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Session 47TS
Tools to Help Senior Management "Manage" Risk

Track: Investment

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Summary: This teaching session discusses the available tools for communicating company risk postures to senior management. The focus is on tools that show distributions of results rather than a point estimate, along with stress testing (examples include value at risk, GAAP earnings at risk, option-adjusted value of distributable earnings, price behavior curves, and cash flow at risk).

Topics include:
- *How to leverage off of existing models to attain results*
- *Which tools can be summed from the product level to view enterprise results*
- *What issues are being debated*
- *How to use the corporation as an internal reinsurer of C1, C2, and C3 risks*
- *How financial services consolidation impacts these tools*
- *How to communicate risk to senior management in understandable terms*

Mr. Bradley Neal Buechler: We have three fairly diverse presentations for you, but they are all strung together by the common thread of risk management, and I think the diversity of the presentations is a testament to the diversity of risks that we, as actuaries and other professionals, are being asked to manage. So let me go ahead and introduce the speakers. Dr. Tom Kravis has a resume that is about six pages long. As chairman of the Mercy Emergency Medical Group he developed and managed the first full-time emergency department specialty group in the city of San Diego. He served on the board of directors of a number of different medical groups and networks. He was the founder and CEO of Data Doctor. He served as chairman and as a member of the national board of trustees for the U.S. Olympic Training Center Sports Medicine Science Task Force. He was a team physician for America's Cup Fitness and Medical Program. He is published extensively in medical journals and has been a health-care management consultant with Milliman & Robertson (M&R) since 1997.

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Note: The charts referred to in the text can be found at the end of the manuscript.

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I am Brad Buechler. I am an ASA and have been with Mutual of Omaha for about nine years. The first five years I spent doing group medical financial analysis valuation and pricing. For the last four or five years, I have been involved with asset/liability (A/L) management for essentially all the products that we sell, which is both individual and group life and annuity and health business.

My presentation is going to deal mainly with investment-related risks and, in that sense, it may have more relevance for pension lines of business or long-term care (LTC). I am actually going to use a case study that is a universal life (UL) case study, but don't get hung up on what type of product we are looking at because I am just trying to go through and demonstrate some potential tools and techniques that you can apply to different types of problems.

Here are two risk-management strategies that we will look at. The first one involves the problem of immunizing your economic surplus, which people usually try to accomplish through duration management. The second is risk and return optimization through risk/return profiles. When I talk about duration, I am talking about effective duration or option-adjusted duration, which is just simply a measure of how sensitive the value of an asset or liability is to changes in interest rates. And the whole idea behind this concept of matching the durations of your assets with the duration of your liabilities is that if those two things move in tandem as interest rates change, then your surplus, which is the difference between those two values, should be approximately immunized. It has a lot of key implications for solvency management. It is something that a couple of the rating agencies are keenly interested in, but it does have a lot of shortcomings. One is that it ignores rebalancing costs. Essentially what I mean by that is, to the extent that at some point in time you find that you are duration-mismatched, it is going to cost you something to sell your assets and buy a different set of assets that are going to reestablish your match between your durations. It also ignores the return implications of the duration target itself. If you can think of an upward-sloping yield curve where you are going to earn a higher yield for your longer maturity bonds, it is really not going to consider the implications of the duration target toward your profitability.

What is economic surplus? I think this is worth going through just because there are some people who are not familiar with this. What we are really trying to immunize is the difference between the option-adjusted value (OAV) of the assets and the liabilities. The OAV of an asset is really, for a publicly-traded asset, going to be the same as its market value. You can go out into the market and look and see what the asset is worth, and, presumably, there are some sophisticated financial investors and modelers who are thinking about how different types of assets that may have embedded options are going to behave under different economic conditions. They are running a number of different interest-rate scenarios and looking at how that asset behaves; that is supposedly behind the market value of

an asset. Just because there is no market for liabilities doesn't mean that we can't apply that same kind of sophisticated modeling to try to model how interest rates might change and what policyholders might do in response to changes in interest rates; therefore, establishing something similar, which we call an OAV of liabilities. It is sometimes referred to as a fair value of a liability. The economic surplus is generally going to be greater than both your statutory and your GAAP surplus. They both have conservatism: statutory, obviously, and GAAP on the *Financial Accounting Standard (FAS) 60* products, particularly because of the provision for adverse deviation. And then we also have persistency assumptions in our projections. We are projecting this in-force block forward and, to the extent that there are profits wrapped up in that business currently that get unraveled over time, the economic surplus picks that up and really comes close to what a sophisticated investor would pay for a firm if you roll everything up to the enterprise level. It tends to be more volatile than statutory surplus just because we immediately recognize changes in interest rates. Every time we do a valuation, we are looking at how interest rates changed, using that as our starting point and modeling our scenarios based on that. It looks at both sides of the balance sheet, whereas GAAP *FAS 115* looks only at the asset side.

As far as implementing it, the first thing you get to do is forget about accounting. Just concern yourself with cash flows; you want to segregate your cash inflows from your cash outflows. There were issues in years past with insurers, netting out premiums and liabilities. It is not hard to come up with an example where you can have an infinite duration if you try to net them out and then calculate a duration on those netted cash flows. So, you want to segregate your cash inflows and outflows. In our models, we don't assume any new business. There is no reason why you couldn't. I don't know what the rating agencies would think of that because of the impact that might have on your duration target. We just look at the in-force block and project that out over time. And then you need to option-price your assets and liabilities, which I have already mentioned. You are modeling the impact of these key embedded options, which many times cause your cash flows to vary with interest rates. We will get into some examples of that. You are going to run against a number of stochastic interest-rate scenarios, and look at how those assets and liabilities behave relative to one another. Run a bunch of scenarios and discount at the rates that are implied by those stochastic scenarios. The average of those is your option price, or your OAV.

In Chart 1 there are points that are plotted that reflect the OAV of the assets and the liabilities. The asset line is that straight top line and the liability line is that curvy, convex bottom line. If you look at that x-axis right in the middle of it that "0" point reflects prevailing interest rates at year-end 1998. If you move to the left to minus 100 basis points, essentially we took the prevailing interest-rate curve, shifted it down 100 basis points or 1% in a parallel fashion, and then generated a whole bunch of new scenarios from that new starting point and came up with a new OAV. Chart 1 is intended to demonstrate how the assets and liabilities behave relative to one another at different interest-rate levels. And the thing that sticks out is just the difference in the characteristics of those lines. We have an asset line that is nearly

a linear function of these changes in interest rates. And the liability line is exhibiting a lot of positive convexity.

Without getting into a lot of specifics because of the time constraints, what is causing this is really an illustration of what I consider to be one of the fundamental problems, or issues, with the insurance business, which is that we sell options on both our assets and our liabilities. We borrow money from policyholders and sell them options, for example am LTC contract that is sold noncancelable or a product where you can't change the premiums while you priced a certain implicit yield on assets. To the extent that rates drop and you are not able to change your premiums, you have really sold your policyholder an interest-rate option. Other examples include a UL policy such as what we are looking at with this case study. There are minimum guaranteed credited rates where the credited rate on the accumulation value can't fall beneath 3%. There are also options to lapse to the extent that the credited rate becomes uncompetitive. So we essentially borrow the money from the policyholder whom we have sold options to. We take the money and when we buy an asset we lend it to someone else and sell them options.

