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RISKS AND REWARDS

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Stochastic Model: A Telescope or a Kaleidoscope?

by Vivek Gupta

A telescope and a kaleidoscope both provide a view but that is where the similarities end. A telescope shows us an actual view whereas a kaleidoscope creates a view from broken pieces of glass. This article will analyze which analogy is closer to the stochastic modeling of interest rate or stock market projections.

There are two basic requirements to develop a stochastic model:
1. Sufficient and reliable historical data to determine variables for the model.
2. An unbiased system that, under certain assumptions, links those variables and randomly generated scenarios to create a range of projections.

Can these requirements be satisfied? The world is changing at such a speed that the historical data is not sufficient and reliable. When we make too many assumptions to create a system, it becomes biased. An examination of six important trends of our present time—and their impact on interest rates and stock markets—will prove this point.

Current Trends

1. Over supply of money in the world market.
An analysis of two crucial economic phenomena can be used to establish this important trend. First of all, interest rates are coming down in most of the world economies. This can only happen if the supply of money is more than the demand for money. Monetary policies or any other government intervention can control the interest rate shifts within a small range and only for a short period of time. The boom and the bust of NASDAQ is another example. Billions of dollars of speculative investments were made in a short period of time and every high-tech initial public offering (IPO) went haywire, a situation only possible because huge sums of money were looking for lucrative parking spots.

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Inside...

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This newsletter is free to section members. A subscription is $15.00 for nonmembers. Current-year issues are available from the communications department. Back issues of section newsletters have been placed in the SOA library and on the SOA Web site: (*www.soa.org*). Photocopies of back issues may be requested for a nominal fee.

Chairperson's Corner

As incoming chair, I'd like to first thank our out-going council members, Doug George for his commitment and leadership as chairperson over the last year, Craig Fowler for his financially savvy investment decisions as treasurer and Charles Gilbert for co-chairing the Investment Symposium and acting as co-secretary of the council. Without volunteers committing their time, our profession wouldn't be what it is today.

The year 2003 was a very productive one for the Investment Section. Three issues of *Risks and Rewards* were published. Thanks to those contributing articles and especially our editors, Nino Boezio, Joe Koltisko and Richard Wendt. The Investment Section will be giving an award in 2004 for the best *Risks and Rewards* article. Joe Koltisko will chair a committee to review eligible articles. The Investment Section organized numerous sessions at the Spring and Annual Meetings. Our Investment Section lunch at the annual meeting in Orlando was quite a success with approximately 280 attendees. Peter Ricchiuti from Tulane University was a very entertaining and informative guest speaker. The Investment Section was a sponsor of the Stochastic Modeling Symposium and worked in coordination with the CIA to organize the Investment Symposium. I'm sure I left out some activities and apologize for not being able to recognize all the efforts put in over the year.

One item the Investment Section Council struggles with each year is how to spend the funds generated by the section. In addition to the usual printing, mailing and administrative expenses, we have committed funds for projects like a delphi study of economics assumptions, the RBC covariance project and the Risk Management Task Force. Fortunately we have more funds available and would appreciate hearing any of your thoughts about how we can use these funds in the most beneficial manner to our membership. Please contact any of the council members with your ideas.

The year ahead will be exciting. The Investment Section will be co-sponsoring an ALM summit in February, organized by Institutional Investor. The SOA is working with the Global Association of Risk Professionals (GARP) to be a part of their annual conference in February as well. The 2004 Investment Symposium will be a collaborative effort from three actuarial organizations, the SOA, the CIA and Actuarial Approach for FInancial Risks (AFIR). AFIR is a section of the International Actuarial Association (IAA). The Spring and Annual meetings will also continue to offer interesting and informative sessions.

Lastly, thank you for supporting the Investment Section through your membership.

Mark Bursinger
vice president, Risk Management
AEGON USA Investment Management, LLC

Taking Stock by Nino Boezio

Should We Worry About Terrorism When We Invest?

In dealing with a number of major investment clients the past couple of years, an issue that often comes up is what to do if something really bad happens. A serious terrorist event can send equities down as much as 30 percent in a short period of time. (Al Qaeda regularly boasts about the devastating new attacks it is planning.) Economic confidence can be shaken very quickly. And despite interest rates being already quite low, there is not much room to take them lower (if required) to further stimulate the economy.

Should we worry about a significant terrorism event ever happening again, is there a way to safeguard or mitigate against it or should we behave as though it will not happen? I have had some interesting conversations with investment advisors and portfolio managers that highlight some of the thinking that exists in the marketplace.

1) We have to invest as though it is business as usual. We cannot remain crippled in our decision making because we fear the worst may happen again. It may not, and if we do behave as though it may, we lose out on investment opportunities and thus suffer regardless.

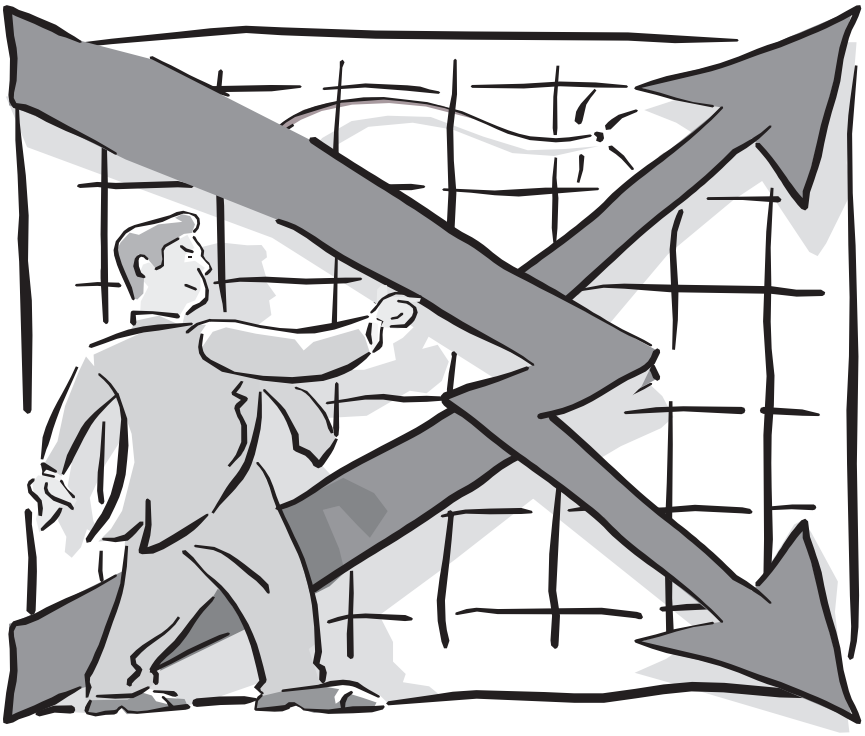
2) It is, or should be, understood by investors that when something cataclysmic happens, all bets are off. These events should, to a large extent, be considered unusual circumstances that are outside the portfolio manager or advisor's control. One has to give investors the best advice possible, react with the best information available and try to address all of the client's needs and concerns as currently identified.

