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# SELECTING AN INVESTMENT STRATEGY

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With so many types of assets to choose from, how does one go about determining an optimal investment strategy? The panelists will discuss how they decide where monies should be invested taking into account today's economic environment, and prospects for the future. The speakers will present their views on how investment decisions are affected by product features.

MR. ROBERT J. LALONDE: We will be holding a discussion on selecting an investment strategy. We will be exploring how one goes about deciding on what assets to invest in. I always consider that to be somewhat of a mysterious problem because I don't deal in investments everyday. I think about all of the anxieties that must come about if you actually have to buy a million dollars of this particular bond or a million dollars of that particular mortgage. It seems kind of complicated to me.

I hope that you will gain some good insight today about how this process works and as we get into cash flow testing, how you might go about describing an investment strategy for cash flow testing purposes.

Let me begin by introducing our speakers. Martin Klein is the managing director for the ICH Capital Management Group, the asset liability spread division of ICH Corporation, which has about $4.5 billion in assets. Marty heads up the product development area and is also responsible for asset liability management issues impacting all of the ICH companies.

Andrew Jarmel cofounded an investment management firm solely for the purpose of managing assets for life and casualty insurance companies. His firm, founded in 1982, now manages $4.25 billion in assets for 82 different insurance companies. As you can imagine, these companies have a very wide diversity of needs and investment goals.

I'm the vice president of PolySystems. We're a 21-year-old actuarial consulting firm located in Chicago. We do projections, cash flow testing, reserve valuations and things like that for over 300 insurance companies here in the United States.

We see numerous challenges ahead as we begin to deal with cash flow testing requirements. One is understanding the investment strategy. As the marketing representative of PolySystems I am frequently asked if we have some kind of a mechanism in our cash flow testing software that would allow a shifting of investment strategies as economic conditions change, something that would help find the best investment strategy. Do we have anything that does that?

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You know, that really sounds like a fairly straightforward and simple request. Most often the inquirer is looking for a yes or no answer, some kind of a black box that will go out and get that perfect investment strategy. Is there a theoretical way that can actually be done? In practice can it be done?

This reminds me of a paradox that I recently read about. It seems that a Commander Gotcha from a nearby galaxy visited our earth and was quite impressed with the *Encyclopedia Britannica*. And so he wanted to take it back with him but thought it was too big to get on his spaceship. He said, "No problem, I can take home a single bar of metal and encode the entire *Encyclopedia Britannica* with one little scratch."

That tiny scratch, unlike a groove of a record, will contain no information, however. Now here's how he had it all figured out. He said if you look at the *Encyclopedia Britannica* there are 100 different symbols that you can work with. He would assign a two-digit number to each one. For example, 01 would be A; 02, B; a semicolon might be 34, a space between words would be 99. Using a very special computer, a powerful one, he would translate that entire *Encyclopedia Britannica* into one huge number. He would put a decimal point in front of it and he'd convert it to a fraction. Then, he would measure a point on there, a ratio a length of A and another one with the length of B so that fraction A divided by B would equal the decimal fraction with this *Encyclopedia Britannica*. And then when he got home, he would have a powerful computer measure those fractions A divided by B and print an entire copy of the *Encyclopedia Britannica*.

Is it possible to represent thousands of pages of writing by making a single mark? Is there anything theoretically wrong with that? Can you do it in practice? You know, it's just like our little black box problem we're talking about.

For the *Encyclopedia Britannica* problem, in practice it would be impossible because the measurements would have to be precise within the diameter of an electron. That's pretty hard to do today.

The question about whether we can develop a computer model to emulate the job of an investment manager is likewise theoretically possible. But there are really some practical problems that we're going to have to overcome. And let's see why. What are the variables that have to be described just to specify a single investment strategy? First is asset selection.

Bonds are some assets that we might want to choose from. Here are a few examples of some bonds that we might want to choose from: bullet bonds, callable bonds, zero bonds and convertible bonds. We might want to choose from mortgages: commercial, residential, collateralized mortgage obligations (CMOs), Ginnie Mae's and so on. We might choose from stocks, if we could put those into our nest egg of possibilities.

Derivative assets are the new wave. There are interest onlys, principle onlys, PACs, TACs, all those fancy names, residuals and jump Zs. Please don't ask me questions about these, because I just know the names but I would have a hard time describing them. Our investment people know about those things. They deal in those kinds of things.

After we were done selecting our assets and trying to set up a routine to describe that we automatically would have to decide on the percentages that we would want to invest; how much to put into each asset, what the distribution might be. After figuring the percentage then there are all kinds of choices with respect to duration. Do we want to buy a one-month, five-month, one-year, ten-year, twenty-year, thirty-year obligation? All of those are certainly possibilities.

How do we describe quality? There are about 20 different kinds of quality. Some of them are investment grade and some of them are below investment grade. We might only want to work with investment grade, for example.

Selling strategies are just the opposite of buying. We might have to sell these at some process. Would we want to have a process that only sells the ones with the highest capital gains or would we want to sell assets when we have negative cash flows that equalize gains with losses? So there are lots of different kinds of selling priorities that would be involved.

And then if we were going to test out an investment strategy, we would want to do some random simulations. Perhaps we would do one hundred random simulations of each of the investment strategies against all kinds of different future economic scenarios. Remember our purpose is to find that one best investment strategy that would work for us.

I'm sure you've all heard stories of actuaries who on Friday have their computer all set up to do the random simulations of their particular cash flow testing program and have come back on Monday to get the result. Let's suppose we have a black box that can make computations very fast. Let's say we can run all this stuff in one second. We can make a projection of a scenario in one second. How long would it take to do that?

If you left on Friday you could come back 285 years later. You would have the complete analysis of the results. And you might be able to invest in a strategy.

What's amazing to me is that investment people do this kind of stuff everyday. The investment department makes these decisions regularly, something which to me seems like a monumental task.

I'd like to ask our first speaker, Andy, if he could shed some light on how a process which I think is so difficult can be handled and how that process works in his environment.

MR. ANDREW M. JARMEL: It's kind of interesting that Bob mentions that the investment process is very difficult and mysterious. A report on "Good Morning America" addressed Bob's concern of how multimillion dollar decisions are made daily. There was a woman on "Good Morning America" who is a trader on the New York Stock Exchange, and she was asked how she could handle such vast quantities of money. She said it is no problem; she just thinks of it as Monopoly money. And that's exactly one way to look at it, except that we have to take it a little more seriously.

