

Risks & Rewards

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Actuaries

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TAKING STOCK: IS BEING BIG BAD AND IS STRONG COMPETITION ALWAYS GOOD?

By Nino Boezio

In the past two years we have certainly heard a great deal about banks and brokerage firms in distress. Financial institutions such as insurance companies were also receiving serious scrutiny, something that they otherwise would not receive under most periods of economic turmoil. In 2008

the news (particularly emanating from the United States) was dominated by the spectre of bank failures due to excessive investment in sub-prime mortgages and other lower quality investments. In 2009, through a variety of mechanisms including government assistance and accounting changes, the banking industries throughout the world began to recover.

In conjunction with this environment, a number of propositions have been put forward on how to prevent this crisis from ever happening again. Some have criticized the practice of keeping many financial transactions “off-book,” and that process is now being reversed in conjunction with deleveraging. Others have attacked regulation and internal risk management practices, and both of these are now being reviewed and are receiving heightened and intense scrutiny, both within public and private circles.

Some have also attacked the large U.S. banking institutions, claiming that the “too big to fail” principle was in part behind the creation of this financial mess. A similar attack has been levied against many financial institutions around the world. The idea is that a “too big” institution knows that it is critical to an economy, and therefore expects a bailout when aggressive risk taking does not work out. Hence government intervention through legislation has been considered as an option to break up the dangerously big financial institutions.

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CHAIRPERSON'S CORNER

It has certainly been an interesting year for investment actuaries. As I write this article, it has been slightly more than a year since the Dow Jones Industrial Average declined precipitously and, in the United States, the Troubled Asset Relief Program (or TARP) was passed with the first installment of funds disbursed to eligible recipients. Of course, the insurance industry has not been immune to the volatile markets of the last year. Indeed, we have all been impacted in some way—from our employer's and/or clients' investment portfolios with which we work to our own personal investments. On a positive note, I am happy to say that the actuarial profession has responded remarkably well to the financial crisis and that, once again, our approach as a profession to investment risk, and enterprise risk more broadly, has been validated.

I am also happy to report that the Investment Section has had a very successful year. In this brief article, I would like to highlight just a few of our many accomplishments over the past year:

- Towards the end of 2008, we published a collection of papers on the financial crisis. The feedback I've received suggests this publication was timely, insightful, and thought-provoking. I hope that many of you have had a chance to read this collection of articles.
- We continued to develop and sponsor a number of continuing education opportunities. In particular, we contributed to the 2009 Investment Symposium, the 2009 Spring Meeting and the 2009 Annual Meeting. Again, the feedback we received has been very positive for all of these events.
- We sought out new opportunities to fund research related to investment work in the actuarial field. In particular, we provided sponsorship to the 44th Actuarial Research Conference, hosted by the University of Wisconsin School of Business. I am happy to say that some of the material you will read in this newsletter is a direct result of presentations made at that conference. I think you will find that the high quality of these articles speaks volumes about the success of that event.

Of course, it goes without saying that the success of our Section is ultimately dependent upon the contributions of our members. For that, I thank each and every one of you for a successful year. Whether you spoke at one of our sessions, attended one of our continuing education events at Society of Actuaries' meetings, or simply kept abreast of developments in our profession through reading this newsletter, I thank you for your involvement. I am anticipating another successful and busy year and, to meet that goal, your contributions will continue to be vital.

We are currently developing our strategic agenda for this year. In a lot of ways, I expect that our key goals will be very similar to last year. We will continue to focus on:



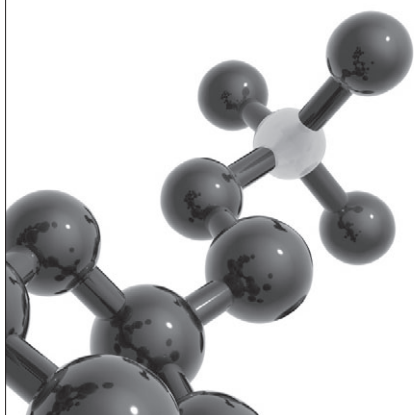
Andrew Dalton

- Communications
- Networking
- Education
- Research
- Integration with non-SOA organizations

Most importantly, we will focus on what you—as a Section member—tell us we should. Your input and feedback is critically important to ensuring that our Section council stays focused on important issues that are of interest to our members. We would love to hear from you. This Section is a member-driven organization. If you have any thoughts on important issues we should be addressing this year, please do not hesitate to contact me.