Take the case of a mortgage-backed security (MBS). You all probably have residential mortgages and understand how valuable it is to be able to prepay without a penalty if interest rates fall. You can prepay and refinance. If you think of an optionless bond like a noncallable bond, that will actually exhibit positive convexity; when you start selling options on your asset side it is really bending that line back so that it becomes more straight, and even negatively convex, in the case of MBSs. The liability line starts off positively convex just like a bond does, and selling options to policyholders on the liability side takes an already positively convex line and makes it even more positively convex. The implications of this on the behavior of your surplus is shown in Chart 2. It exhibits (the surplus is just your assets minus your liabilities) this kind of frown. You have the maximum surplus at prevailing interest rates and you are averse to significant changes in interest rates. For those of you who are somewhat familiar with options and derivatives, it all kind of jibes and makes sense because if you are short options or if you are selling options, volatility makes options more valuable. If interest rates stay where they are at, that is the best thing if you are short options. As interest rates become more volatile or change significantly, those options become more valuable and start eating into your surplus. The duration is really, if you hold your pen up, just the slope of the tangent to any one of these lines. So, you can see that the slope of that asset line isn't going to change materially almost regardless of what happens to interest rates. Whereas with the duration of the liabilities in falling interest-rate scenarios, moving to the left you can picture the slope of that tangent increasing, so your duration is increasing; conversely, in rising or higher interest-rate scenarios the slope is decreasing.

That is what Chart 2 is meant to show in a different way. The x-axis is identical to the x-axis on Chart 1. The y-axis is now the duration. The line that is nearly horizontal that is kind of cutting through that graph reflects what the asset duration looks like at those different interest-rate levels; it stays a little bit above a duration

of 3.0. What is called the UL Duration Target is really your bogey that you are trying to hit and match your assets up with. It exhibits this wild volatility where, in falling interest-rate scenarios, your duration is increasing significantly and vice versa.

What this brief case study is going to show, hopefully, is that, again, if you look at the center of that x-axis, which was year-end 1998, we went from a case where the assets were 2.0 shorter than the liabilities to a year later. Interest rates increased by almost 200 basis points, or by 2.0%. We went from assets being 2.0 years shorter than liabilities to assets being almost 3.0 years longer than the liabilities. You still have your asset duration of 3.0 and a new liability duration that is 0.6 or something approximate to that. So the obvious question gets raised: How important is it to readjust so that you are back into balance with your assets and your liabilities?

What we did was to look at what we are calling risk/return profiles. The return we measured by the present value of distributable earnings (PVDE) using GAAP accounting to model profits, which was just the cash in excess of reserves and target surplus. This is another thing to not get hung up on. I could have used a statutory income statement to come up with the same answer because at our company we model something called required assets and it is really statutorily constrained. GAAP required assets and statutory required assets are identical, so really you are holding the same amount of reserves and target surplus.

And, again, in this case study we are going to initially ignore rebalancing costs and look at two different investment strategies. The first one will be what happens if you maintain the same investment strategy that we are accustomed to which was invested in things with about a duration of 5.0. And the other one is, What if magically we were invested at a duration of only 0.6 and matched up? What would be the implications for risk and return? The risk is measured by the dispersion of these different PVDEs, or present value of profits, under 62 stochastic interest-rate scenarios. Why is it 62? We are using variance reduction techniques, so it is not like Monte Carlo simulation where you have to run 1,000 different scenarios. But why 62? That isn't really important. We are essentially going to look at how dispersed the present value of profits were under those different scenarios. Here are a couple of definitions: The OAV of distributable earnings (OAVDE) is, under all of those 62 scenarios, the average of all of the present value profits. The OAS is a spread to Treasuries that equates the present value of cash flows with the initial investment. It is a way of measuring profit. It is really just like an internal rate of return for the product line.

We are going to go through a two-step process. One, for each of the two investment strategies we are going to solve for the spread, or this internal rate of return, that makes the OAVDE equal to the initial investment. We are going to compare that across the two strategies to find out which one is more profitable and has the higher expected profit. Two, we are going to just pick a spread that is appropriate to the risk and use it to discount the profits and look at a graph of the results.

Mr. Richard B. Pitbladdo: Just a question and clarification. What was the initial investment? Is this discounting the whole block of business so that it doesn't front-load any distributable earnings?

Mr. Buechler: The initial investment is just the initial GAAP target surplus.

Mr. Pitbladdo: So you are saying you want to get a spread that will discount it so that the value you get is the same as what you would get on a GAAP basis?

Mr. Buechler: Yes. This is an explanation of the two different investment strategies. For the current investment strategy you are investing in longer duration spreads; they have a higher Treasury spread which is just a credit spread. Basically all that is saying is that you can earn more on the assets. The short investment strategy with a duration of only 0.6 has a lower spread and, therefore, a significantly lower yield. So the results of the expectations of the profitability of those were not surprising. It was just that the option-adjusted spread (OAS) of that longer, or the current, investment strategy is 113 basis points higher than the short investment strategy as a result of the investment income that you are able to earn by investing in longer duration types of assets.

For the second part of the process where you essentially just pick a spread, I think I picked a 500-basis-point spread and then all I did was enter all the 62 different scenarios and just ranked them in order of lowest to highest. This was just the discounted PVDE. So you can see there is a fair amount of dispersion in the results. They vary anywhere from about $26 million to maybe $57 million. Under the shorter investment strategy, you have a lower expected profit but a much tighter distribution, and a lot less risk. Essentially, for this particular case study what that was due to is the fact that when you are invested shorter, and interest rates in some of those scenarios rise very quickly, with a shorter investment strategy you are able to alter your credited rate more quickly because you are constantly reinvesting at the higher rate. So, essentially, it immunized you against those rising interest-rate scenarios. But it is similar, or it is analogous to, the concept of reinsurance where you have a lower expected profit but a tighter distribution of results. So, again, investing short just mitigates the risk in exchange for reduced profits. In our case there was a $15 million capital loss that we would have taken since interest rates had increased by a couple 100 basis points in a year. To reflect our short investment strategy with rebalancing costs, we just cut all of those down by $15 million to reflect, as far as actually implementing the strategy, what kind of a capital loss we would have suffered.

So in summary, what we have been able to do with our senior management is to use this type of duration management and option pricing to establish some investment constraints with the investment department. We use it to monitor and manage changes in the economic surplus, which senior management should be, and is at our company, keenly interested in because it is a good proxy for the value of the enterprise and how volatile that is. How much does that change over time and what can you do to maximize that and make that potentially less volatile? You also do this to fulfill rating agency requests. But you need to recognize the

limitations and round out the analysis. In this case we did so by actually looking graphically at a risk/return profile for the product line and trying to determine under a couple of different strategies what are the implications of those strategies to your risk and return trade-offs.

Dr. Thomas C. Kravis: I probably am the most qualified attendee in the audience today because what it says here is that this session is designed for attendees who have no experience with the subject. And I have no experience whatsoever with what I just heard, but it was very informative. I liked the clinical terms that were used throughout. Brad started out with the term "immunization" and it was used three or four times throughout. I am glad to see that people on the actuarial side use some of our terms. I want to comment on some of the points that were made in this presentation because the other term that was used was "Treasury bills." When you use a Treasury bill, a Treasury bill is the same in Japan as it is in New York or San Diego. On the medical management side, we have tools but they are not necessarily as objective as a Treasury bill. And I think one of the disadvantages that we have in medicine is that it is an art and a science and only about 20% of what we do is based on evidence or science. The rest is based on "this is the way we were taught to do things." So when I talk about some of the tools that we have to manage medical risk, you will understand where I am coming from. They are not quite as well-defined and accepted and objective as some of the terms that were just used.