My charge is to convey to this esteemed group the thought processes and actions taken by our investment people when they face the task of coupling interest-sensitive lines with an effective investment strategy. Any of you who might have attempted to document what it is you do, knows how difficult the task is. We will look at the portfolio manager, our shopper as he enters the investment supermarket and watch what products he selects from the multitude offered and why. Then we will take a look at what recipes he uses to finally cook the evening meal.

The task of developing an investment strategy can take numerous directions. There is everything from conscientious asset liability matching to its opposite, total disregard for asset liability work; aggressive investment management or conservative investment management. Then there is total return management, spread management and so on and so forth.

Needless to say we cannot cover all the possibilities in detail. But perhaps we can give you some insight to how it can be done effectively in the real world; what tools can be utilized, and how the investments are selected from such a very broad range of alternatives. Let's meet the guy on the front line.

In my opinion there are two broad classes of investment managers. The first we will discard very quickly. He's the manager who is a purist, and is only concerned with investments and has little knowledge or understanding or even cares about insurance company operations. Very often he or she is an outside advisor who handles pension funds and individual portfolios. But I must say I have seen within insurance companies investment people who think just this way.

But our hero is just the opposite. He or she is an investment professional possessing a good working understanding of all phases of insurance operations and is fully cognizant of the ramification of every action he takes. (To put your mind at ease, Asset Allocation and Management clients are all insurance companies.) Now let's look at what he faces and how these options can be addressed.

These are just some of the traditional vehicles facing the portfolio manager as he goes through his daily routine. The decade of the 1980s has created a current environment of intense and rapid change. Wall Street is generating new vehicles and permeations of these vehicles daily. Bob indicated a few of them earlier. There is globalization, interest rate swaps, rate caps, and junk bonds. We can go on and on about junk bonds, but I won't, because the papers have done a very effective job, very recently.

Product competition among the insurance companies ultimately results in heavy pressure on the investment arm to boost yields. Once a company succumbs to this pressure, more often than not the organization finds itself mired in the quicksand of unacceptable risk. We have defined those fixed income risks applicable to this endeavor as duration, credit quality, liquidity and convexity. We will visit these risks in greater detail a little later. On top of all of Wall Street's goodies we must overlay four more inputs, all of which are self-explanatory but nonetheless important.

Just to pick upon the regulatory environment, our clients are domiciled in 30 states and of course, the regulations vary widely and our portfolio managers must keep up

with the regulatory changes that can affect their clients. But whoever is managing the assets must fully comply with the investment regulations within the domiciliary state. So is our hero confused? I think not. He's just smart enough to ask the right questions. A problem once recognized is half-solved. That's what Bob's grandpappy used to say.

Before we meet him we should inject one concept that I mentioned earlier. These are the fixed income risks. Four fixed income risks will be sprinkled throughout my talk. These are the potential risks that may be assumed in the fixed income marketplace. The company and the portfolio manager must determine the appropriate level of risk to be assumed in each of these areas: duration, credit, liquidity and convexity.

Duration of the bond is a pretty straightforward thing. There is always the temptation to lengthen duration when there is a positively sloped yield curve. The credit quality of the issuer is important. We use Standard & Poor's, Moody's, Duff and Phelps, both our own as well as street research.

Liquidity is the ease in which an instrument can be sold. The extremes are T Bonds on the one hand which are the most liquid and real estate on the other which is the least liquid.

Convexity is the fluctuation in cash flow in response to changes in market interest rates. Mortgages are a great example of convexity. As interest rates fall, houses turn over faster, and people will refinance their homes. So principle is paid down faster. As interest rates rise, of course, the real estate market slows and prepayments also slow down.

So what are we? We don't have an identity crisis but what do the market, the economy, the marketed product, and management require us to be? In broad terms, are we total return managers or are we spread managers?

Let's define the total return manager. And really what is that concept? Total return is the process of affecting investment movements based solely upon the market judgment of the portfolio manager. That's an important concept because it's a very, very difficult thing for a lot of people to comprehend and there's a lot of controversy about it. Total return is the process of affecting investment movements based solely upon the market judgment of the portfolio manager. If the portfolio manager believes interest rates are increasing he will shorten the portfolio.

Conversely, if he believes rates will fall he will lengthen the maturity. Also in a total return environment the company must be willing to take losses, when the portfolio manager is shifting maturities or when he is swapping bonds, to improve his position. Typically the portfolio manager is measured against an index such as the Shearson Lehman Bond Index. This is not to say that there could be some imposed operating ranges on our four risks: duration, credit, liquidity and convexity. But those limitations are very, very small.

I submit that total return management is inconsistent with an effective interest-sensitive portfolio. First it's not controllable, nor can management depend upon any investment constant. The portfolio manager is making the decisions to adjust the

parameters of the four risks and not the parameters established by the interest-sensitive product. Second, I don't know any investment professional or economist who is consistently right predicting the market direction a high percentage of the time. Can a company afford errors in judgment made when bets are placed on market directions?

Within the framework of the four fixed income risks – duration, credit, liquidity and convexity – spread management is the maximization of book yield which is the foundation upon which the crediting rate is built. Simply put, the crediting rate equals no less than the sum of the earned rate plus expenses and expected profits. Why is spread management the preferred road to take? Basically because you must first earn the rate which you credit rather than credit a rate which you may or may not earn. In my view there is no room for speculation on market movements in an interest-sensitive account. The company is best served by adjusting the crediting rate to movements in the earned rate. In practice, total return management will result in more volatility because of sensitivity to the market fluctuations and sensitivity of applying capital gains simply to boost rates of return. In spread management, capital gains are spread over the life of the issue.

There are six facets to determining an optimal investment strategy. The first facet considers economic scenarios. We're talking about short- and long-term trends and the probabilities of predicting the trends. The second facet is investment limitations. There could be environmentally imposed limitations which are not controllable or there could be company imposed limitations. Market sector analysis is the third facet; relative value determination within the scope of market alternatives. We'll discuss this a little later on in greater detail. Facet number four is cash flow testing. I'll deal with the assets and leave the liability side to you. Facet five is taxes. You must look at whether to use tax advantage vehicles and the effect upon the earned rate. Facet six is product characteristics.

How do we develop the economic scenarios? The first inputs, of course, are our personal biases and opinions. Within our group we have monetarists from the Chicago school, who I sometimes call the Milton Friedman worshipers, and various other classifications of economists. We also depend upon street research. We put a lot of credence into some respected economists and some market strategists such as Henry Kaufmann, Larry Kudlow, Allen Greenspan, and The Fed, and so forth. Each of us have our own people that we specifically listen to. We model "what if" scenarios on the CPI or inflation numbers and how they might affect interest rates.