3) Whatever takes place, we may have to learn to live with it. We may need to adapt. We, as a society, should try to get used to it. The markets will adjust too.

4) If something cataclysmic does happen, and an individual investor will thus suffer greatly because of it, could the suffering have been avoided? Was the investor too leveraged by holding too much debt in other parts of their personal balance sheet? Were they maintaining expectations that were too high for their standard of living, or incurring too many unnecessary expenses anyway? It is always interesting at times to hear of people who have come from humble beginnings that have achieved great wealth either through industry or by being a celebrity, etc. Some of these people can no longer survive on several million dollars of income a year! Something went wrong in the way their finances and expectations were being managed—something that really should not be blamed on anything or anybody externally. It was a disaster waiting to happen on its own merits. Financial plan-

ning thus becomes key to many individuals who do not really appreciate the relationship between debt, costs of living, income and investment return.

5) Pessimism will fade as time passes. All other periods have had excuses as to why it is different this time, or reasons as to why the good times or why the bad times will continue. We need to be prepared for the time when the investment cycle will shift in the other direction. This cycle shift is something that has been difficult to learn and accept because it is difficult to predict. Emotion has to be understood as a problem that governs our decisions too much in the short run, and that can cripple someone from making rational decisions until it is too late.



6) The next event, even if it's of similar proportion to a prior event, will have a much lesser effect. The world may have appeared to be coming to an end when a similar event happened before—but instead the world survived, and people's lives continued. When something similar happens again, people know it will eventually work out to a sense of normalcy again. Hence a bad investor reaction will not be as severe as the prior one had been.

7) Concerns may have already been factored into market performance and expectations to some degree. Market prices already reflect this addition to the risk premium; therefore, such worries are to some extent already factored into the market.

8) Sometimes we have an opportunity to further educate our investor base. For example, a client may have not considered life insurance, estate planning or other products, until they have witnessed events that further illustrate life is unpredictable. They have not considered the market upside or downside from various other points of view before, or felt that they were smart enough to "see it coming." Unfortunately, in any market decline of the past, no one really saw it coming for the longest time, even when their portfolio declined for a number of months. There is often overconfidence in investors when markets are going up, which sometimes translates to an unwillingness to listen and a belief that they will also know when markets are headed for a fall. Now we can better emphasize that no investor can be assured that conditions will always remain the same, and that it can be foreseen. Hence they should be more willing to listen to the weaknesses in the construction of their personal portfolio.

9) Can we be creative? In the early 1990s we saw all sorts of papers, discussion groups, committees and forums arise that addressed matters involving derivatives and other financial products and services that were coming to the marketplace. These things were new in many cases. We needed to come up with new attitudes and approaches to use and address these new tools. In some sense, the latter 1990s still had much discussion regarding these same tools, but nothing particular new was invented. Perhaps now we need to once again come up with something completely novel to address the needs of the future. Sometimes we just need to package these tools differently.

10) More credibility to discuss a doomsday scenario. Now we have a better opportunity to discuss the worst-case scenario. Before worst-case scenarios were considered to be largely hypothetical and "pie-in-the-sky" prognoses. Now there is a greater proclivity for investors to listen to such scenarios and for us to bring up the matter since we now know that such bad events can happen with much more likelihood than previously envisioned.

Some people today do not feel confident that we will bounce back as when we were coming out of past recessions, but this era that we are currently living in has not been unprecedented. There has always been something to worry about, or in times of prosperity, something to be exuberant about.

Unfortunately we have been accustomed to a safe society where bad things always happened overseas. However, in the past few years we may have felt uncomfortable, given that we saw dangers that we were not used to seeing. In 2003 for example, we saw disease such as SARS which has no quick medical solution; hence the only solution is quarantine. This was not a scare we have had for a very long time in North America, or for that matter, the world. Doctors and new medicines always solved the problem before. We even had hints of mad cow disease, West Nile virus and some other potentially dangerous epidemics that threatened to dot our northern landscape. This does not mean that we should worry, but rather that we may have to come up with new modes of living that may have to recognize that there are other things to keep in mind when undergoing various actions. This is also true investing. In a sense, terrorism may foster a sense of conservatism that we may now need in the marketplace. Before, the average investor may have been too aggressive in their investment posture. Perhaps an institution sponsoring an insurance product or pension plan did not pay as much attention to the relationship of assets and liabilities as it could have. Now that policy may have to be changed. In the process, risk will become better understood, common sense can replace, to some extent, the irrational behavior or excessive risk taking of the past and we will all appreciate our financial situation much more, and won't expose ourselves to unrealistic expectations as much.

We do not like trouble and uncertainty in our life. On the other hand, there may be times when we should view such situations as an opportunity to develop and foster new solutions to help our lives and the lives of others over the longterm. Those organizations and professionals that are able to offer new solutions successfully to their clients ultimately achieve the best results for themselves and society as a whole. Hopefully the actuarial profession can respond to the challenge, since we are the best qualified to quantify such risks in the marketplace.

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From Page 1

2. Demographic changes
All of the western countries are experiencing major demographic changes. Birth rates are declining at accelerating rate. Fertility rates, except for in the United States, are below 2 percent. (The fertility rate of a country has to be at least 2 percent in order to replace its population.) People are living longer in these countries and, as a result of aging populations, effective dependency ratios are increasing as well.

3. Terrorism and wavering world peace
Relatively speaking, the last 50 years were the most peaceful years in world history. There were some small wars in Asia and Africa but no major war. This is unusual in human history.

4. The crash of the Japanese stock market
The Japanese stock market dropped by more than 50 percent approximately 10 years ago and has not recovered. Can similar setbacks occur to other major stock indexes?

5. Online trading
The Internet has revolutionized stock trading over the last five years. The cost of a trade is as low as $10 and there is no intervention required by an agent. Currently, one third of personal trading is executed through online services.