What I would like to do is talk about several different ways to measure and monitor utilization and to manage risk. One I am going to call administrative efficiency. I would like to refer to the term degree of administrative management (DOAM). This is a term developed by Ken Sacia from M&R in the Seattle office, and it is his way of measuring how efficient a health plan or health organization is in administering its plan. Then we will talk briefly about staffing models—the health-care management numbers and types of personnel who are required to efficiently manage the medical care. Then I would like to talk about medical efficiency, which is the degree of health-care management. We refer to this as DOHM. These two clearly go together because when you look at the premium dollar, you have your administrative costs and your health-care costs. Next I will talk briefly about some of the tools that we have, the diagnostic related groups (DRGs) and the all patient refined DRGs (APRDRGs), as a way of looking at outcome. Employers are increasingly looking for report cards from insurance companies, medical groups, and providers, and we have a really hard time sometimes in establishing what is quality and how quality compares from one plan or one group to another. One way you might be able to do this is by using APRDRGs. These are clearly tools that can be used not only to measure outcomes, but to measure income or, if you are on the health plan side, the cost. Then I will briefly mention a new product just released by 3M health information systems about three weeks ago. I have been working with them over the last year on this software tool. I will tell you a little bit about its background, how it can be used to identify the clinical status and severity, and how it can be applied to determine severity-adjusted capitation rates for inpatient, outpatient, and pharmacy as well as a tool that can be used for disease

management. And then, last, I will briefly talk about some Web-based initiatives that we are working on.

The first is the degree of administrative management. On the left axis of Chart 3, we are looking at full-time equivalents (FTEs) or personnel at a health plan in a benchmark health plan versus the plan that we are comparing the benchmark to. Essentially, the worst plan has lots of FTEs and the best has fewer FTEs for the number of lives, for the number of premium dollars, compared to the best practices. Now, this is a deceiving illustration because what we do is we go to a health plan and we evaluate the number and quality of the administrative personnel, claims personnel, nursing personnel, and medical personnel and we look at the qualifications and the tasks that that individual performs and we compare them to what we have observed in the best of practices. The problem there, of course, is that the definition of a nurse at Plan A may be different from a nurse at Plan B. Some of those nurses are really benefits counselors and they take calls from beneficiaries explaining what is in their benefit plans. They don't manage care at all. So when we look at DOAM we have to understand what are the unique characteristics of those personnel at the plan and look at that compared to our benchmarks; then we compare the cost and resource consumption of those individual FTEs. We then look at the clinical versus the nonclinical. When looking at health-care management personnel, we would define that as nurses and doctors for example, and we would look at their functions and find out whether they are clearly marketing people. I met someone earlier who said that all some medical directors do is market—they don't manage. So we would clearly look at what that medical manager did in terms of his or her function whether he or she is truly measuring medicine. And then we compare that to our benchmarks. A lot of judgment is required, however, when we get the answer. For example, we had one plan where there was one medical director and he spent eight hours a day once a week working. If you look at how efficient they were in managing the care, they were at the upper end of our benchmark. They were 72% DOAM. The problem is that particular plan delegated all of the medical management to a provider group in the community. So even though on the DOAM scale it looked as if they were very efficient, the medical director really did very little. He really marketed, talked, and signed a few contracts. So the interpretation of DOAM is important and requires a certain amount of judgment.

The next tool that we use in conjunction with DOAM is degree of health-care management. Chart 4 simply looks at the left axis per member per month (PMPM) cost, and we have arbitrarily said that the costs here are $0–200. On the other axis zero is considered loosely managed, 100% is well-managed, and everything in-between is what we call moderately managed. If we were to look at the full local costs for a plan, the local providers would be willing to be paid in order to provide that care. One would get a profit either by reducing what you pay to your providers or by increasing the required management. And, as we have learned in California quite well with about 350 medical groups going belly-up, this is an exceedingly difficult part to do. They have lowered in California. They have lowered to an exceedingly low level the premiums, the dollars that they will pay physicians.

The required management that the doctors and the providers have is not sufficient to make it profitable.

Now when we look at DOHM, we can look at premiums but we can also look at individual types of diseases. For example, one of our clients in California had $188 PMPM for their severe Medicare heart failure patients, and they were able to lower this in 6 months by a very sophisticated intense disease management program. In addition, not only can you look at individual types of diseases with this model, you can look at different types of services. You can look at mental health and cardiovascular. You can look at medical-surgical. So when someone says he or she is moderately-managed or well-managed, the question on this model is, "What is he or she managing?" Are we just talking about the mental health? Are you talking about the skilled? When you define the terms here, you will define the management in terms of length of stay or days per $1,000. You could look at a well-managed system that indicates that their length of stay equals or exceeds M&R guidelines. And you would say that is probably a pretty efficient, well-managed group of providers. However, when you go in and look at the patients there, the patients aren't sick. They were admitted inappropriately. They did not meet any known criteria known to medical management for a hospital admission. So, yes, their length of stay is short, but they meet or exceed benchmarks because people are well. So the important part here is not to look only at one piece of the management such as the length of stay, but to look at the days per $1,000. And if you look at the days per $1,000, you can more accurately compare that group of patients with another group of patients. Unfortunately, a lot of times all we have to deal with from hospital provider groups is a length of stay, and we don't have what actuaries have—the denominator.

There are two other ways to measure DOHM. One is through claims and the other is through actually looking at the patient's care. If you look at claims and you have an elevated or increased length of stay, you know there is an increased length of stay compared to your guidelines or your benchmarks but you don't know why. The other problem with looking at claims is, besides all the adjustments you have to use, they are usually old so that when you go to the providers and you say, "You are not well-managed," they say, "Well that was last year, we are much better this year." In order to mitigate that problem, we often do a chart review. We go in and look at a couple hundred actual charts. We might target those types of diseases by medical surgery, mental health, whatever. Then we compare the charts, the length of stay, and the reasons for admission to our benchmarks and we give a DOHM compared to loose, moderate, and well-managed. And in those chart reviews, which we usually do in concert with the actuaries, we can then express whether a particular health plan is loose, moderate, or well-managed and we can also tell you why. And if we have done a chart review, we can identify providers in the network that are champions and we can provide indications as to who the outliers are. The importance of that is if you can show the champions, you can tell the other providers that those benchmarks are achievable; that is the first step in changing behavior. It is one thing to say you are loose. You want to be able to fix that by showing there are champion providers within the network; thus, you can improve the DOHM. Let's say a provider group is very efficient.

What kind of outcomes do they have? One of the ways of using this is to look at APRDRGs. You can look at mortality, you can measure resource consumption, and you can follow the infection rates, readmission rates, certain types of complications like pneumothorax following a certain surgical procedure, and the rates of ambulatory sets of conditions.

From the Floor: What is an APRDRG?