And we look at the Treasury yield curve. The short rates over this past ten-month period have fallen 200 basis points. The long rates are down only 20 basis points. The interesting thing is that the Fed can only control the short end. It cannot touch the long end. The Fed's only ability is to handle the discount rate and the purchase and sale of treasuries. The market controls the long end.

In 1982 the rates were high on the short end and lower on the longer end. That's when short interest rates went up to 22% and the long rates were at about 12%.

The leading indicators are something else that we analyze. The index of leading indicators is used because it allows you to anticipate economic direction, usually three

to six months in advance. The index is made up of 12 components. Money supply is an example. The Standard & Poor's index, new factory orders, inventory and housing starts are other components. Housing starts historically have been the prime leader out of a recession.

According to Larry Kudlow, who I mentioned earlier and who is a very respected barrister and economist, money supply, the Standard & Poor's index and housing starts are the only important components of the leading indicators. As the leading indicators accelerate, the economy accelerates also. Then the index peaks and starts to fall. Now we are in a recession. In the last month, the index blipped up. And the big question is, Are we out of the recession? And I'm not going to answer that because I don't know.

Housing starts peaked in 1987. After that point it started falling and there was a precipitous fall from early 1989 to where we are today. And that helped produce the recession that we're in. Recently, housing starts blipped up. This has not gotten a lot of publicity but is one that we find is very, very important, certainly as an indicator of inflation.

The Commodity Research Bureau (CRB) index, which you can see published in *The Wall Street Journal* in the third section, is an assortment of commodities: oil, gold, a variety of food stuffs, various metals, rubber, etc. When prices are low or falling, obviously that's a stimulus to the economy. When prices are rising it's a drag on the economy. From the early 1980s prices were falling, and the CRB index was falling. Obviously we produced a strong economy. From 1987 into the 1990s the CRB index rose; prices of oil, gold, etc. went up and we had the predictable results of a recession.

Now I'll talk a little about investment limitations. These are the constraints either imposed apart from the interior or the exterior of the insurance environment. These limitations must be addressed and included in the formulation of investment strategy. For the most part, exterior influences obviously are not alterable.

These are some of the investment limitations. These limits again must be incorporated into the formulation of an investment strategy and an investment vehicle selection:

- Credit quality imposed by regulations as well as internally.
- Management personality. Are they conservative or are they aggressive?
- Risk parameters. What is management's tolerance to taking risks?
- Surplus. Is surplus adequate or is it tight?
- The regulatory environment. Not only are we talking about the percentage of each classification of security, but municipals, corporates, preferreds, junk, options and hedging, etc. Many states have limitations on how much you can have in each category. But it's interesting that we keep bumping our heads up against some states' restrictions that limit AAA securities, both government

and agency guaranteeds, but say there's no limitation on corporates. This absolutely makes no sense to us at all.

- Taxes. Both the marginal and effective rate. Obviously some companies have a small company deduction. We have to worry about the alternative minimum tax (AMT) and an item that very few people concentrate on in a life company: company share and policyholder share.

- Management's risk tolerance to quality, to classes of security. What's the reaction of management to trading and turnover? How about exposure of new vehicles and acceptance of those new vehicles?

- Market sector analysis. We also call this relative value. What securities in the marketplace at a given time are the best buy? We use the Treasury yield curve as a bench mark. Basically, how many basis points above a like Treasury is the vehicle trading at? That produces a spread. The market will tell whether you are paid enough to step up in risk. Obviously we look at the basis point spread between AAAs and As; or between mortgages, CMOs and BAAs.

- Cash-flow testing. I won't even begin to get into this area. It would be like an auto mechanic instructing a neurosurgeon. That's why we have Poly-System's expertise under the same umbrella as Asset Allocation and Management Company. We look at the asset cash flows of individual securities and portfolios. We can model the convexities to quantify the effective interest rate by varying scenarios on individual securities and portfolios. We do this when substantial data bases are available to us to produce accurate responses to different interest rate environments.

- Taxes are an external factor that we have very little control over.

- A portfolio manager can mitigate part of this impact with the utilization of tax-advantaged securities. Tax-advantaged income using both munis and preferred dividends can obviously have dramatic affects. What we don't want to do is put the company into the AMT simply by buying too many tax-advantaged issues.

- Product characteristics. For an effective investment strategy it's critical that the portfolio manager have a full understanding of the characteristics of the cash flow he's investing. Established procedures must be put in place for the actuary, to be a part of the investment process. He must attend investment meetings and he must have a good working relationship with the investment professional.

There we have the optimal investment strategy and all the aspects of it. By no means is this static, it is extremely fluid and there's nothing so constant as change. How we respond to change is how all of us are measured.

Now we've reviewed the major components of our optimal investment strategy. The question is, what do we as investment professionals do with all this input? Strategy

is one thing, but how do we go about implementing this strategy? Let's return to our four income risks: duration, credit, liquidity and convexity. Let's assume that we have some simple guidelines: duration being approximately five years, credit quality AA or better, and we want marketable liquidity and we want to be able to control convexity as much as we possibly can.

Let's revisit relative value. We know we can screen for the five-year duration vehicles. We can screen for the AA or better securities. It's not too difficult to find marketable securities that we're able to sell within a reasonable amount of time and for the most part for this discussion let's just exclude taxes and economic opinions. We can plot all these issues that I mentioned earlier, everything from a single A security or a BAA security. We can plot it all against our Treasury benchmark. And that really leads us to where the widest spread is, which today will be mortgage securities. The spread off the Treasury yield curve ranges between 95 and 135 basis points in today's market.

So we've satisfied our conditions if we purchase mortgages. We've satisfied our five-year duration which probably is a seven-year average life. We're buying AAA securities. We're buying marketable securities. The convexity is controlled by diversification or a combination of interest onlys or principle onlys to offset the convexity. And as part of the security selection we can test the volatility of acceptable vehicles.

Let's look at the price comparison of a Bear Stearns 89-4C which is a collateralized mortgage obligation against a generic Government National Mortgage Association (GNMA) 9.5. They start out at 9%. The price to yield 9% is very, very close. And as they progress down there is a slight spreading. The reason they're spreading as we go down the interest rate scale is that the GNMA is subject to lower convexity. There is the prepayment risk. The collateralized mortgage obligation has no prepayment risk.