6. Globalization
Globalization is evident everywhere. Most, maybe all, of the clothes I buy are made in China. Most of the fruits and vegetables we eat come from Mexico and Chile. The next time you call a customer service line, the phone may ring in India.

Are these trends permanent or temporary?

If these trends are temporary, they can be easily ignored in our projections. But if they are permanent, we need to know the likelihood of these trends continuing.

1) Oversupply of money in the world market
A technological break—through with widespread application—like the introduction of electrical power in the early 1900s or the introduction of computers later in the same century—can help absorb the excess supply of money in the world. Recently, major advances took place in the fields of nano—technology and biotechnology. These sectors will have widespread applications and will add an abundance of high paying jobs to the western economies. Of course, that will require the manufacturing of high-tech equipment and the engine of the world economy will churn again. But these technologies are still in the laboratories—the way computers were in the 1950s and 1960s. So we can assume that it will take 15 to 20 years before these new technologies will start entering our homes in the way computers did in the 1980s.

Until plenty of high-profit investment opportunities are available in the manufacturing of innovative products, it is highly likely that this particular trend will continue.

2) Demographic changes

The fertility rates in the western countries have been declining over the last three decades and will continue to decline. A look at history and the evolution of the human species helps explain why this is so. The way I see it, our species is quite selfish. Humans wanted, or needed, children mainly for two reasons. First of all, children were the parents' only source of food, shelter and defense in their old age. Secondly, people saw their own growth in the growth of their children. The younger and able people, to a large extent, took care of their elderly creating a circle of life through mutual dependence.

Today, the working population knows that it cannot financially depend on the next generation and should save for its own old age. The working population also knows that they are not taking care of their elderly very well either. No doubt they are financially providing for the elderly population through the tax system but the direct care of the elderly is less and less of their responsibility.

At present we are experiencing a phenomena of baby boom echo in North America. That is, baby boomers are passing through the age of fecundity. Even still, the current fertility rate is 1.6 percent in Canada and barely 2 percent in the United States.

We can also look at some of the current social trends to see how the fertility rate will pan out in the future.

- The family structure is under tremendous pressure and is crumbling. In the past, families stayed together out of necessity. However, due to the continuous prosperity of the recent past, there are enough resources that each individual can afford to live on his or her own.
- With the availability of affordable birth control methods, more and more men and women are voluntarily deciding not to have children.
- Statistics report that almost 50 percent of the children in North America do not live with their biological set of parents. When these kids grow up, they will be the least likely to start a family and have children.

The fertility rates in the western countries have been declining over the last three decades...

Low fertility rates seem like a natural result of continuous prosperity.

3) Terrorism and wavering world peace

If someone was to ask me if the next 50 years are going to be as peaceful as the last 50 years, my answer will still be in the affirmative. But, five years ago I would have given the same answer with more confidence. The know-how and ability to use nuclear weapons is increasing. The religious and the economic rivalries are increasing in intensity. Given today's political situation in the world, things do not look that positive, so there is less likelihood of peace which we are accustomed to.

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4) The crash of the Japanese stock market

The economy of Japan flourished after World War II by exporting electronic goods and cars to the rest of the world. For years, the Japanese economy reaped billions of dollars of surplus and the Japanese people enjoyed the highest level of disposable income. But the dragons and tigers of the Far East in the mid-1970s challenged the dominance of the Japanese superiority. Along with clothes, Hong Kong started producing electronics at much lower cost and the quality of goods made in Hong Kong was also very competitive. In order to stay competitive, the production of brand names like Panasonic, Toshiba and Hitachi was moved from Japan to Taiwan, Korea and China.

The Japanese economy reaped billions of dollars of surplus and the Japanese people enjoyed the highest level of disposable income.

Are these production lines going back to Japan? I don't think so, because the economic and natural factors are so strong. China has a large trained work force that is willing to work at a much lower cost than their Japanese counterparts. The availability of natural resources and slack environmental laws make is easier for manufacturing. When investors from all over the world are looking for someplace to invest, capital is not a problem either. In spite of the political problems of the past, the Chinese government is also playing a constructive role in the development of the country.

By the mid-1980s, due to the oversupply of money, the interest rates in Japan touched the ultimate floor: zero percent. The industrial over-capacity was well beyond healthy levels. Real estate prices were bulging. Yet, politicians and investors did not want a soft landing and kept blowing the bubble. Investment in the manufacturing sectors is considered to be the most important signal of the future prospects and it propels the economy in the shortterm. So, more and more money was poured into such investments without any rigorous economy analysis. Any cost-benefit analysis is not difficult at all when the interest rates are zero. So, more and more money was poured into such investments without any rigorous economic analysis. These investments did not return profit and soon turned into bad debts. Inevitably, the bubble burst. So far, all the political and economical efforts to patch the bubble have been unsuccessful.

Still, there is one highly favorable aspect of the Japanese economy. Japan invests, as a percentage of its GDP, in research and development more than any other country in the world. With a new breakthrough technology, which has mass application around the globe, the Japanese economy can add new manufacturing lines and abundance of high-paying jobs. Until then, most likely, the Nikkei will keep deflating.

5) Online trading

The Internet is becoming cheaper, faster and more widely available. One can browse the Internet over a cell phone and execute a trade. This is the way to go.

6) Globalization

The international trade barriers are coming down around the globe. The Internet and TV are becoming more affordable everywhere. More and more countries are becoming familiar with distant cultures, which was not possible before. Means of communications are becoming cheaper and more widespread. More and more geographical efficiencies are exploited in agriculture, manufacturing and trade.

There is another question: Will the political boundaries be able to contain the new technology? It does not seem that way. Take, for example, cell phones. When they came out in early 1980s, they were made in the US or Japan. Today most of the cell phones are made in China or Taiwan. The reason that happened in such a short period of time is that the major cell phone companies wanted to bring the cost down. A wider consumer base was necessary to create a good enough critical mass to set up networks. So those companies took the technology to the low cost regions of the world. Globalization is the way to go.

Current/potential impacts of these changes

1) Oversupply of money in the world market

The number-one effect of this phenomenon is that interest rates will stay low. The fundamental forces of economics will kick in and will rebalance the supply and demand. This situation in North America is quite similar to the Japanese experience, so low profit investments will be made here as well. That will absorb some of the oversupply of money. After some time, commercially viable applications of nano-technology and biotechnology will show on the horizon. They will provide opportunities for high profit investments and will create new demand for money. The overall result, I believe, of current low profit and high-risk investments will send the stock market indexes lower over the next decade or so.