Dr. Kravis: A DRG is what Medicare uses to pay providers. It clinically groups patients into a particular group, but it does not mention anything about severity. APRDRGs subcategorize patients into several levels of severity and procedures. John Cookson, who is going to give a talk tomorrow, and is from our Philadelphia office, uses this to target hospitals. He takes the 5% Medicare claims database and looks at all the APRDRGs in every hospital for every patient everywhere. He sorts and gets the ten best hospitals. That is the benchmark; everyone else is compared to the top 20 hospitals in the U.S. What John has been able to show is that about 53% of all Medicare days are potentially avoidable. That means every other day in Medicare is a potentially avoidable inpatient hospitalization. And the reason it is important is that the doctors and the plans in those geographic areas can't say our patients are sicker because these patients are the same. Every APRDRG of one patient is the same as the one that is being compared to in the other geographic area. And the advantage of these is you can then target those high-cost, high-volume patients and medically manage those as opposed to the ones who don't need the medical management. Does that answer the question about the APRDRGs?

From the Floor: Yes.

Dr. Kravis: It is used in about 1,500 hospitals in the U.S, so it is a very good tool. Table 1 is APRDRG acute myocardial infarction or a heart attack compared to benchmarks. Why this is important is, again, your clients who are buying insurance products, you have contracted with these doctors and hospitals. Are they providing good care? If you look at APRDRGs, they are severity-adjusted. You could look at the four levels of care: the least involved, a little more severe, a heart attack with heart block, or a heart block with congestive heart failure (CHF), which would be the sickest patients.

TABLE 1
APR-DRG 190 ACUTE MYOCARDIAL INFARCTION
(National Benchmarks)

Subclass	% Count Severity Index	Avg LOS	Charge ($)	% Count Risk Mortality	% Died
1	17.8	4.2	9,773	29.6	0.78
2	48.5	5.0	11,177	23.2	2.88
3	23.8	6.7	13,821	32.6	10.32
4	9.9	9.7	26,962	14.6	47.08

You can see the percentage of patients in those categories. The sicker they are the longer the average length of stay. The more severe patients consume the most resources. Look at the percentage of patients at a risk for mortality and the percentage who died. You can compare outcomes by APRDRGs, severity, age, sex, commercial, or Medicaid for any patient in the country and you can then establish whether your providers are getting good quality. The same sort of tool can be used to look at cost. Chart 5 graphs the net income cost models for CHF and, again, if you look at severity, this is the cost on the left-hand column. The horizontal contains the levels minor, moderate, major, and extreme. These very severely involved patients with heart failure take up most of your resources. This is a model that you would use to contract with providers. You might want to pay them more for patients who are really sick but, on the other hand, pay them less for patients who are not quite as sick. It also allows you to compare one group of providers to the other.

Now I want to briefly talk about the clinical risk groups (CRGs). This is the new product that was developed by 3M. I don't work for them. I don't get paid by them for saying this. I am a clinician. I am not an actuary, but I think it is a very powerful tool. It has been developed over the last four or five years. The goal was to develop a clinically meaningful means of measuring the health status of a population for the purpose of predicting future health-care expenditures. Another purpose was as a management tool for the managed care organizations that could also be used to risk-adjust capitated payments.

We are in a pilot program with a health plan in the West to pay providers based on how sick the patient is. We think this is more fair than just giving a capitation rate to a doctor based on age and sex and a few little other variables. Develop a language that links the clinical and financial aspects of the care so that you link them according to severity. So if the patient has both heart failure and emphysema, you have two guidelines that are used to manage that patient. And then, lastly, it's a system for all ages that has been tested on all populations. The CRGs provide a single system for all ages, rather than separate systems for different ages. This is an example. This system doesn't take regular claims. It takes claims in the first year of claims. It identifies the clinical CRGs, the clinical group. In the second year, it measures all the resources that were expended on that clinical group. It looks at claims for outpatient, inpatient, and pharmacy so it is

able to categorize patients and put them into a unique CRG. There are 1,083 different individual risk groups. And each risk group is clinically meaningful. And by meaningful, I mean there were a couple of dozen doctors, and I was not one of them, who looked at each risk group time and time again and argued with the actuaries who helped develop this and said, "No, that doesn't make clinical sense, change it." So they are very clinically meaningful. It is something that the actuaries can look to the clinicians as helping them develop a tool that has a lot of clinical meaning and significance.

Table 2 is an example of different CRG statuses. The basic one is the healthy status. This is the patient that in year one has used very few resources, if any. Then as you go up the ladder these are more significant. This is single minor chronic disease—for example, someone with acute pneumonia who gets better and goes home. As you go up the list, you go to more chronic diseases, single dominant or moderate chronic diseases, diseases in chronic multiple organ systems, dominant chronic diseases in three or more organ systems, dominant and metastatic malignancies, and then catastrophic conditions. These are the different severity levels, as you can see, for this particular Medicare population. There is a severity level built for each status of these CRGs.

TABLE 2
ACRG3 PAYMENT WEIGHTS BY SEVERITY LEVEL
FOR THE MEDICARE POPULATION

CRG Status	Severity Level 1	2	3	4	5	6
Healthy	0.2009					
History of Significant Acute Disease	0.4993					
Single Minor Chronic Disease	0.4266	0.5867				
Minor Chronic Disease in Multiple Organ Systems	0.4666	0.6540				
Single Dominant or Moderate Chronic Disease	0.5256	0.7189	0.9370	1.1841	2.0850	3.7962
Disease in Chronic Multiple Organ Systems	0.8857	1.4277	2.1845	2.9002	3.6478	6.1852
Dominant Chronic Disease in Three or More Organ Systems	1.3768	1.8098	2.5294	3.6102	4.9347	6.6154
Dominant and Metastic Malignancies	1.4912	2.4280	4.0026	5.3719		
Catastrophic Conditions	1.5661	2.7608	5.3801	9.0080	10.8938	13.2945

Table 3 is an example that we have used in some disease management models. We are looking at the payment rates by severity level for an individual with diabetes mellitus (DM), CHF, and chronic obstructive pulmonary disease (COPD) for the Medicare population. You can see that the severity and the payments would go up. The same would be similar with CHF or COPD. Then, if you add these diseases, and

we know these people have comorbidities, it accounts for these comorbidities and accordingly increases the payments.

TABLE 3
CRG PAYMENT WEIGHTS BY SEVERITY LEVEL FOR INDIVIDUALS WITH DM, CHF AND COPD FOR THE MEDICARE POPULATION

CRG	Severity Level 1	2	3	4	5	6
DM	0.5953	0.7797	0.9246	1.3985		
CHF	0.8950	0.9782	1.1783	1.7863		
COPD	0.8426	1.0144	1.3077	2.2961		
COPD & DM	0.9925	1.1082	1.4112	1.7560	2.2504	3.3735
DM & CHF	1.0632	1.2664	1.6494	2.0645	2.6528	3.6650
COPD & CHF	1.0956	1.4792	1.7433	2.2875	2.8244	3.8638
DM & COPD & CHF	1.4588	2.1968	2.5539	3.2849	4.2358	5.7845

Table 4 is an example of some of the managed reports that can be developed by using this kind of tool to help you manage the risk. You would look at diabetes level 1, 2, 3, and 4, and you might look at what are the outpatient laboratory visits or expenditures for level 1. The actual here is 0.39 compared to 0.25. You would expect if you manage diabetes well, you would be seeing patients as outpatients rather than inpatients. And you would hope that the complication rates would go down. The charges interestingly enough would go up. The reason for that is that if you keep people out of the hospital, when they do go in they are usually sicker and they are going to use up more resources. Then the hospitalization rate would be less than the expected.