Let's take a look at one other relationship. This is the same collateralized mortgage obligation versus a AA three-rated Haliburton. The price spread is even larger than the prior example. This is for the very similar situation except the Haliburton is callable.

Segmentation. This is an area that bothers me terribly. The reason it does is that, in my opinion, all companies should segment. During my talk we centered on a single line of business, but in real life this is not the case. The whole point of our past discussion is moot if the company won't segment. And Lord knows, we see a lot of resistance by management to segmentation. Many companies with multiple lines of interest-sensitive products won't spend the money to segment the assets and do the asset liability work that's necessary. But from our perspective we must segment the existing business and also report the cash flow on a segmented basis so the portfolio manager can know which pocket to invest in and what strategy to apply to each particular pocket.

There should be a strategic review. We're talking about something that is very, very fluid. This is complicated by having multiple investment strategies for each different segment. Environmental changes could potentially have a greater impact on one

strategy over another. Strategies require constant review to remain current. Those strategies should not be carved in granite. They should be reviewed on a constant basis.

MR. LALONDE: It's quite interesting to compare the theoretical approach I presented to your real life approach. There's a lot more human interpretation involved in selecting an investment strategy than one might ever imagine. That may not be reproducible through any kind of current computer software. Martin will talk about developing an investment strategy at ICH.

MR. MARTIN P. KLEIN: In discussing how to select an investment strategy, I'm going to talk about risk and our approach to analyzing it, as well as some issues that should be addressed. Then I'll go over an example of an approach for developing an investment strategy for a specific product.

**I.C.H. CAPITAL MANAGEMENT GROUP**

Before discussing how we go about selecting investment strategies, I want to give some background on our organization, sort of a who, what, why, and how description. This is important because my remarks on investment strategies are in the context of what our company's goals are.

With respect to the "who" and "what" part of the description, our organization, which we call the ICH Capital Management Group, has two primary responsibilities to our parent, ICH Corporation:

1. Manage Constitution Life Insurance Company, through which we design, market, manage, and invest behind accumulation products, such as GICs and annuities.

2. Manage the asset/liability issues and invest the assets for the other ICH Companies, which are primarily individual life and health insurance providers.

In discussing the "why" part of the description, the goal of our group is to provide differentiated products on which to earn a large and consistent spread within particular risk constraints.

How will we accomplish this? There are a couple of key elements to our strategy:

**Integration**

To manage the risks that exist in the spread business, the risks in the assets and in the liabilities cannot be dealt with separately and independently. Because of this, we run our business with an integrated team of investment, marketing and actuarial professionals. So that we do not work at cross-purposes, we all have a common business objective -- to earn a spread. This is different from many organizations where the marketing area's main goal may be linked to volume of business, while the investment manager's goal may be to beat some total return bogey, with the actuary trying to pull the conflicting factions together to somehow make a profit. In fact, for our group of actuaries, investment people and marketing people, the bonus pool of money accumulated each year for everyone is based primarily on our spread or profit.

**Niche Orientation**

Niche markets and products are becoming buzzwords in the business world, and for good reason. As everyone who took Economics 101 knows, price is a function of supply and demand. As such, we prefer to tailor products to needs in the marketplace that are underserved by other providers; that is, we target areas where there is demand but little supply. For insurance companies that base their accumulation business solely on fixed rate bullet GICs, for example, it can be difficult to earn big spreads. Since the product is a plain vanilla commodity, and there are many providers, there is significant competition on credited rate.

**RISK**

Now that we've covered the background of our organization, I want to discuss risk. Obviously the type of risk and magnitude of risk a company is willing to take is a key determinant in what kinds of investment strategies it uses with its products.

**Type**

There are certain key risks companies can take on in the accumulation business: credit risk and interest rate risk. Over the last decade, many companies have focused more on credit risk, playing a credit risk mismatch game instead of an interest rate game, or a duration mismatch type of game. This credit mismatch game is one where a financially solid insurance company, with claims-paying ability (CPA) ratings of say AA or AAA, provides guaranteed products and backs them with assets of lower quality, junk bonds or commercial mortgages being the main examples. Recently, however, many companies have reduced the degrees of their credit mismatch, that is, the gap between their CPA ratings and the quality ratings of assets in their portfolio. There are two ways that this credit mismatch can be reduced. Some insurance companies have done this voluntarily, by improving the quality of their assets. Regretfully, other companies have reduced their credit mismatch involuntarily; they haven't improved their asset quality, and now their CPA ratings have been downgraded.

Credit risk is a tough risk to manage. It is cyclical. During boom times in the economy a lot of money can be made, but during bad times controlling losses is difficult.

Our focus is not to rely heavily on credit risk but rather to take on what we call analytical risk – risk that can be modelled, i.e., measured and quantified, as well as risk that can be managed, i.e., hedged or otherwise controlled. Analytical risk, of course, includes interest rate risk, and there are lots of terms and tools and measures available to quantify and manage interest rate risk. Analytical risk is not limited to pure interest rate risk, however. It also includes such aspects as prepayment risk on mortgage-based assets, which of course, is risk linked to interest rates. Analytical risk also can involve taking on other forms of risks, such as currency risk, the risk of investing in nondollar securities creates due to changes in currency exchange rates, which may be linked to interest rate changes in the relevant countries.

There have been two explosions over the last few years: the explosion in computer technology, which provides immense capabilities for analyzing risk, and the explosion on Wall Street with the rapidly growing availability of instruments that are options or derivatives, or vehicles with lots of options imbedded in them. In fact, the availability

of vehicles with imbedded options such as CMOs is linked to the increase in computer technology, which has allowed complicated models to be developed and used to take mortgage collateral and carve it up into some very complex tranches. The technology and Wall Street explosions allow us to focus on analytical risk, and because of the key aspects of what we define as analytical risk, that it can be modellable and manageable.

"Modellable" means we can model, or otherwise quantify, the contingent cash flows in certain asset structures, and more importantly, how those cash flows relate to liability cash flows. Therefore, under particular well-defined scenarios, you can determine what your spread is.

"Manageable" means we can take steps to control or perhaps prevent certain outcomes. With the availability of swaps, caps and floors or other instruments, you can protect yourself from potential outcomes that are outside of your risk constraints. We believe having an integrated structure, where individuals from the asset side and the liability side work closely as a team, is important in modelling and managing analytical risk.