2) Demographic changes

In the last 20 years, baby boomers saved a lot of money and invested in stocks, mutual funds and in fixed-income vehicles. In order to provide fixed return to the depositors, the banks had to lend money to businesses. There was a buying pressure on the stocks and the businesses had an abundant supply of funds. We all know that concept is changing. Large cohorts of baby boomers are going to retire in the next few years and will start withdrawing their deposits. Due to the larger swing in the birth rates, relative to the American birth rates, this change is especially important for Canada. So in a few years, the buying pressure is going to change into a selling pressure.

The supply of labor will also shrink when baby boomers begin to retire. No doubt, new immigrants will fill some of that gap but will not fully replace all of the retirees. Again the law of supply and demand will show its strength and the cost of labor will increase. The demand will be adjusted with North American production lines becoming less competitive and moving to low cost areas. Overall, demographic changes will cause a downward trend for the equity markets.

3) Terrorism and wavering world peace

Deteriorating world peace will add uncertainty to the economic prospects of countries. We observed the excessive volatility of the markets during the second Gulf War. After the September 11 attack,

the stock market analysts were forced to consider at least some catastrophic scenarios in their projections so their stock valuations are down. More uncertainties will lower their valuations further.

4) The crash of the Japanese stock market

Are North American stock markets going to experience something similar to the Japanese market (i.e. a permanent correction)? An analysis of similarities and differences of the two markets can help us answer this question.

One obvious similarity is that North American politicians, investors and analysts are following in the footsteps of their Japanese counterparts. The evidence of the political will to boost the stock markets in the shortterm can be seen in unprecedented tax cuts. The economic and international factors faced by Japan are also faced by North America.

The former has quite a few advantages over the latter (for instance, the availability of natural resources, the sheer size of the consumer base). Japan is highly dependent on North America for the consumption of its massive industrial production. The status of the sole super power definitely adds strength to the American stock market. The flight to quality will also help sustain the other downward pressures. All the major stock markets are following the American trends and their correlation factors are steadily going up. The balance of cost and benefits of international diversification will shift. The portion of capital outflow from North America, which is occurring just to achieve diversification, will slow down to a large extent and will support the market at home.

Clearly, North American markets are better off relative to the Japanese markets. The bubble of North American stock markets is not going to burst like the Japanese market; it will just deflate to some degree. Overall, a large number of forces are tugging these markets in different direction all the times and that means more volatility.

5) Online trading

In the pre-Internet days, one had to talk to an advisor before executing a trade. So the advisor could give his/her input before the execution and could dissuade the investor from making a hasty decision. Now there is less control on the investor against over reaction. As a result, we are observing more volatility in the stock markets. With more investors choosing to trade online, the stock market volatility is bound to increase.

6) Globalization

The most important influence of globalization is that quite a few non-western economies are rapidly progressing on the path of prosperity. Asia used to be a net importer of not only the manufactured goods but also of agriculture items. Today, most of the Asian countries are self-sufficient in their food requirements and are the net exporters of manufactured goods. Of course, the developing world is importing high-tech items and heavy machinery and exporting labor-intensive and low-tech manufactured goods. However, that balance is tilting. Globalization will put downward pressure on the major stock markets. No wonder, for the first time after the great depression of the 1930s, the federal reserve board is worried about deflation.

Up to this point, this article has examined two concepts:

1. History is history. The world is changing at such a fast pace that history is not relevant any more.
2. Major changes are happening and have

a definitive effect on the stock markets and interest rates. When and how much they impact the stock markets is highly uncertain.

Limitations of a stochastic model to project stock market behavior

1. The historical data do not include the impact of current changes. For example, the Toronto Stock Exchange (TSE) was established in 1952. Even if we use the entire TSE data, it will not include the effects of the Second World War on the stock market. No matter which statistical theory is applied to hammer the invalid data, the variables it churns out are not going to be meaningful. Any model that does not include the effects of the above-mentioned six points will be no more than a naive attempt. These trends are not moving in a purely random fashion. To incorporate their impact in a stochastic model someone has to make educated guesses. When a model is based on so many biased assumptions and apprehensions, how can it generate "pure" projections?

2. Any attempt to develop a correlation of all the variables affecting the stock market will not be more than a random guess. The impact of each variable is uncertain, so their combined uncertainty will be too large. The range of outcomes in a short period of 10 to 15 years could be more than six times of its mean.

3. What can one decipher from such uncertain results? Can a mean of such a range be a meaningful number? Obviously not! Any other statistical measure (for example 95 percent CTE or 99 percent VAR) will not be more than a guess squared.

4. When the range of stock market outcomes is so large, it means the range of the liabilities of a block of variable annuity is also very large. It is so difficult to match assets to a single stream of liabilities over the next 20 years. How do we match assets with such a wide range of liabilities?

5. Let us assume, somehow, we developed a "perfect" model to reasonably simulate the market behavior with 1000 iterations. What is stopping a company from running multiple cycles of 1000 iterations, selecting a cycle with "the right" answer and discarding the cycles with not so good answers? The right answer could be a lower level of reserves or a better match of liabilities with assets! That way, any low probability outcome could be mistakenly conceived as the most likely outcome. Is it not a wide-open legal loophole?

Proper application of simulation

1. **Over a very short period of time**
   Banks use stochastic modeling to calculate VAR over the next 10 days. That is fine. One can have a reasonably high level of confidence in the assumptions for that short period of time. Insurance companies not only need projections over the next 20 or 30 years, but also those projections have to be based on highly uncertain assumptions on lapse rates and consumer behavior.

2. **For a known scientific phenomenon**
   A flight simulator uses the stochastic modeling in the best manner. The developers of a simulator know exactly how a plane behaves in a particular scenario. Basically, they just recreate past behavior.

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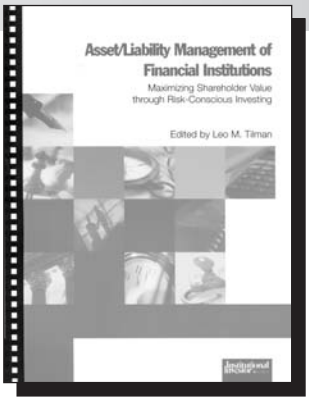
Book Review by Mark Bursinger

Asset/Liability Management of Financial Institutions



Book Review: *Asset/Liability Management of Financial Institutions*, edited by Leo M. Tilman, Institutional Investor Books (2003)

Those of us working in investment risk management for financial intermediaries over the past few years have experienced the perfect storm. The bursting of the equity market bubble, treasury rates at historic lows, credit related losses at historic highs and liquidity scare from September 11. Some intermediaries weathered the storm better than others, and some didn't survive. Whether you were prepared or not, asset/liability managers received a gut check that called into question whether we really understand our assets and liabilities and whether we have the right systems, processes and controls in place to deal with the potential uncertainties in our markets. Leo M. Tilman has brought together a collection of authors, including a number of actuaries, that frame a comprehensive ALM discipline to protect against the next possible storm.