TABLE 4
SAMPLE CRG MANAGEMENT REPORT - DIABETES

CRG DM	Outpatient Laboratory	Complications		Average APR-DRG Charges		Hospitalization	
	Actl/Expt		Actl/Expt	Actual $	Expected $	Actual	Expected
Level 1	0.39 0.25	EDCs	4.....7	3700	4106	1.4	0.5
Level 2	0.47 0.39	EDC	2.....9	4700	5707	2.8	1.2
Level 3	0.40 0.59	EDC	6.....12	12,537	9085	3.1	3.5
Level 4	0.30 0.75	EDC	12.....18	33,445	21,695	6.8	9.6

This would be a type of tool that you could use as a management report to look at the kind of patients you have with diabetes.

This is one of the CRGs. This is diabetes CRG. This is level 1, 2, 3, and 4. The highest level is someone who was sick enough to have their knee amputated and has nephritis and has other complications. So, this is a very sick patient. Level 1 is your garden-variety patient with diabetes. We had a client in North Carolina and we looked at hospital claims that did not include outpatient claims. So it did not adequately reflect the full scope of the model. These were hospital claims. We looked at diabetics only and we looked at how many levels 1, 2, 3, and 4 there were. About 60% of the patients in this group had level 1 diabetes. Then we took just level 1 and we looked at that level from that year over into the second year. Now, 3 and 4 are projected, so this represents how many patients were in level 1, year 1. The second year this dropped. The difference is diabetes and other. The implications of this is that lots of resources in diabetes are spent not on diabetes but on complications of diabetes. And when we talked to the disease management companies that have $30–40 million worth of venture capital and they ask us how we are going to manage diabetes we said you have to be able to manage sick people. Because when they have diabetes they have all these other things, and they actually use up more resources than the diabetes.

This is an example of how one would use this in a disease management company. This is what would be expected in dollars, cost, and this would be the actual. You would look at your year 1 claims, and you would define the patients in the clinical group. Year 2 you would measure, or in the second year claims you would measure, the actual cost and then you would be able to predict what your expected costs are going to be in year 3. Now you have a baseline to which you can compare the actual cost. In this example, your other costs are going to increase because when you take care of diabetics, you increase lab and pharmacy and you reduce inpatient. And that would be your actual experience. The way health plans are managing risk is they are going to disease management companies and they are downloading and downstreaming that risk to disease management companies, giving the disease management companies a management fee plus a percentage of those savings. What this CRG model does is help to establish what are the real costs and what are the real savings.

This is what will replace it. The things that medical managers do—medical management, pre-op, concurrent review—will be Web-based; not all of it, but a lot of it. Some of these tools will be on the Web. In fact, we are working with 3M. In a couple of years, we will have a Web-based type of product where providers with the oversight of the insurers will be able to self-authorize based on severity. The advantage to the actuaries is that if any of you are involved in point-of-service, you don't know who is using those services until months later, so it is real-time. So it allows you to measure on-line what resource consumption is, not just for the uncomplicated patient, but for the severity-adjusted patient. I guess what it would also allow you to do is provide a profile. So once you collect the information on the providers that are not behaving the way you want, you get them to go where you want me to go right now, to the exit door. Thanks very much.

Mr. Antonio L. Tan-Torres: My background is more on the pension side. For anyone else who hasn't been introduced to the pension side of your pension plan and thorough aspects of that, hopefully this might provide you with some introduction.

Anyway, for most corporations out there, at least the well-established ones, one component of liabilities they should have, whether they are an insurance company, a manufacturing firm, or a financial company, is the pension plan. My discussion will focus on how pension actuaries might be able to help the chief financial officer (CFO) or the treasurer manage this pension fund risk. And one of the more common tools that pension consultants use in managing the appropriate risk for the plan sponsor is setting what we call a strategic asset allocation—the mix typically between equities and fixed income. The way we typically do it is from an A/L framework. Most asset-only analyses will just say 70% equities, 30% fixed income, or 60/40. The problem with that is that to the plan sponsor, 60/40 or 70/30 doesn't mean much. What the plan sponsor, the CFO, and the treasurer need to know is what is the impact of that asset allocation decision in terms of the financial variables that he or she is interested in? Typically this would be ERISA minimum contributions, *FAS 87* accounting expense, funded ratios, and perhaps PBGC premiums. And, so, to do that, we typically project the demographics of the plan. We do a 10- and 20-year projection and we look at 5 or 6 different mixes. Our aim is to show the long-term impact of each of the mixes on the required contributions, account expense, and funded ratios. Now, the approach we normally take, the simple approach, is just to do a projection based on an expected scenario basis for a liability at normal cost, pump it up with interest, and take away benefit payouts. The problem with that is that when you just use an expected projection scenario, the answer always comes out to 100% equity. The reason being, on an expected basis equities are expected to return more than fixed income. So what you are not able to relate to the CFO and the treasurer is the volatility around that level. To do that you need a multi-scenario, Monte Carlo stochastic forecast.

I work for SEI Investments. We help you manage money. So we need to pay a whole lot of attention to expected returns, risk, standard deviation, and correlations. We do all of that as any money manager would. However, the approach we take is this A/L framework. We will model, as most consulting firms will, demographics, plan provisions, expected payroll growth, and all that stuff. Together we combine that and take into account, talking with the CFO and the treasurer, what their objectives are. Is it minimized contributions? Sometimes, maybe. Should they maintain this level of pension income, which they are enjoying right now? I had a case where the fund was over 200% funded and I was going to recommend a lower equity allocation. Again, there wasn't any real need to build the surplus further. But the treasurer came out and said, "Well, we would like to maintain the current level of pension income that we have right now." And, as it turns out, the pension income was, say, 80% of their earnings. It is a framework where you take into account what they want. It is not, in all cases, clear what the right objective is.

To do this Monte Carlo simulation we have this three-stage simulation process (Chart 6). On the highest level, we have a stochastic model of the usual variables: bond yields and yield curves. Then we have an inflation model, and then we need to model the stochastic returns for each of the asset classes we are interested in. Moving down to the second level using the stochastic model on the first level, the bond yields determine the discount rates that you might use in discounting financial liabilities. Inflation will determine projected payroll. Asset class returns will determine portfolio returns based on the asset weights. After that you finally get to the third level, which are the financial variables the CFO and the treasurer might be interested in. From there you will apply the ERISA funding rules to get minimum contributions. You apply *FAS 87* to get accounting expense and then you can get the funded ratio. We try to relay this to the treasurer and the CFO that we modeled these stochastic scenarios. It is not just a straight line going up or a level line or a line going way down; it is a stochastic model that can go up one year, down another, and stay level for a couple of years; again, that goes through all three levels. You can show that the contributions could go up and down from one year to the next. Accounting expense, the same thing, as well as funded ratios. Again, this is to give them the expectation of the volatility that they should expect over the next five to ten years. From there the usual approach we take, rather than showing them 1,000 numbers, is to sort them according to ascending order and pick off some percentile. Typically you would show the median—the 50th percentile. You could show a 90% confidence interval where you show the 95th percentile and the 5th percentile. There is a wide variety in terms of the financial sophistication of treasurers and CFOs, and more often than not you need to go way back and explain step by step. For a lot of them, this is the first time they are seeing a floating bar, as we call it. So we take pains to explain what they mean.