**Analytics Behind Analytical Risk**

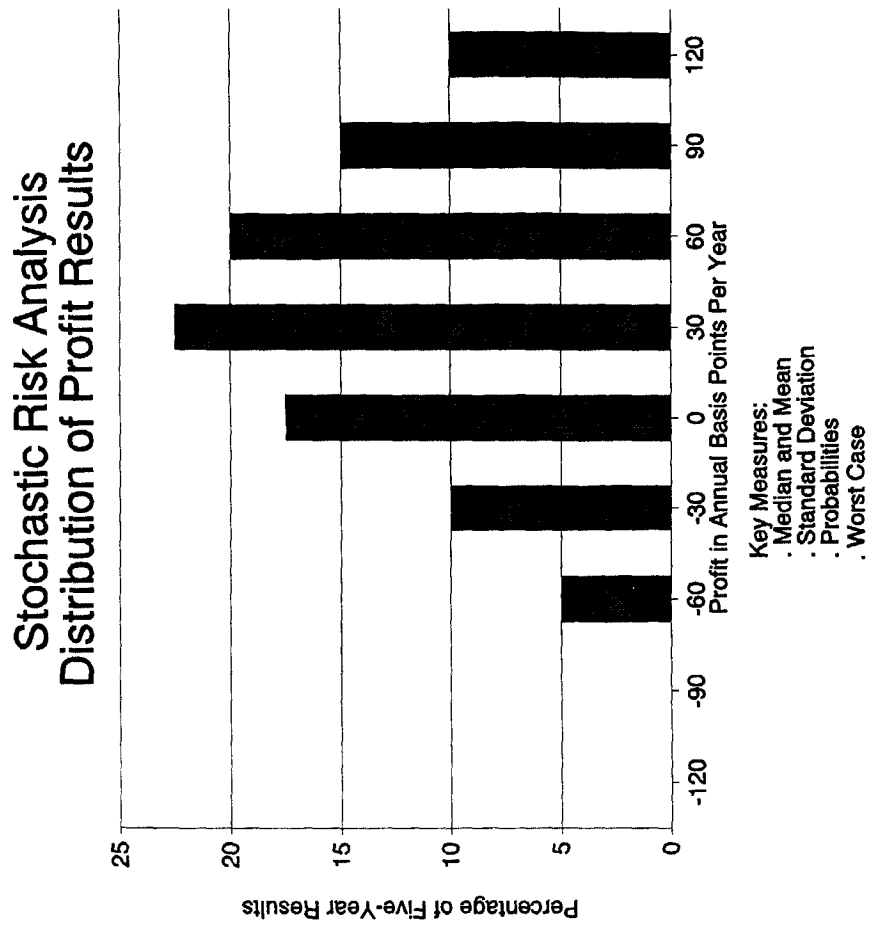
Given analytical risk as the risk we choose to focus on, the next issue is how to analyze it. Our approach is to use stochastic models, which allow us to take a statistical or probabilistic view of the potential returns of various asset/liability structures. Using the power of available computer software and hardware, we can do in minutes or hours what was for practical purposes impossible years ago -- model contingent asset and liability cash flows under dozens or even hundreds of scenarios and get a distribution of resulting spreads (Chart 1). Under this approach, we determine not only what our expected spread or profit is, but also a number of other key measures: variability or volatility of potential returns; worst case results; and probabilities of earning spreads within particular ranges, for example the probability of earning a negative spread (losing money).

I should mention that these measures are very dependent on the characteristics of the scenarios the assets and liabilities are modelled under. Therefore, depending on the particular set of scenarios, the numbers that result might not necessarily be accurate in an absolute sense; however, they are still very worthwhile in a relative sense, for example in comparing how one investment strategy works behind a product versus another strategy.

I want to say a few words on how this stochastic approach relates to other types of measures, such as duration and convexity and option-adjusted spreads. While we view stochastic analysis as a primary tool, measures such as duration and option-adjusted spreads are of course, useful to us as well.

For us, duration and convexity are important measures but don't paint the entire picture. They are a little bit like looking at what the temperature forecast is in New Orleans when deciding what to pack for the trip. While the temperature forecast gives an indication of how cold or hot it will be, there are additional measures such as wind chill, humidity, or precipitation, that are important in deciding what to pack. But, of course, temperature is still a key measure. Similarly duration is a key measure and

CHART 1


Stochastic Risk Analysis
Distribution of Profit Results
Percentage of Five-Year Results
25
20
15
10
5
0
-120
-90
-60
-30
0
30
60
90
120
Profit in Annual Basis Points Per Year
Key Measures:
. Median and Mean
. Standard Deviation
. Probabilities
. Worst Case

combined with convexity provides a rough sense of imbedded risk. In fact, the more severe the duration mismatch, and the more negative the convexity of the assets, then the more volatile the spread results in a stochastic model will tend to be. In other words, the distribution of profits will be more spread out if there is more duration or convexity mismatch. A disadvantage of duration and convexity is typically they do not address impacts of nonparallel yield curve shifts, which of course, happen practically all the time. As we'll discuss shortly, stochastic modeling should and can factor in nonparallel yield curve movements.

Under the option-adjusted spread approach, the nominal spread over Treasuries of a financial vehicle is adjusted for the value of the options imbedded in that vehicle. Therefore, to find the "expected profit" in a particular asset/liability strategy, one would take the option-adjusted spread of the assets and subtract the option-adjusted spread of the liabilities, then subtract expenses. This number is comparable to the expected profit number resulting from a stochastic analysis, but stops there, while a stochastic analysis goes beyond providing an expected profit number.

**SPECIFIC ISSUES**

I'd like to turn now to specific issues in determining an appropriate investment strategy. First, I'll discuss issues that involve assumptions on which to model, and then I'll move to issues and considerations that are outside the scope of modeling. Then we'll go through an example on developing an investment strategy for a particular product.

**Model Considerations**

With respect to model considerations, there are three key areas to deal with: scenarios, liabilities, and assets. One of the major elements in modeling under stochastically generated scenarios is, of course, the scenarios. This subject is a speech unto itself, but I do want to at least touch on some important considerations.

For most asset/liability strategies, we are concerned not only with rising or falling rates but also the impact of yield curve shifts or twists. Unless all assets and liabilities are linked to one and only one spot on the yield curve, there is of course, risk not only in rising or falling rates but also in changing yield curve shapes. While many of the CMO term sheets Wall Street firms put out for illustrative purposes show what happens under parallel yield curve shifts up or down 100, 200, and 300 basis points, they say nothing about performance in say an inverted yield curve environment; this lack of information is even more critical when relating that CMO return to a liability, such as a CD annuity, where perhaps the focus is on the short end of the yield curve.

