, in many cases, sampling without replacement with adjustments. It's a potentially fertile area for these very difficult-to-characterize distributions.

Another particularly important issue is how spread changes and defaults go together, because when you're measuring capital (I already sort of alluded to the five-year point as being the point of maximum risk), depending on how your measurement is done, you'll see the spread blow out and defaults begin to happen. That's one way it happens. The other way it happens, of course, is that defaults happen and then spreads blow out. Either way, those two go together and create a source of double stress. There may be frank default losses on a portfolio that come right out of credit, but your mark-to-market position on your assets also can deteriorate very quickly. Then the question is, how does that get reflected in whatever is your capital measure? If you're using a pure mark-to-market measure, it's easy. It just drops right through. If you're using a statutory balance sheet measure, it's not so easy. Just how does that roll in? Country-specific may not roll in at all. You may be dealing with book value assets unless sold. In that case, that's fairly easy, but you've got to keep track of what you sell. In a number of cases it turns out to be hard to actually figure out what is realistic and to do it.

I'm told by a P&C actuary with whom I work that the world has the P&C actuarial community to thank for the parametric approach, that is, the split between probability of an event and the severity of an event. It works pretty well for defaults. The real issue is characterizing the probability of default, whether you use it as a static or a stochastic variable. Realistically it looks like it ought to be stochastic, but that turns out to be hard to calibrate. Loss given default (LGD) is quite clearly linked to the probability of default, that is, bad default years tend to have lower recovery rates. Calibration is important. It is one of the core issues here, and, in fact, the more exotic and the better-calibrated your model, the more challenging it can be to explain sometimes.

I think nonparametrics are underused. There is a yield curve model that does a good job of producing real-world yield curves that looks at a historical pool of yield curve movements, picks from them and in some statistically defensible way jumps from one section of this table to another periodically. It does a pretty good job. It reproduces the statistical qualities of the interest rate yield curve perfectly in the limit because it's actually using real yield curve data and also produces what you would think are not that realistic yield curves, except that they happen sometimes, particularly in other countries. I challenge everybody here to try to develop it. Look it up. The approach is called the "spring constant yield curve model." You have to get your relationships right in order to have a good economic capital estimate.

As actuaries, we all need to learn about the statistical technique called "copulas." I'm not sure that this is the be-all and end-all, but it certainly is a standard and accepted technique for deriving nonlinear correlations between variables. We need to develop both familiarity and enough understanding that we can say that that is the correct or incorrect approach for the problem at hand, because our friends from

banking certainly will have a position on this. Rank correlation is a nonparametric technique. The P&C side uses it. In factor-based estimation, the credit modeling companies sometimes use this. They're moving more in the direction of this. But noncredit items can clearly drive expected gains and losses on credit in a very time-specific way.

You want to think about measures of default association, as shown in Hopewell Chart 3, page 3. There are three things that can happen, at least over the last 20 years. The world is relatively normal in correlations between different credit risks, and these are very closely related credit series. BAA1 and BAA3 are pretty tightly linked. But in the 1980s and the early 1990s, there was very low correlation. There was an occasional spike in defaults. They didn't happen at the same time. Then the world got good and everything was good together, and then the world got bad and everything was bad together. How do you handle something like this? This is where the copulas approach comes in, because you can actually have correlations that are very high when you're at the extremes of the distributions and correlations that are very low when you're in the middle.

Hopewell Chart 1, page 4, is my graph to link equity risk to credit risk. One line is the beginning of a bear market. That's when stocks go down 20 percent from their most recent high, and you can see that bear markets are strongly associated with substantial increases in credit spread. It looks like it did in the mid-1970s and early 1980s to a slightly lesser degree, and certainly in the 2000 bear market there were enormous increases in credit spread associated with the bear market. Three times out of four, bear markets and credit spreads go together.

Hopewell Chart 2, page 4, is yield curve slope, and you can see the world may have changed here. It looks like widening spreads and steepening yield curves go together, and tightening spreads and flattening yield curves go together. I think this is the way the world is for reasons that I'd love to tell you but don't have time. But clearly you have to link not just the level of interest rates or the movement of interest rates or your gain or loss due to duration but also the short end and the long end of the yield curve to your credit model. If you don't, you're not realistic. If you ask someone whether spreads are wider or tighter when rates are higher or lower, they'll probably say that when rates are lower, spreads are tighter. Statistically that has been a very weak relationship. Spreads are almost independent of the level of Treasuries, and that has been tested over the last 20 years between interest rates of 3 percent and 15 percent on the Treasury yield curve.

Now as you look at Hopewell Chart 1, page 5, you can see that there seems to be some diagonal structure from the lower right to the upper left. That, in fact, is the effect of credit spreads getting wider when interest rates fall. This is a very important effect. Treasury yields have been associated with widening credit spreads, and, in fact, this relationship is so strong that I didn't believe it at first, and so I went and confirmed it. I went to a Wall Street firm Web site, got their very

extensive and highly regarded bond return series out and tried to prove it to myself from that time series. I got the same thing. There was a slightly different number, but the same effect; the same very large, very statistically powerful sign was there. That is, when Treasury rates fall, credit spreads widen. When Treasury rates rise, credit spreads tighten. Now this has a lot of implications. One of them could be that the insurance industry for the last 20 or 30 years has, without realizing it, been taking advantage of the world's greatest natural hedge, long-duration mismatch and credit risk. I find that to be amazing. What I would say here is that I believe there must be a synthetic bond out there that has some mixture of credit risk and Treasury duration that outperforms either credit or interest rate risk. So if one of you finds it, you can become an investment person, get a fraction of your profits as compensation and not have to come back next year.