I would also like to take this opportunity to ask for your support as a volunteer. As I mentioned above, our success over the past year has been due to your efforts. We will again be looking for speakers, authors, and other volunteers over the next year. If this is something you're interested in, please let me hear from you.

I started this article by noting that the past year has been an interesting one. Given the nature of our work, I suspect that my successor as Chair of the Investment Section Council will be able to make similar comments in next February's Risk & Rewards newsletter. I'm looking forward to an interesting and exciting year—and am expecting a few surprises along the way. Our goal as a Section council is to support your work as investment actuaries during these interesting, and often challenging, times. I am optimistic that our work as a Section is adding value to the profession and, more generally, helping to elevate the actuarial profession in the larger investment community. Again, please let us hear from you if there's anything we should be doing in support of those goals. 🍀



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May 31-June 1, 2010
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This seminar is designed to give professionals with limited-to-moderate experience an understanding of how to better quantify, monitor and manage the risks underlying the VA and EIA products.

Learn more at www.soa.org.

// IN CONTRAST TO THE “TOO BIG” ARGUMENT, SOME HAVE ARGUED THAT BEING SMALL IS ALSO A SERIOUS PROBLEM. ... //

“TOO BIG TO FAIL” VERSUS “TOO SMALL TO SUCCEED”

In testimony before the House Financial Services Committee in Washington on Oct. 29, 2009, Treasury Secretary Timothy Geithner gave indications that new regulations governing big financial institutions would, “enable government the ability to order even healthy companies to ‘shrink and separate’ if their size or scope threatened the broader economy.”¹ The premise is that market dominance is potentially a bad thing, and that companies will engage in risky business strategies (that they otherwise would not engage in) if they know a government put option exists. President Obama has indicated that he also wants measures taken against the large institutions.

The public discussions on this issue have influenced many to conclude that being big is often bad, or at least not necessarily the best market model to follow, especially in the case of financial institutions. I do tend to somewhat differ in the overall view, because I do not believe many large organizations like the idea of gambling with their survival, thinking that the government will otherwise bail them out if things do not turn out—virtually everyone wants their organization to succeed, even though sometimes this might be tainted by unreasonable optimism. Also an organization can make a mistake by assuming the cost of risk-taking is quantifiable when it is not, leading to higher losses than ever anticipated—but this is not caused by any ease of mind created by the thought that the government might otherwise be there to assist if things go wrong. As well, there is the legal repercussions and embarrassment of being partly responsible for a failed or failing organization.

We should also focus our scrutiny on the smaller institutions. In contrast to the “too big” argument, some have argued that being small is also a serious problem, and that U.S. government regulations have encouraged weak banks to continue in operation. For example, Martin Fridson in his

book, “Unwarranted Intrusions: The Case Against Government Intervention in the Marketplace”² (written in 2006 before this financial crisis was gathering momentum), made a number of observations which I found rather insightful:

- Deposits were insured through the creation of the Federal Deposit Insurance Corporation (FDIC) via the Banking Act of 1933. The FDIC has unfortunately encouraged weak banks to exist by allowing them to continue in operation rather than fail. Fridson cites that for bank losses, “the deposit insurer has transformed them into costs that include payments to depositors, assumptions of bad loans, financial assistance to the troubled institutions, and the insurer’s operating and administrative expenses.”
- Fridson cites the findings of an economist, Eugene White, who performed a study of the FDIC for the period 1945 to 1994. White concluded that, “the tab has probably exceeded the cost of bank failures that would have occurred if deposit insurance had not been adopted.” White also concludes that, “the destruction of weak banks and the formation of larger banks would have produced a stronger banking system with fewer losses.” Fridson remarking on these findings states, “by enabling small, weak banks to continue attracting deposits despite their precarious financial state, the innovation halted the trend of merger and consolidation of the nation’s highly localized banking industry.”
- Fridson also makes the following observation, “In reality, the impetus behind deposit insurance was the preservation of small banks. These institutions were highly prone to failure. Not only were their financial resources limited, but small banks’ loan portfolios were heavily concentrated in their local economies. A single major employer’s failure could financially devastate the small businesses to which a local bank had lent money. The small banks knew that they could survive any business downturn, however, if only the government would agree to insure their deposits. That way, depositors wouldn’t withdraw their money, no matter how shaky the little banks became.”