Another consideration is whether the scenarios are "arbitrage free." Different methodologies exist in how, if at all, the stochastically generated interest rates will be held within reasonable limits. One approach might be to impose absolute minimums and maximums on the interest rates. Our approach is to use the concept of a "mean reversion" yield curve, which is the yield curve toward which rates will tend to revert. Think of linking the stochastic yield curve generation to the mean reversion curve with a rubber band. The further away a stochastically generated yield curve gets from the mean reversion curve, the stronger will be the pull towards the mean reversion curve for the subsequent yield curve generated. Care must be exercised in using the mean reversion approach, because depending on its relationship to the initial yield curve in

the model, there can be a bias, either positive or negative, on the general average direction of rates in the set of scenarios, which will impact the expected profit number that results in modeling. For example, if the five-year point on the mean reversion curve is far below that of the initial yield curve, a significant capital gain, on average, might result if we invested in fixed rate assets – this would of course, not be an "arbitrage-free" set of scenarios.

Before using sets of scenarios for modeling, we check to see if they have the appropriate degree of volatility, if there are enough inverted, steep, or humped yield curves, and check the maximum, minimum, average, and median rates.

Moving from scenario considerations to liability assumptions, commissions and expenses are of course, important, as they are in static asset share testing. Claims experience, for example, outflow due to mortality, is also important. However, the real power of a stochastic model is its capacity for dynamically handling lapse rates or borrowing rates, or bailout exercise rates, or other interest-sensitive cash flows. For a dynamic model such as this, it is important, although perhaps difficult, to define the interest crediting strategy. It is important to relate the customer's behavior to the interest rate credited on the product versus the investment rate available on new money products that competing companies may be offering in particular interest rate environments. This relationship can be difficult to ascertain because the options imbedded in products are generally not economically exercised as would be a call provision on a bond.

With respect to assets, the stochastic model of course, needs to handle bond calls, mortgage prepayments, and other options dynamically. Reinvestment strategies must be assumed, and realistic disinvestment strategies should be provided for as well. For disinvestment purposes, we don't consider borrowing to be realistic – if we have huge cash outflows we will probably have to liquidate assets, and simply assuming we borrow understates the immediate impact. One element of risk most models unfortunately ignore, including ours, is the variability in nominal spreads of assets to treasuries in various yield curve scenarios, as well as changing default rates. These elements would increase the volatility of profit results if they were incorporated in the model.

**Considerations Outside of Modelling**

There are, of course, several considerations or issues to be addressed which are outside the scope of modeling. These include still more investment issues, as well as corporate issues. Of course, there are also product issues that actuaries typically deal with, so I won't get into those. With respect to selecting asset classes for an investment strategy, such considerations may include the general outlook for the sector, the question of ongoing availability of an asset class and diversification among asset classes or market sectors. In addition, liquidity needs for the liability, or the company in general may be a factor. Another factor, related to liquidity, is the potential added value that active investment management might add.

At the corporate level, there are other considerations and questions to address. What are the company's internal required or target surplus levels for the various products it offers? What is the company's desired return on investment, where the definition of "investment" includes the earmarking of target surplus? What are the company's

dollar profit goals? Taking the design of an investment strategy beyond the needs of one particular product line, are there potential risk balancing strategies among various product lines that should be considered? It may be that the risks in one product and its investment strategy, when combined with another product and its own particular investment strategy, in aggregate provide an overall asset/liability risk profile that is lower than either of the two product lines viewed separately.

**EXAMPLE**

Up to this point we've discussed several issues: what type of risk we choose to focus on, i.e., analytical risk, how we use stochastic modeling to measure it, and what the related issues are. Now I would like to go over an example where we develop an investment strategy for an actual product.

The product is a GIC. However, in keeping with our niche orientation, this GIC product is unlike conventional GICs that provide a guaranteed fixed interest rate with the funds locked in until a given maturity date. This particular product is indexed to short term rates and has no stated maturity; instead, it has a put feature where the contractholder can get his money back in seven days at book value, that is, with no surrender charges or market value adjustments. This short-term indexed GIC is targeted for use in the liquidity buffer of GIC funds. Funds use these buffers to meet cash outflow needs should the funds' incoming cash flows, which include contributions, maturities and interest payments, be insufficient to satisfy outgoing benefit payments. Due to the extra liquidity the buffer provides, funds are able to get a higher interest rate on their fixed rate GICs because those fixed GICs are less likely to be tapped for benefit payments. This short-term indexed GIC is intended to be a core holding in the buffer of GIC funds -- this is true because it pays a premium interest rate versus the other investments in the liquidity buffer, and because its credited rate is designed to float so that the contract remains competitive as interest rates change.

The contract has a guaranteed index of Donoghue's money fund average plus 75 basis points, and resets monthly. The Donoghue rate represents the average of all major retail money market fund yields. Since these money market funds are invested in paper with average maturities of as much as 45 days or more, the Donoghue rate lags current short rates a bit.

For modelling purposes, let's assume that the basis of comparison investors use for our product is the one-month London Interbank Offered Rate (LIBOR) plus 20 basis points, so that if our short-term indexed GIC were to credit a rate significantly below the LIBOR plus 20 benchmark, it would be put back to us. The LIBOR is a commonly used short-term interest rate, and represents the rate that most creditworthy international banks dealing in Eurodollars charge for large loans. To avoid this, let's assume our crediting strategy is to never credit less than the one-month LIBOR flat, so that effectively the credited rate is the higher of the guaranteed index of Donoghue plus 75, or the LIBOR. In fact, while we were in the process of developing this product, this is the approach we firmly decided to take -- so firmly that the actual product that resulted is guaranteed to pay the higher of the LIBOR or Donoghue plus 75. This "higher of" index gives this floating rate product an edge over other floaters because as market rates rise, the contract's rate adjusts upward quickly due to the LIBOR index. As rates fall, however, the contract rate is slower to fall due to the lagging Donoghue index.

Lapses are assumed to occur at a rate of 10% per year. No dynamic lapses are assumed because the crediting strategy always keeps the product's rate current and competitive. If, for example, we had not incorporated the LIBOR into the strategy, but had decided to always credit exactly Donoghue plus 75 no matter what, then there would be a need to incorporate dynamic lapses. This is because, in a rising interest rate environment, the Donoghue index chronically lags the market, and in such a scenario lapses would increase above the 10% level assumed.