And then we instruct them. We try to set an asset allocation. Normally, from an asset viewpoint, it is always based on a relative benchmark. Alpha is over a benchmark. It is frequently helpful to get some absolute benchmark. If you could tell the CFO and the treasurer what asset return that they need to achieve so as to be able to cover the liability growth as well as the benefit payoff without having to put in any contribution—let's say they are fully funded and are putting in zero contribution—what is the investment return they need to achieve so that they might be able to maintain that funded ratio they are enjoying right now? This is where you combine assets and liabilities. From the A/L projection, you can get a liability growth. You can get some sense of the benefit payouts and from there, summing up the two terms, you can have some absolute benchmark in terms of portfolio returns.

We show them various definitions of pension liabilities to let them understand their plan better. We can show funding liabilities, which are the actuarial liability and the current liability—the two definitions of liabilities that determine ERISA contributions. If they are interested in the accounting side, we might show projected benefit obligations and accrued benefit obligations. For example, the current liability might be $160 million and in 10 years they should expect it, on a median basis, to grow all the way up to $400 million. To try to explain that growth of liabilities, we give them some sense of the normal cost. Normal cost is the present value of new

benefit accruals. In this case, it might be between 3% and 4% of the actuarial liability, or between 6% and 7% of the current liabilities. So we use these components to explain the plan liabilities.

Benefit payouts is a strong consideration for them. They can't do much about it, but it is good for them to know. Payments might be rapidly increasing from roughly $5 million to $12 million over the next 10 years. And that is good for them to know. They won't be surprised, as a percent of assets payouts might be increasing at 3.57% per year over the next 10 years. So, if you took a ratio of the tenth year and first-year liabilities and took the tenth root, then that would be the other component of liability growth. Just say it is 5%. I add the 3.5% of benefit payout. So I can tell them OK if your fund earns 8.5% average over the next five to ten years then you should be in good shape. You will not need to put in additional contributions. That is a big added value in terms of information for a CFO or treasurer, which is an absolute benchmark that they can look out for.

Then we start showing them projected contributions. Assume they put in some additional contributions for 1999. The way ERISA works, you can use this buffer. You have built in because that is an additional $10 million in contributions in 1999. You could enjoy three years of zero contributions, after which your buffer is gone and you might likely need to put in additional contributions. The implication being in all likelihood that the expected returns that we show for various portfolios are probably less than that absolute target that I mentioned earlier. That is easy to confirm because, again, they are forced to put in money after three years. We would show them on a present value basis how much they need to put in. We would present it in a floating bar format. There is an expected number. For a 70% mix, it might be $105 million roughly. If you wanted a 90% confidence interval it is quite wide and might go from $10 million to $230 million. We are looking over a ten-year period. The funded ratio might initially increase and then decrease over the years on an expected basis and a median basis. The same thing might apply to the accounting expense. We show them if they are interested in pension expense drops initially, and then increases over the next nine years. And finally we might show the specific mix that we might be recommending and show the ranges on a year-to-year basis. And just to remind them I typically provide a sample scenario out of the 1,000 scenarios that we show. We have to plot one of the scenarios just to remind them that in terms of what to expect in the future, it is not just a matter of connecting the middle bars, i.e., the medians. The reminder being that in some years the actual value will be under and in some years it will be over. And one specific scenario will remind them of that.

So, that is the approach that we do for pension plan clients. Thank you.

Mr. Buechler: Any questions?

Mr. Kevin J. Shand: Most of the time when you are looking at stochastic simulations it is focused mostly on the asset side and I was kind of curious to see that you were talking about modeling demographics which we don't see a lot of.

So I am just curious as to what your approach is to modeling, say, turnover or new entrants or retirement or what demographics you are referring to.

Mr. Tan-Torres: Generally, we would assume zero gain/loss in terms of the decrements. Again, this is just a rough generalization. You are right. The general process has been to disregard the stochastic volatility around the decrement itself. What we sometimes do is look at the volatility in terms of what might be a bigger factor—the growth and actual demographics. Generally, we ask the client what they expect over the next 5 to 10 years, and, generally, we would apply that in whatever scenario it might be over those 1,000 scenarios. However, you can play around and if you think that under high-inflation scenarios or whatever for some reason you might have increasing work-force growth you might try and factor it in. But, generally, we don't, yes. In terms of the stochastic demographics, it is more the impact of the discount rate that we look at. Thank you.