Even though Fridson notes that the FDIC has also protected banks that are, “too big to fail,” one of the other major points made from his review is that the United States now likely has more banks (and many of smaller size) than it otherwise would have had, because of government introduced safeguards. This

result has caused a weaker financial system, given the inefficiencies that it indirectly brings to the financial system as a whole. If larger institutions had been developed and fostered, it would have been healthier for the banking sector.



Photos from the banking crisis of the 1930s. Source: <http://www.fdic.gov/about/history/historicalphotogallery.html>

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// THE ARGUMENT LEVIED THAT THE BANKS “TOO BIG TO FAIL” EVENTUALLY BECOME A PROBLEM FOR GOVERNMENT, CAN ALSO BE LEVIED AGAINST HAVING TOO MANY SMALL BANKS. //

In my own review of FDIC data, I was surprised at the number of U.S. financial institutions that exist. Consolidation did not occur with any great regularity until the early 1990s. There were 14,146 insured commercial banks in 1934 (after the FDIC was created in 1933), to a peak of 14,507 in 1984 (with the overall number being relatively stable during that period of 50 years), to a much smaller total of 7,097 at the end of 2008 (a drop of more than half).³ The decline since 1984 was in large part due to unassisted mergers between banks, even though the number of banks remaining is still a relatively large number, especially when compared to other countries.

Of course, how big an institution is allowed to get is another question, but having small and smaller institutions is not a solution either. No one really wants to talk about the latter since the public, politicians and the banking industry may be overly concerned with losing the perceived value of deposit insurance and with defending against the spectre of reduced competition, but it does nullify the cleansing effects that a free market has on limiting the number of institutions that operate.

Ironically, FDIC insurance has helped the “too small to succeed” banks to otherwise survive. By having deposit insurance

as a backstop, they can engage in speculative ventures with depositors’ money. So the argument levied that the banks “too big to fail” eventually become a problem for government, can also be levied against having too many small banks.

WHAT ABOUT TOO MUCH COMPETITION?

Throughout this period of financial turmoil, I often would hear (primarily through the Canadian media) about how Canada has a superior banking system and how regulation had safeguarded Canadian banks from getting into the same financial trouble that U.S. banks now faced. I was not always sure if this told the complete story (for example, one of the Canadian banks, CIBC, was heavily involved in sub-prime exposure, and it was not due to any violations of either regulations or general bank industry standards). In addition, the strengths and weaknesses of any type of financial system can alternate depending on what economic environment we happen to be in.

I attended a presentation in June 2009 that addressed the prospects for the Canadian banking industry and the financial industry as a whole worldwide. There was one particular comment that really caught my attention, and which really shed some light on one of the major structural differences between the Canadian and U.S. banking industry. The speaker highlighted the fact that since the major Canadian banks have such a dominant presence in the Canadian market, they make sufficient shareholder return from providing basic banking services without having to get into more exotic and risky investments.⁴ He noted the fact that Canadian banks are an oligopoly, which means that the top six banks control about 90 percent of the market (I include two charts from that presentation for illustration, and one includes a 7th financial institution).