Before developing the investment strategy for this product, and of course, even before designing the product, the risk and reward desires for the product and its investment strategy must be decided on. How much spread do we want to earn, and how much risk do we want to take on? For purposes of this example, let's say we want to earn a profit, or spread net of expenses, of 50 basis points. As for our risk parameters, let's also say we want a low standard deviation of results, and that as a worst case we are willing to accept no more than a 25-basis-point annual loss over our time horizon, which we'll assume is five years. Let's also say we want to have no more than 10% of the scenarios result in negative profits. Every company will have different risk/reward goals. The specific goals I've mentioned here are only illustrative, and not necessarily reflective of our company's targets.

Having laid out these objectives, let's use our stochastic asset/liability model to help develop an investment strategy for the short-term indexed GIC. As a starting point, let's try a strategy that would have little risk with our floating rate product. We'll assume we invest 100% of the fund in high-quality floating rate notes that yield LIBOR + 65 basis points, with defaults of 10 basis points annually. This "match" strategy is of course, a low-risk strategy because both the assets and liabilities float off short-term rates. Running this asset/liability mix through our set of scenarios of five years in length provides an average annual profit of 31 basis points with a very low standard deviation of 5 basis points, and a worst case of 21 basis points (Chart 2). The distribution of results is very tight, that is, indicative of little risk, but the profit level is below our 50-basis-point profit target.

To try to achieve the 50 basis points, let's take on more risk, through what we'll call a "mismatch" strategy. In this strategy we'll invest 25% of the fund in floating rate notes. However, we will also invest 50% of the funds in adjustable rate residential mortgages, which float off one-year Treasuries plus 140 basis points, have an annual default cost of 5 basis points and have annual rate caps of 2% and a cumulative rate cap of 5% above the initial rate. Let's also assume an even more "mismatched" asset class is utilized, by investing the remaining 25% of funds in three- to five-year fixed rate corporate bonds, which are yielding 115 basis points over Treasuries, with an assumed annual default cost of 10 basis points. Running this "mismatch" strategy through our scenarios will of course, produce a much different distribution of profits for the short term indexed GIC than did the "match" strategy. Chart 3 shows, the distribution of results is much wider, as you would intuitively sense. Median and mean annual profits are 67 and 54 basis points respectively, which meet our 50-basis-point target. However, there is a lot of volatility in results in this approach, as shown by the chart and the standard deviation of 44 basis points. The worst case of an 80-basis-point-a-year loss is far more than the stated goal of a 25-basis-point annual loss tolerance.

CHART 2

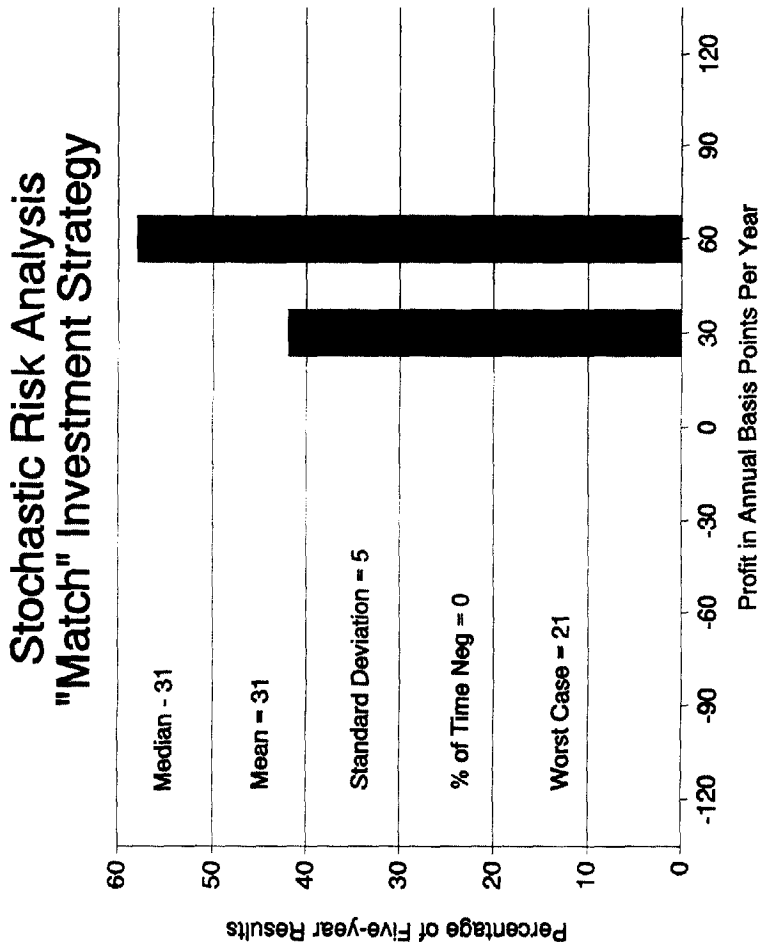
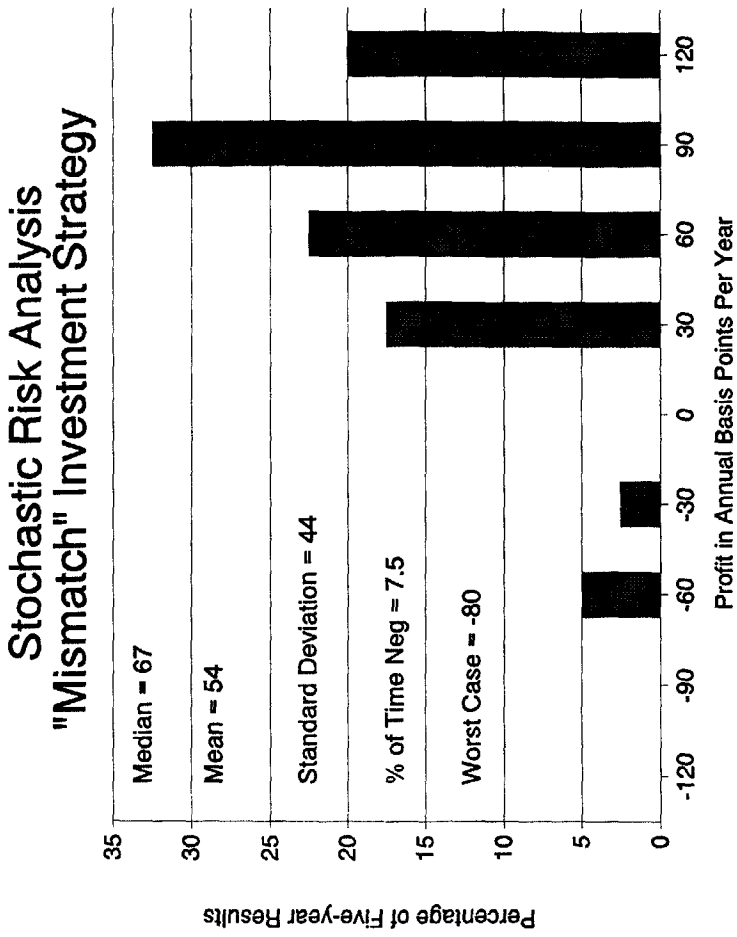