I found the book to be very beneficial in its practical application of ALM. Topics are presented and demonstrated in a variety of industries including banks, insurance companies, pensions and mortgage intermediaries. While not every topic is covered in each industry, they are demonstrated in a way that allows practitioners to understand the critical elements so they can be applied to their own industry. The book also effectively demonstrates the need to integrate ALM with capital management and corporate finance objectives.

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The book is timely in its incorporation of current and very relevant ALM issues. In particular, embedded options in fixed-income and equity-insurance products. In addition to the necessary recognition of these risks, the book touches on the properly pricing of these options. Another current topic presented is the diversification benefits of alternative asset classes such as hedge funds.

I was pleased to see some often overlooked or subtle ALM issues included in the book. Included in this are counter-party credit risk and collateral requirements resulting from derivative use to manage ALM risk. In addition, the need to properly align asset benchmarks with liability characteristics. The improper alignment of incentives and ALM goals can lead to unintended risk exposure.

I read the book over the week of Thanksgiving. With all the talk of family recipes, I thought about the perfect recipe for ALM. However, no such recipe exists that can be applied by all practitioners. The book emphasizes the need to recognize the vast array of constraints and goals that exist for financial intermediaries. We are subject to varying degrees of regulations, accounting rules and policy constraints that have to play an intrinsic role in our pursuit of maximizing the goals established by our management and ultimately shareholders. These goals can vary greatly from one intermediary to the next. The book consistently emphasizes that proper ALM is customized to meet the needs and circumstances of the particular intermediary-much the same way as the best turkey recipe is only the best if it happens to meet your particular tastes.

As a more experienced ALM practitioner, I found the book mostly beneficial in its coverage of fundamentals, completeness and application to various industries. Useful for the beginning and senior ALM practitioners alike, this book provides a complete ALM foundation covering topics from duration to accounting rules for derivatives.

Mark Bursinger
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SOA members are eligible for a 20 percent discount on this book.
Please call Institutional Investor's hotline at:
+1 (800) 437-9997 to order.

Price: $195 ($156 for SOA members)
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Any alternative?

One answer is conservative deterministic scenarios. In order to remove individual biases from these scenarios, organizations like SOA and CIA can set up a committee to conduct a delphi study on a periodic basis. This group can be responsible for collecting comprehensive data, completing in-depth analysis of the data and applying its collective wisdom to generate a reasonable number of deterministic scenarios.

The choice between a stochastic valuation and a deterministic valuation is like choosing between "playing with fire or letting the fire play with you." Personally, I would play with the fire rather than let the fire play with me! That way I will be in charge and can stop playing with the fire when it starts burning me! But if the fire is in charge, it will not stop when it becomes unbearable to me. It is a choice between bad and worse.

Is using deterministic valuation methods like playing with the fire?

I think so because, when we are setting deterministic interest rate scenarios, we are basically trying to do something that is clearly out of bounds for humans. We actuaries are still humans and none of our five senses can explore the future. There is no trace of any mythological globe that tells the future. So, based on what we read and what we hear, we guess. At the most, we use our sixth sense. Some make conservative and some make aggressive guesses. It very well can be biased because we, as humans, always like what we perceive to be good for us.

Is using stochastic valuation methods like letting the fire play with us?

I think so. We let the computer guess the future for us because we know that our guessing ability is limited and we can be biased. At least, it will not be biased. It will project values based on a large number of unbiased scenarios and give us the desired statistical value. This value could be an average or a Conditional Tail Expectation. Note: "CTE" cannot be used by itself. At least it has to be "a CTE measure." So, did the computer enhance our ability to project the future interest rates?

I do not think so. A computer does what we program it to do and thereby it inherits all our limitations. We make it guess based on our biases. We tell it that the interest rates are going to mean revert. Either it will calculate the mean as we tell it to or we just hard code the mean. All it does is extrapolate the past based on the coded assumptions.

Even though we know very well that the future is going to be different from the past, still we put very high confidence in the outcomes generated by the computer. Somehow we end up following the black box blindly and we let our guards down. That is why I believe we are letting the fire play with us.

Conclusion

In a nutshell, I believe a stochastic model to project interest rates or stock market behavior is like a kaleidoscope rather than a telescope. A kaleidoscope, made with some broken pieces of red glass, will create a view with some shades of red, no matter how many times you turn it. Let us not navigate our ships through rough waters by mistaking a kaleidoscope for a telescope.

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2003 Investment Symposium by Max Rudolph

Investing in a post-everything world provided the setting for the 2003 Investment Symposium. Held in Toronto November 10-11, this marked the first time that the Canadian Institute of Actuaries (CIA) and Society of Actuaries (SOA) combined their efforts regarding investment topics. Chairing the event were Charles Gilbert and Max Rudolph.

Four keynote sessions highlighted the two-day seminar. Warren Jestin, chief economist with Scotia Bank, set the table by discussing the ongoing global economic recovery, with emphasis on North America. During lunch on the first day, Dr. Peter Bishop, professor at University of Houston – Clear Lake, introduced and implemented the Delphi concept with the symposium attendees to study several economic variables. In a Delphi study, the objective is not to necessarily reach consensus, but to develop a stable distribution of responses over multiple survey rounds while generating discussion of the outliers. For example, while the median estimated inflation rate over the next 10 years was estimated to be 3 percent by the group during both rounds, responses ranged from negative one to eight during the second round after being more variable during the first pass. Full results are available on the CIA Web site.

Terry Dunn of Assuratech, talking about Complex Adaptive Systems, gave the third keynote. This technique has been used to estimate damage inflicted by hurricanes and track terrorists. It models small groups that interact with other nearby small groups, none of which is led by someone who sees the big picture. Ant colonies and football games are analogies. The final keynote speaker was Frank Partnoy, professor at San Diego University School of Law and author of *Infectious Greed: How Deceit and Risk Corrupted the Financial Markets,* which details the financial scandals of the past 20 years. He shared stories from his research, focusing on how derivatives have been used to circumvent regulations, adding risk to manufacturing and financial firms alike.