CHART 1

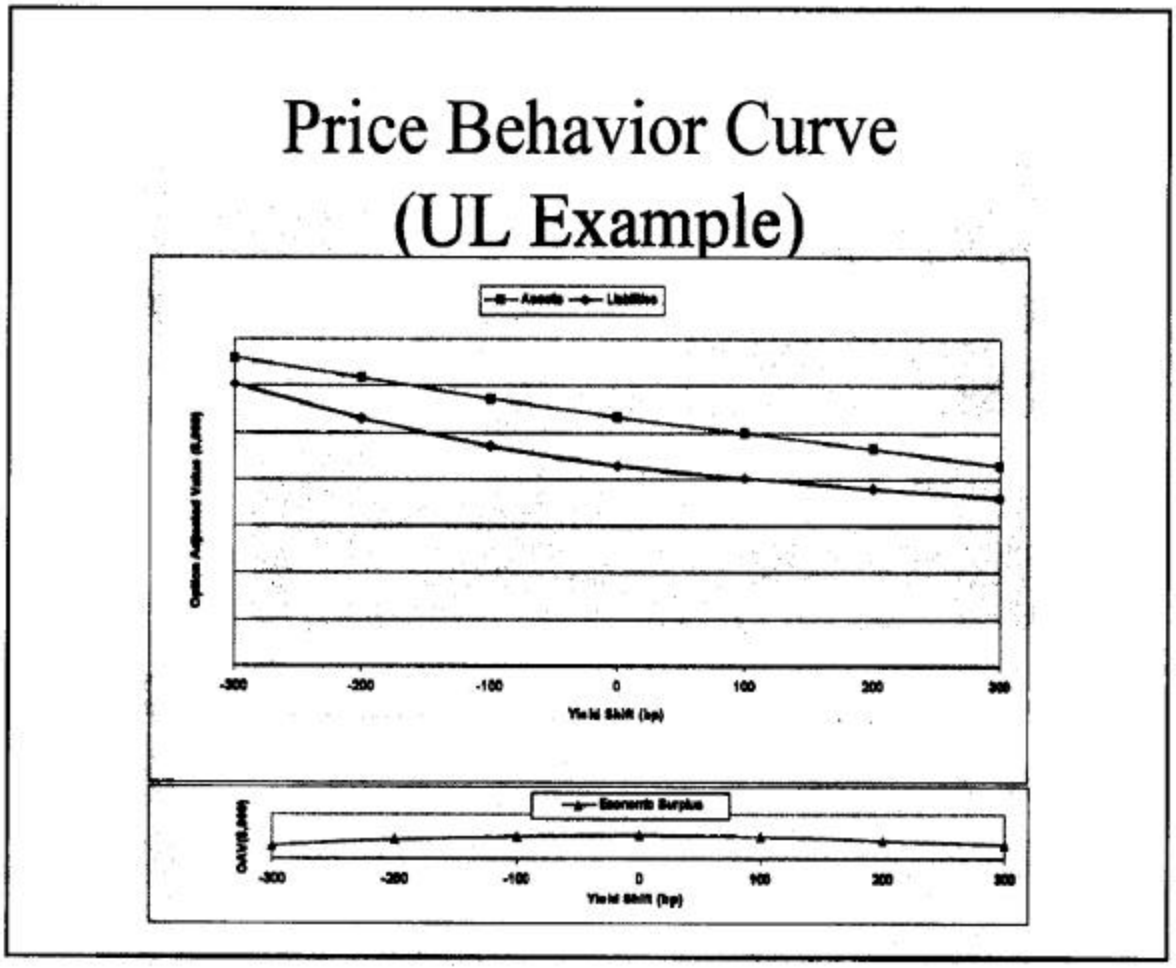


CHART 2

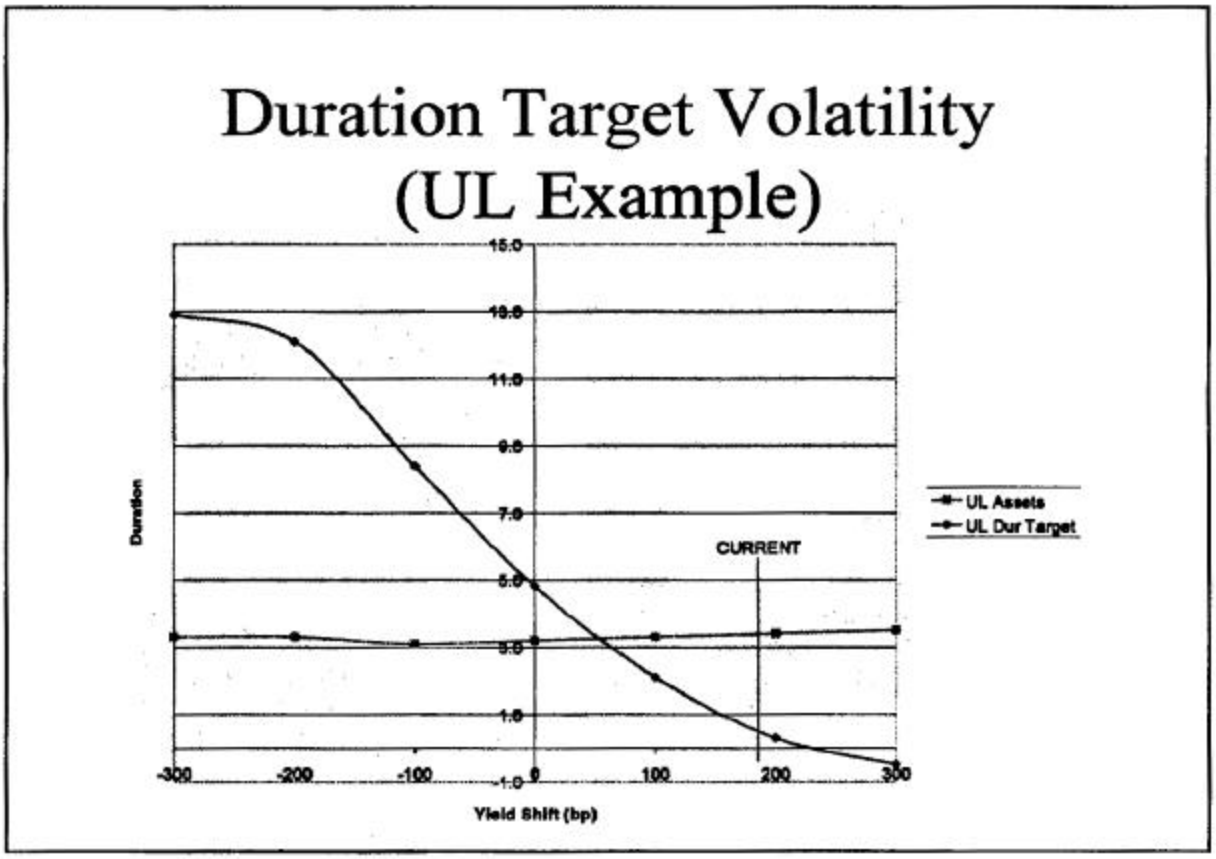


CHART 3

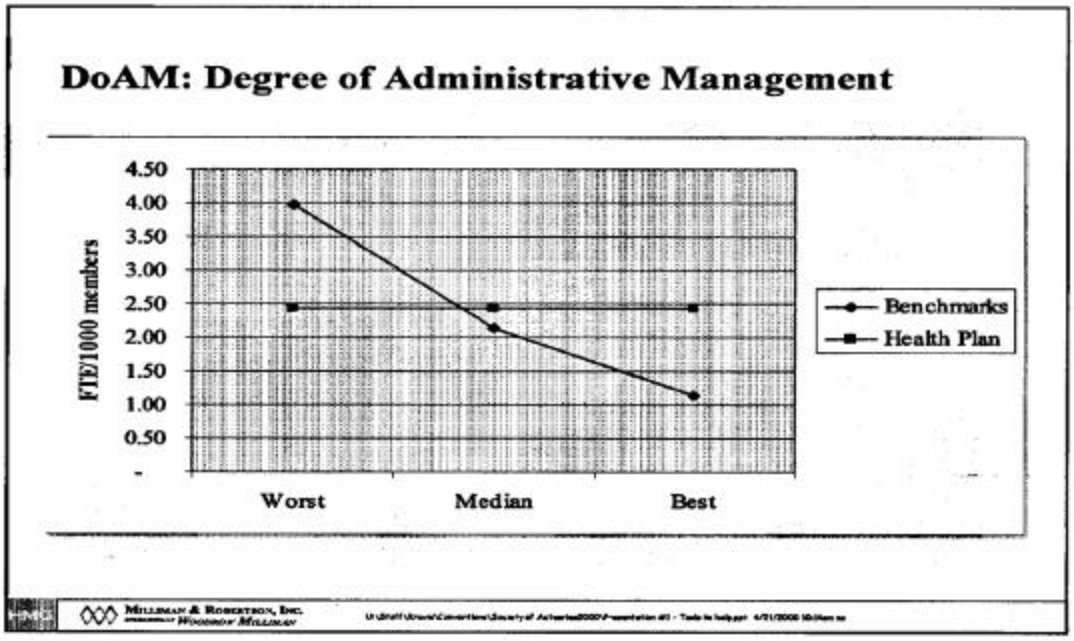
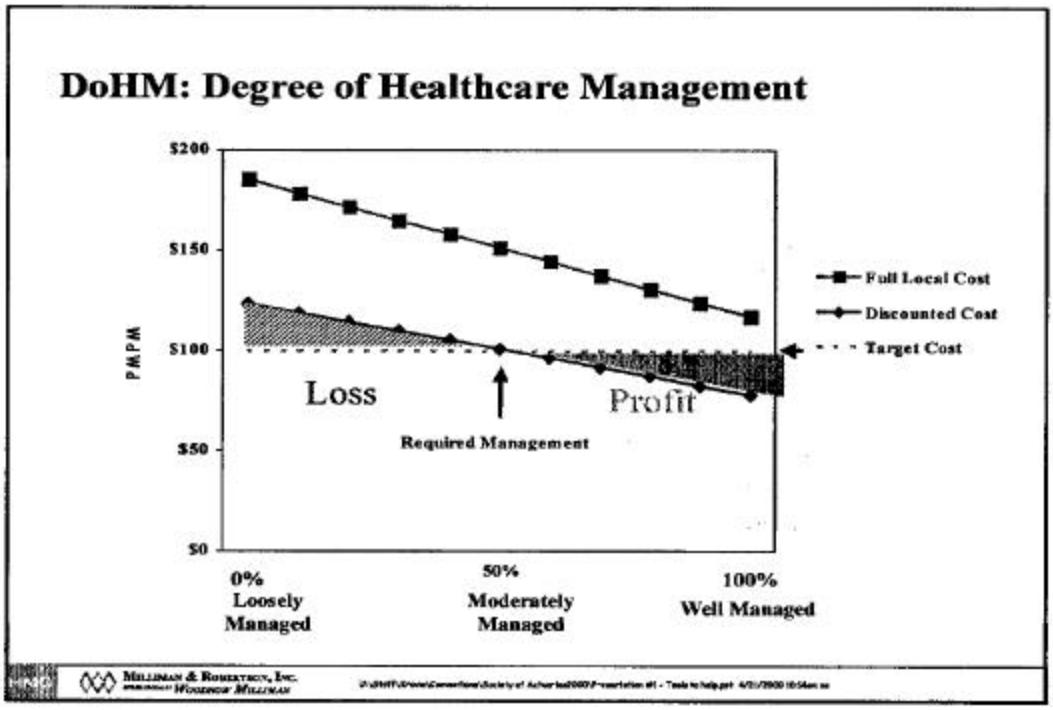