Stochastic Risk Analysis
"Match" Investment Strategy
Median - 31
Mean = 31
Standard Deviation = 5
% of Time Neg = 0
Worst Case = 21
Percentage of Five-year Results
60
50
40
30
20
10
0
-120
-90
-60
-30
0
30
60
90
120
Profit in Annual Basis Points Per Year

CHART 3

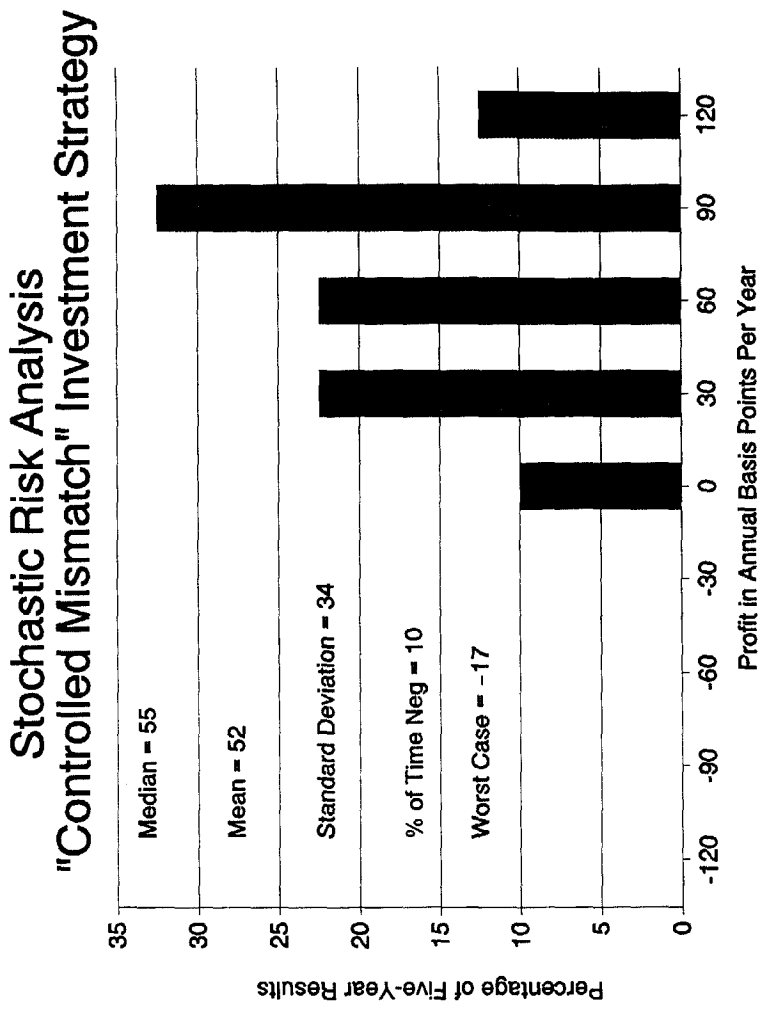

Stochastic Risk Analysis
"Mismatch" Investment Strategy
Median = 67
Mean = 54
Standard Deviation = 44
% of Time Neg = 7.5
Worst Case = -80
Percentage of Five-year Results
35
30
25
20
15
10
5
0
-120
-90
-60
-30
0
30
60
90
120
Profit in Annual Basis Points Per Year

At this point there are a number of roads to take to attempt to reduce the risk of this strategy, but I will try just one more iteration. I'll call this iteration a "controlled mismatch" strategy. As in the "mismatch" strategy, we will invest in the same asset classes and in the same proportion. However, to reduce the ugly negative tail of the "mismatch" strategy distribution, we will buy interest rate caps. Interest rate caps are derivative instruments that provide protection against rising rates, which is when the "mismatch" strategy suffers. For an initial premium and a determined notional amount of principal, an interest rate cap reimburses the holder if the index it is linked to rises above a set strike yield. In this example, we buy LIBOR caps to cover a notional amount of 25% of the portfolio, corresponding to our investment in fixed rate bonds. The strike yield is 150 basis points out of the money, so that if LIBOR rises say 200 basis points, we are reimbursed at a rate of 50 basis points, or 200 minus 150, on the notional amount of principal. Essentially, we are using caps as a hedge against the fixed bonds in the strategy.

The resulting profit distribution is still somewhat spread out indicating some volatility in potential results, but not as much as in the "mismatch" strategy (Chart 4). Our median and mean annual profits are 55 and 52 basis points respectively, down somewhat from the "mismatch" strategy but still greater than the 50-basis-point profit target. Comparing the "mismatch" and "controlled mismatch" strategies, the worst case, however, has been dramatically reduced -- from a loss of 80 basis points a year to only a loss of 17 basis points a year, which is now within our worst case tolerance of a loss of 25 basis points per year.

As I discussed earlier there are issues to be addressed outside the model, which include investment issues, such as diversification or potential for active management, as well as corporate issues. In the interest of time, I have not covered these issues specifically in the example, but I hope this example provides a sense of how to use tools such as stochastic models as an aid in determining baseline investment strategies behind products. As any investment manager will tell you, the expected reward of an investment must be put in the context of the risks in that investment. For asset/liability strategies, potential rewards must also be put in context of the risk involved, and stochastic models can be a powerful approach to determining the risk/reward profile of investment strategies behind products.

CHART 4


Stochastic Risk Analysis
"Controlled Mismatch" Investment Strategy
Median = 55
Mean = 52
Standard Deviation = 34
% of Time Neg = 10
Worst Case = -17
Percentage of Five-Year Results
35
30
25
20
15
10
5
0
-120
-90
-60
-30
0
30
60
90
120
Profit in Annual Basis Points Per Year