Two receptions were held to provide networking opportunities. Many of the presenters were available at these times for informal discussions of more specific topics.

In addition to the four general sessions, eight time slots were dedicated to concurrent sessions where three distinct topics were addressed in breakout rooms. One opportunity to participate in a track of four sessions was developed by the SOA's Investment Section along with the Management and Personal Development Section, and was moderated by Joe Koltisko and Kelly Rendek. The first two sessions focused on capital markets hedging for insurance products, laying the technical base for the final two sessions titled, "Communication and Negotiation Skills." These sessions were well received and will likely be recreated in the future.

Several other mini-tracks were informal, including one focusing on pension topics. Pension topics included Revisiting the 60/40 Asset Allocation and the Pension Perfect Storm. This actuarial area of practice has been under fire of late, and suggestions were given to help the actuary address the issues head-on and make good recommendations.

Benchmarking was another common topic, with sessions focusing on transfer pricing and outsourcing the investment function.

Focusing in on creating multiple scenarios, topics included the trouble with monte carlo, stochastic modeling, variable annuity hedging and risk management uses of equity derivatives.

Three sessions dealt with credit risk, stressing measurement and research and mitigation. Other sessions included securitization, communicating with investment analysts, rating agency views of risk, reinsurance of investment risks, alternative asset classes and yield enhancement strategies.

The organizing committee, consisting of CIA and SOA members, included Nancy Bennett, Bryan Boudreau, Josee Deroy, Steve Easson, Charles Gilbert, David Gilliland, Jay Glacy, Valentina Isakina, Joe Koltisko, Catherine Murphy, Kelly Rendek and Max Rudolph.

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For all the speaker details and presentations, click on http://www.actuaries.ca/meetings/archive_investment2003_e.html for the English version andhttp://www.actuaries.ca/meetings/archive_investment2003_f.html for the French version. Recordings of many of the sessions are available for a fee.

Following up this year's success, the 2004 symposium will be held in Boston on November 8-9, with co-chairs Larry Rubin and Josee Deroy. You can contact them directly if you have suggestions for sessions or speakers, or just want to help out. The AFIR will join the SOA and CIA as hosts. As you can see, there is something for everyone. Make plans to attend in 2004!

Swaps and the Swaps Yield Curve

by Joseph G. Haubrich

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Interest rate swaps have become a popular financial derivative, and market watchers and economists are paying closer attention to them and their associated yield curves. This *Commentary* gives a brief introduction to swaps and their relation to other interest rates.

Anyone who reads the financial pages soon becomes acquainted with a variety of interest rates—long rates, short rates, rates on government bonds, bank accounts and corporate bonds. Those readers may have recently noticed a new rate getting more attention in the financial pages: swap rates. As the interest rate paid on an increasingly common financial derivative—the interest rate swap—these rates deserve attention in their own right. Spreads between swap rates and Treasury bonds are becoming a closely watched indicator of the market's view of macroeconomic risk. Furthermore, some analysts view swaps as the most likely replacement for Treasury bonds as a financial benchmark, should budget surpluses dry up the government bond market. They have already become the standard for pricing many corporate bonds.

Swap rates, like bond and mortgage rates, can provide information about current and future economic conditions. But swaps are not bonds or mortgages, so their interest rate measures something a bit different than the rates on those instruments. Extracting information about the economy from swap rates requires understanding the differences between them and other types of interest rates. This *Economic Commentary* describes the swaps market, explores the differences between swaps and other interest rates, and attempts to illustrate some of the information swap rates can provide.

• Swaps—An Overview

Unlike derivatives such as CATS, DOGS or Quantoes, the name "swap" actually describes the instrument.[1] In a swap, the two parties exchange, or swap, payment streams. For example, suppose one firm has invested in a bond that pays a coupon of 5 percent each year, and another firm has invested in a bond that pays an adjustable, or floating rate each year. The two firms can enter a swap agreement and pay each other their interest streams. The firm paying the fixed rate (or "fixed leg") is called the buyer and is said to be "long the swap." That paying the floating rate is called the seller and is "short the swap," though these terms are really just a market convention.

Just why firms enter swaps agreements is an open question. Swaps have grown exponen-

turn to page 16

tially since their introduction, so firms must perceive some value to them. Researchers suggest several possibilities.[2] Swaps may help firms protect their cash flow from frequent changes in interest rates on bank credit. They may reduce a firm's overall financing costs, either by giving the firm the flexibility to adjust the terms of its existing debt— maturities, cost or whether it's fixed or adjustable—or by enabling firms to effectively obtain lower credit-risk premiums from each other than they can from banks or by selling equity.

There are different kinds of swaps, but they have several common features. First, the swap payments are all based on what is called the notional amount. An annual coupon of 5 percent on a notional amount of $1 billion would mean a payment of $50 million each year. Swaps are often measured by their notional value, and it is common to see corporations reporting numbers such as "$2 billion notional value" or even reports saying things like "the total swaps market has become enormous, with notionals exceeding $3 trillion." Notionals are like the principal on a bond, with the extremely important difference that the notional amount never gets exchanged. Because the notional amount is not at risk—unlike a bond—a $1 billion swap has less credit risk than a $1 billion bond or loan. (One way to think of this is that two bonds are being swapped—a fixed bond for a floating bond, and the principal amounts cancel out.)

In a similar fashion, to avoid redundant payments, the two swap counterparties make only net payments to each other. On that $1 billion swap of a fixed 5 percent for a six-month floating rate currently at 2.5 percent, Megafirm does not pay $50 million to BigBank while getting $25 million back from BigBank. Rather, Megafirm makes the net payment of $25 million. This netting is one reason swaps are less risky than bonds. If BigBank fails, Megafirm is happy to be out of the contract because it owes money to BigBank. In a swap, you only lose when the failing party owes you money—so even if one firm fails, there's roughly a 50-50 chance no losses will occur.

Interest rate swaps, in which interest payments are exchanged, are one kind of swap and they come in two general types—coupon swaps, like the one above, where a fixed rate is exchanged for floating, and basis swaps, where two different floating rates are swapped, such as a six-month rate for a twelve-month.

Another basic type of swap is the currency swap, which exchanges payment streams in different currencies—say, dollars for yen. Simple sorts of swaps are often denoted as "plain vanilla"— nothing fancy. The more complex sort are exotics.