Capital is incredibly sensitive to the assumptions that you make around how things happen, how severe they are, how frequently and how they happen together. It is also sensitive to the measure you use to incorporate those things into a shortfall: statutory, GAAP, mark-to-market or whatever. You have to recognize these links. It's impossible to do a good job without recognizing these links. There are new techniques out there, not because we have too many Ph.Ds in the United States who want to get into the financial services industry, but because it's actually a requirement to effectively recognize the dynamics of the world as they are observed today and over the fairly recent past. I think the change is on us. As we move to stochastic modeling, as we move to economic capital and as we move to assessing the cost and potential benefit of options and guarantees, we need more realistic models. These are some of the reasons why and some of the techniques that you'll be called on to use.

MR. MUELLER: If you're talking about AAA-type capital having a 99.9 percentile requirement, what does that mean in terms of the minimum number of scenarios you'd like to see to sort of match with that? Of course, again, it's got to be more than 1,000, right?

MR. SIBERON: Unfortunately, we haven't reached that level. That's why we're trying to develop the new criteria and framework that David Ingram and the ERM group will be working on trying to define how we review the companies' owned economic capital model, which will be more the stochastic version of what you're talking about. We are talking like 10,000, or at least in the thousands, scenarios to better understand the tail risk. Also, if we do go with the stochastic analysis, we probably would like to understand a lot of the tail and failure scenarios. What assumptions drive those failure scenarios? Are those realistic assumptions?

MR. MUELLER: Following the P&C industry practice, it's typical that they do 10,000, 50,000 or 100,000 scenarios.

MR. SIBERON: That's another area where we don't know yet where we're going to go. We're probably going to have an ongoing normal volatility scenario and a

catastrophic (CAT) risk charge for the long-tail risks, similar to what we're doing in reinsurance CAT risk for P&C companies. We're probably going to move that for direct writers, too, where we have an extra CAT risk charge for mortality and morbidity, P&C risk, etc.

MR. MUELLER: Of course what this implies, if you think about it, is that we have continued to improve the runtime. We have to continue to improve the ways we look at scenarios. We have to continue to improve the quality of the models. Grid computing, distributed processing and all those things are going to have to become a staple in the industry. Some companies are now already are using hundreds of PCs for grid computing, and I think that's where the market's going. If you're going to be doing 10,000 scenarios of any block of business, I'd suggest you start thinking about what computers to buy and how you distribute processing right now.

MR. SIBERON: Don't forget the presentation to external parties like us. We don't want to see the cart full of papers. It's good, but we won't go through the model output. A nice presentation, kind of what you will present to the board of directors, will be probably what we need.

I think actuaries need to get more involved in the development of economic capital models and risk management. I have a bias because I'm an actuary, but when I go visit companies, and they show me a lot of the actuarial information, it's very impressive how much work they've been doing behind the scenes. But we only deal a lot with the chief-level people. They don't tend to present that information to us. Some companies are starting to bring the actuaries and talk to us on product development modeling in more detail. A lot of companies we've been assuming that are not as good because they're not as sophisticated just don't show it to us. So I think actuaries need to be more involved in that.

MR. MUELLER: They're not quite ready to show it all yet.

MR. SIBERON: Sometimes they're not.

MR. FRANK SABATINI: I have a question for Jose. As you move to economic capital, one of the likely outcomes is it could demonstrate that a company, because of diversification, because of the way they manage the company, could produce substantially lower capital than you might think they should be holding. If they're able to demonstrate that to your satisfaction, how does S&P plan to address that in terms of the rating of the company?

MR. SIBERON: That's a key question. We're working on developing criteria, and over the next few months we're going to be developing criteria about the new static model but also, hopefully next year, we'll be publishing more about economic capital and how we're going to integrate that into our analysis. Right now it's mostly qualitative. One area that you mentioned is that there's sometimes bad diversification, too, and we have to be careful. With asset risk measures, there's a

lot of room in there for us to look at correlations. For example, the collateralized debt obligation (CDO) approach and new techniques can be implemented with some companies to measure the asset risks. The problem is that the data and the information exchanged between the company and us is very hard to get it. We would love to run an asset pool of companies into a CDO approach and look at what is the true correlation and true default probability of that pool of assets, and I bet that you'd probably have as an insurance company a better asset pool than a CDO that is rated single A, AA and AAA.

MR. MUELLER: So you're saying the whole thing is emerging?

MR. SIBERON: It is emerging, and there is a lot to learn. A lot of companies have to be more proactive. We encourage more discussion and interactions with the rating agencies.

MR. MUELLER: I have just one comment on what David said earlier. If you've been following the news, there was actually some discussion. When you talked about long-duration mismatch, the Treasury is thinking about bring the 30-year Treasury bond back. That might be one of the vehicles.

MR. HOPEWELL: That's right. One of the things that surprised me, I would say, is that these days Treasuries are actually a negative risk asset. That's kind of a provocative statement, but think about what that means. Treasuries go up when other risks go down.