CHART 4



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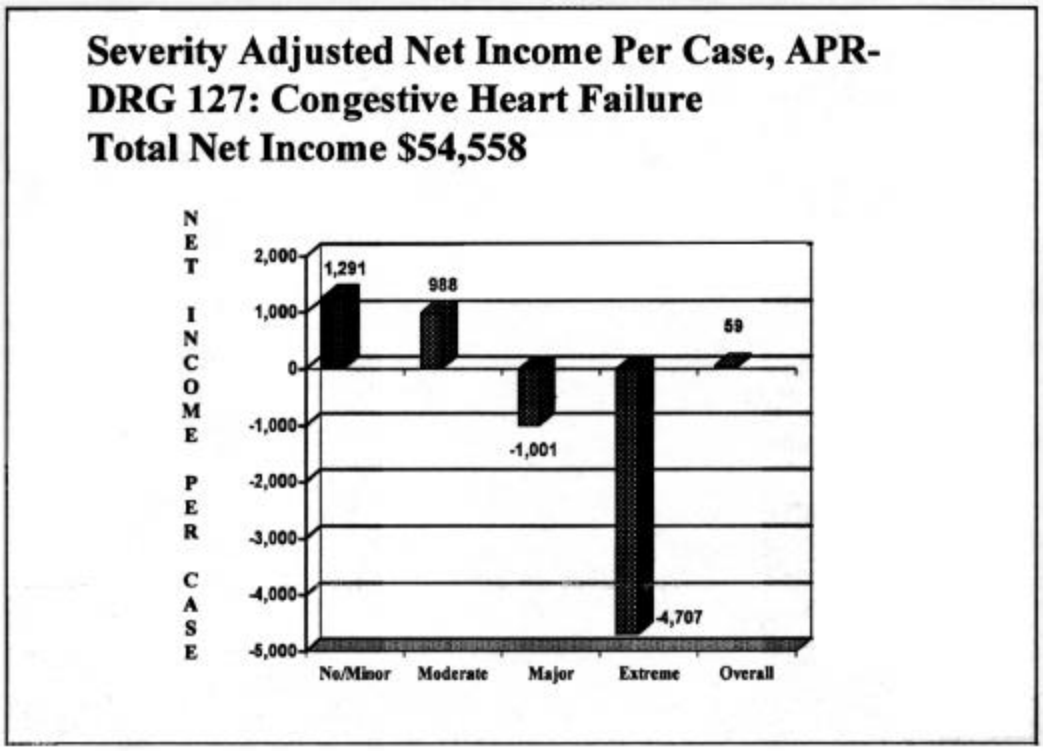
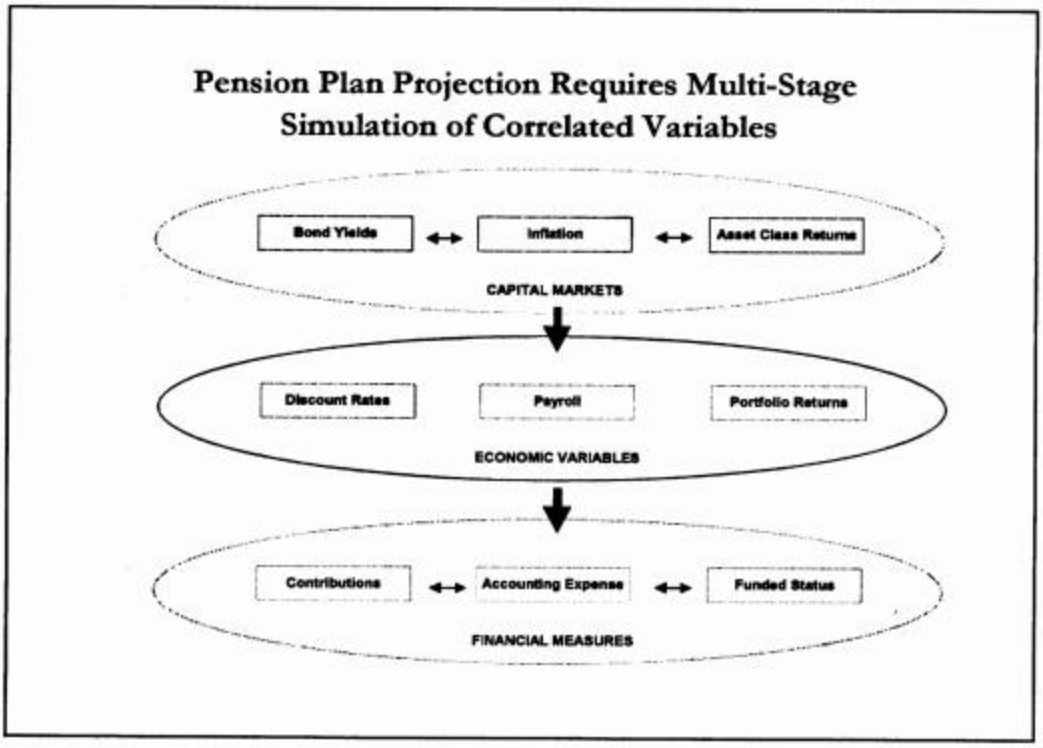


CHART 6


Pension Plan Projection Requires Multi-Stage Simulation of Correlated Variables
Bond Yields
Inflation
Asset Class Returns
CAPITAL MARKETS
Discount Rates
Payroll
Portfolio Returns
ECONOMIC VARIABLES
Contributions
Accounting Expense
Funded Status
FINANCIAL MEASURES