• The Importance of LIBOR

The floating rate used most often in the swaps market to reference a swap rate to is LIBOR, or the London interbank offered rate. This means swaps can be thought of as derivatives on the LIBOR rate. LIBOR has some special characteristics and it therefore imparts a special character to swaps and interest rates based on it.

First, LIBOR is an unsecured rate. It is the rate at which major international banks can borrow unsecured funds from each other, that is, without posting collateral. As such, it is similar to the federal funds rate, the rate at which banks in the United States borrow funds from each other. Second, LIBOR is a standardized rate. It is set by the British Banker's Association, which produces the actual reference rate itself each business day at noon. The association surveys a panel of banks at 11:00 a.m. about the interest rate each bank would pay if it borrowed funds right then.[3] The highest and lowest 25 percent of the responses are thrown out, and the mean of the remaining middle half is the LIBOR "fix" for that day. LIBOR is calculated for several currencies—the most popular being for the U.S. dollar, and LIBOR without a qualification means the U.S. dollar rate. So the US$ LIBOR gives the interest rate for borrowing Eurodollars, dollar deposits held in banks outside the United States.

LIBOR rates are short term—the maturities are one week and one, two, three, six, nine and twelve months. If we plot a yield curve for LIBOR, that is, a graph of yields (such as interest rates) against maturity, and compare it to the more familiar Treasury yield curve, we see the LIBOR curve is richer at the short end, because only a few Treasury securities

have an original maturity of one year or less. The LIBOR curve, of course, does not extend nearly as far as the Treasury curve, which goes out to 30 years. Figure 1 on page 18 compares the LIBOR yield curve with the U.S. Treasury yield curve for October 26, 2001. Since the banks behind the LIBOR rate are not as safe as the U.S. government, the riskier LIBOR curve is everywhere above the Treasury curve. Still, the LIBOR rates have become such a standard that the Financial Accounting Standards Board has accorded LIBOR special status as an acceptable benchmark, which in turn makes swaps based on it more attractive.

• The Interest Rate Swaps Market

Interest rate swaps, unlike stocks, futures or options, but like most bonds, are traded "over the counter," that is, not on an organized exchange. There is no set location where trade takes place and no clearinghouse to ensure the swap contracts are honored. This means firms need to be aware of who they are dealing with, but it also allows customized variations, both in terms of the amounts involved, the maturity and in the interest rates chosen. It is not uncommon for the floating rate to be some amount above the index, say LIBOR plus 5 percent.

Other variations extend far beyond the "plain vanilla" versions described above. Indeed, the many exotic flavors provide one measure of the swap market's success. For example, a collapsible swap gives a firm the option to cancel the swap if interest rates turn against it—as long as the floating rate is below the fixed rate, the firm gets the net payment, but if rates rise, the swap is cancelled and the firm pays nothing. Quanto swaps let firms get a floating payment in another currency—the firm may pay the fixed rate in dollars but get the floating rate in yen. A swaption is an option to enter into a swap. That is, the buyer of a swaption has the right, but not the obligation to enter into a swap before the option expires.

Because it is an over-the-counter market, some swap counterparties may get together on their own, but many use swap facilitators, who may be either brokers or dealers. The brokers bring people together, while dealers may trade and enter swaps for their own account. Often dealers are large banks, which use their extensive experience in lending and payments to work both sides of the market. This adds some needed anonymity to the market. For example, Ford and GM may both want to enter into an interest rate swap, but they might be reluctant to reveal that information to their rival— but a bank might act as go-between, say, by doing one swap with Ford, paying fixed and getting floating, and by doing another swap with GM, getting fixed and paying floating.

Despite, or perhaps because of the over-the-counter nature of the market, the interest rate swaps market has grown: Since the first interest rate swap in 1981, total outstanding swaps reached $682 billion in notional value in 1987, $6.2 trillion in 1993, $22.3 trillion in late 1997[4] and, by one measure, $46 trillion at the end of 1999.[5] This compares with total U.S. government debt outstanding of $5.7 trillion in June 2001 (of course, this figure is a nominal, not a notional amount.)[6]

• Yield Curves

The large volume of swaps outstanding has made yields on swaps of various maturities ("tenor," in market parlance) readily available, allowing us to plot a yield curve for the swap rate. The "swap rate" curve shows the fixed-rate leg of a plain vanilla swap against the floating leg of a six-month LIBOR.

The swap rate curve has become popular as a benchmark, and one reason is the dual nature of the risk involved. As discussed above, interest rate swaps are close to riskless—the "general swap rate" is only for highly rated counterparties, there is no principal to default on, and counterparties lose money only if they are a net receiver when the other partner defaults. In addition, many swap agreements require collateral—putting up bonds or other securities that the other side may take in case of default.[7] On the other hand, the swap is based on LIBOR, which is a risky rate. This combination means that although swaps themselves are not risky, they are tied to a risky rate, and therefore they make a nice asset to hedge other risky assets. In fact, this rather amphibious duality of safety and hedging ability has led regulators to give swaps a special status in portfolio accounting.[8]

The usefulness of swaps as a hedge became particularly apparent in 1998, during the Russian default and the Long Term Capital Management debacle, when spreads between risky bonds and safe Treasury securities increased dramatically. This hurt firms that had hedged their portfolios of corporate bonds and mortgage-backed securities using short positions in Treasury bonds; as the value of the risky bonds fell, and since the value of the Treasuries increased, the value of the short position fell as well. So rather than offsetting or mitigating the loss, the so-called hedge position in Treasuries increased losses, just the opposite of what a hedge should do. Swaps looked more like risky bonds, then, so a short position (paying floating) was a better hedge.[9]

Another advantage, though, is that, extreme incidents aside, the swaps curve behaves somewhat similarly to the Treasury yield curve. Figure 2 shows that over the past several years, the curves have moved together. The biggest difference is that the term spread for swaps (that is, the difference between rates on the longer maturity and the shorter maturity) did not invert—that is, go negative as short rates exceeded long rates—in the second half of 2000. While special factors (such as a riskier market) might explain the failure to invert, some people suspect a deeper reason: that risky yield spreads, more closely tied to firm behavior, invert less often. In an inverted market, private firms will issue a lot of longer-term debt in place of short-term debt, and the resultant supply will drive the yield curve slope upward again.

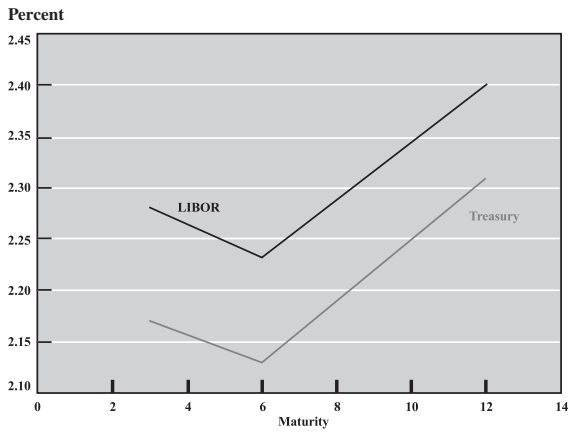
Even so, differences between the Treasury and the swaps yield curves can be very important. Yield curve inversions are often taken as a signal of recessions in the near future.[10] If the swaps curve rarely inverts, that signal may be missing. On the other hand, perhaps a new signal arises when there is a big spread between swap rates and Treasury rates.

• Conclusion

Judged either by the volume outstanding, the special status accorded by regulators, or the intense scrutiny of practitioner and academic alike, interest rate swaps and their associated yield curve occupy a key, if not yet central place in financial markets. The attractions of swaps that have fueled their growth, however, have also caused the swaps market to differ significantly from the markets for Treasury or corporate bonds, and some of the differences are reflected in the respective yield curves. Swaps are not bonds, but derivatives on a standardized interest rate (LIBOR). Though having very little credit risk of their own, they are based on an interest rate that does reflect credit risk.

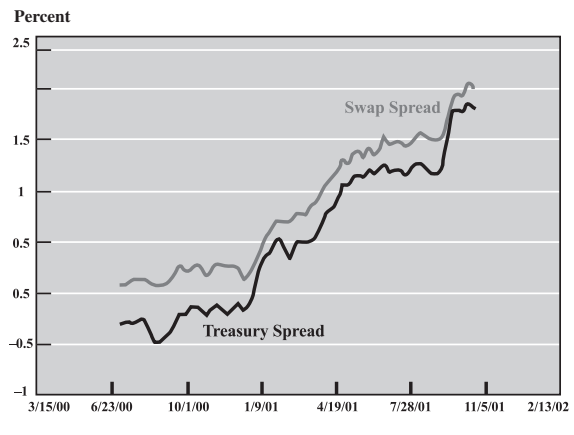
These differences account for much of the popularity of swaps, but they also mean that swap rates will differ in subtle but important ways from other interest rates. Some time-honored relationships —such as the tendency for the yield curve to invert before recessions—may not hold when the yield curve in

FIGURE 1 LIBOR AND TREASURY YIELDS, OCTOBER 26, 2001



SOURCE: Bloomberg Financial Services.

FIGURE 2 TERM SPREADS FOR TREASURY AND SWAPS MARKETS



SOURCE: Bloomberg Financial Services.

question measures swap rates. Thus, a clear view of the similarities and differences of this market is essential for nearly everyone concerned with financial markets.

• Footnotes

1. CATS are *certificates of accrual on Treasury securities*, an early attempt to separate the stream of interest rate payments on government bonds from the principal. DOGS are *dibs on government securities*, another attempt. Quantoes will be explained below.

2. For a good discussion of this and related issues, see Anatoli Kuprianov, "The Role of Interest Rate Swaps in Corporate Finance," Federal Reserve Bank of Richmond, *Economic Quarterly*, vol. 80, no. 3 (Summer 1994), pp. 49–68.

3. For the U.S. dollar, the 16 current (as of January 2, 2002) panel members are: Abbey National PLC, the Bank of Tokyo-Mitsubishi, Ltd., Bank of America NT & SA, Barclays Bank PLC, Citibank AG, Credit Suisse First Boston, Deutsche Bank AG, Fuji Bank, HSBC, JP Morgan Chase, Lloyds TSB Bank PLC, the Norinchukin Bank, Rabobank, the Royal Bank of Scotland Group, UBS AG, Westdeutsche Landesbank AG. For more details, see <www.bba.org.uk>.

4. These numbers are from the International Swaps and Derivatives Association, "Summary of OTC Derivative Market Data," <www.isda.org/statistics/qtcderiv.html>.

5. Charles Smithson, "Swaps Become the Benchmark," *Risk*, April 2001, pp. 78–79.

6. *Federal Reserve Bulletin*, September 2001, p. A27, table 1.40.

7. Some swaps also have market-to-market provisions for additional safety. For more information on this and a sophisticated view of what determines swap yields, consult Pierre Collin- Dufresne and Bruno Solnik, "On the Term Structure of Default Premia in the Swap and LIBOR Markets," *Journal of Finance*, vol. 56, no. 3 (June 2001), pp. 1095–1115.

8. See Andrew Osterland, "Good Morning Volatility," *CFO Magazine*, July 1, 2000.

9. See Robert N. McCauley, "Benchmark Tipping in the Money and Bond Markets," *BIS Quarterly Review*, March 2001, pp. 39–59.

10. My favorite reference for this is Joseph G. Haubrich and Ann M. Dombrosky, "Predicting Real Growth Using the Yield Curve," Federal Reserve Bank of Cleveland, Economic Review, vol. 32, no. 1 (Quarter 1, 1996), pp. 26–35. For more on why the swaps curve is generally steeper, see John Youngdahl, Brad Stone, and Hayley Boesky, "Implications of a Disappearing Treasury Debt Market," *Journal of Fixed Income*, March 2001, pp. 75–86.

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Investment Section Happenings in Orlando

Redington Prize winner Luke Girard (left) accepts a plaque and check from Doug George, section chairperson, for his paper "Market Value of Insurance Liabilities: Reconciling the Actuarial Appraisal and Option Pricing Methods." The Investment Section has sponsored the prize six times since the early 1990's.

Peter Ricchiuti, finance professor and dean at Tulane University's A.B. Freeman School of Business, speaking to the section's membership at lunch in Orlando

Mark Bursinger (right), incoming Investment Section chairperson, presenting the "Bull and Bear" statue to Doug George, outgoing section chairperson, in appreciation of a job well done

Craig Fowler, outgoing section council treasurer, receives a gift of appreciation from Mark Bursinger and the Investment Section

Members of the Investment Section Council taking a break while meeting to plan the section's 2004 activities:

Left to right – Mike O'Connor, Sean Casey, Doug George, Stephen Stone, Mark Bursinger and Martin le Roux

Other council members are Joe Koltisko, Steve Eassson, Bryan Boudreau and Larry Rubin