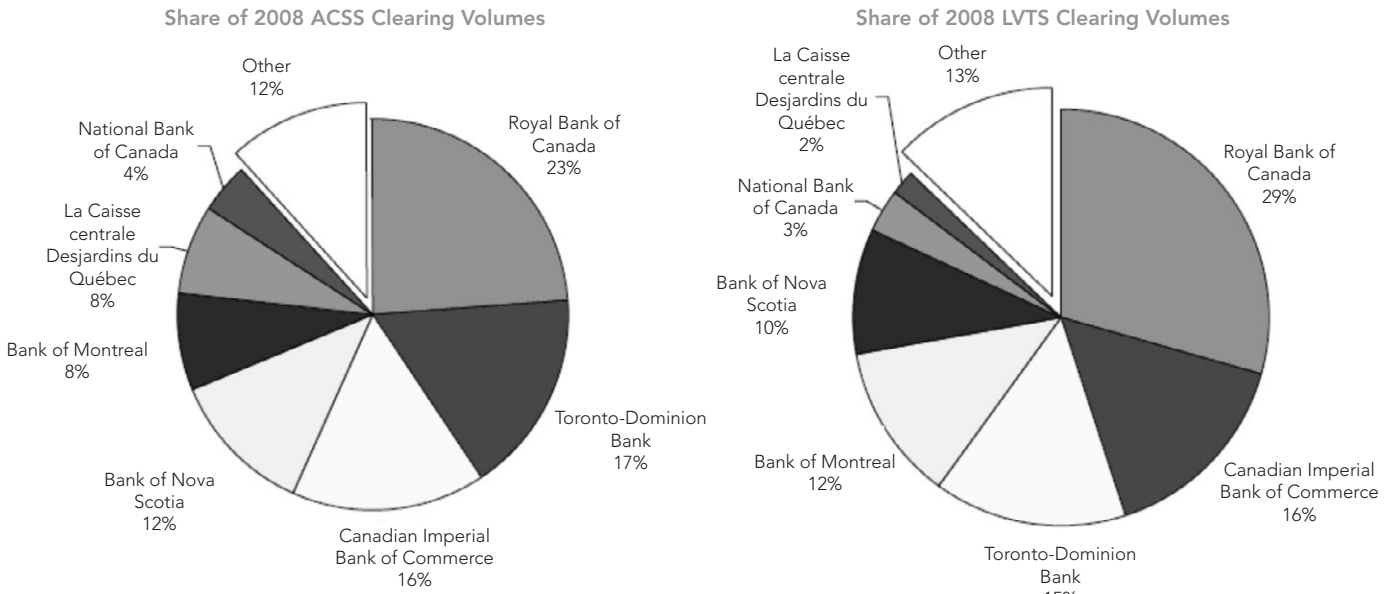


Associated Press

President Franklin D. Roosevelt signed the Glass-Steagall Act which was passed in 1933, and which separated commercial and investment banking

The top seven deposit-taking institutions in Canada constitute a powerful and stable oligopoly

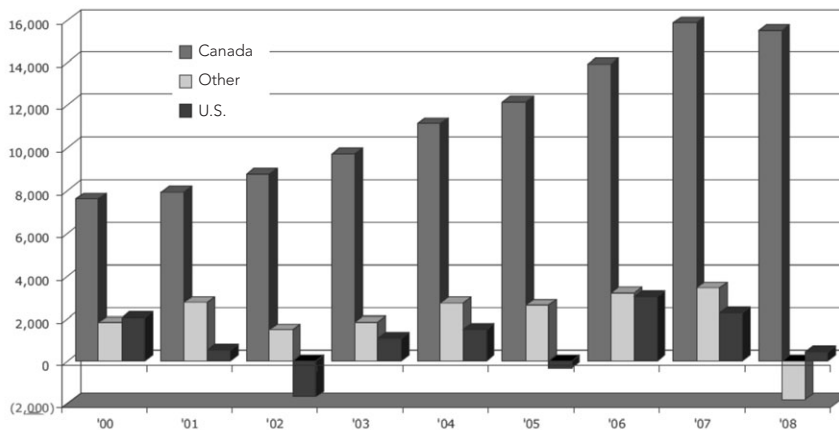
Canadian payments—Clearing Systems Volumes



Source: Canadian Payments Association; Moody's Analysis. Note: ACSS=Automated Clearing Settlement System; LVTS=Large Value Transfer System

The oligopoly acts as a market-based regulator, reinforcing rationale pricing of risk and mitigating against excessive innovation

Big Six Canadian Banks—Net Income by Geographic Area, C\$ millions



Note: The big six Canadian banks are Royal Bank of Canada, Toronto-Dominion (TD), Bank of Nova Scotia, Bank of Montreal, Canadian Imperial Bank of Commerce, National Bank of Canada

Source: Bank Annual Reports, Moody's Analysis and Estimates

CONTINUED ON PAGE 8

Taking the speaker's point further, if we use the common measure of 10:1 (that many like to use when comparing the United States to Canada in terms of size, based on relative population), one might figure that six banks in Canada may be like having 60 banks dominating the U.S. market. However this rationale can be flawed.

Having a higher population does not necessarily mean that we should proportionately have more banks. If there were only 60 banks dominating a particular market, one could still expect more competition than with only six as is the case for Canada. Competition is not always tied to the population it serves, but how easy it would be to coordinate strategies among the banks and thus function in an attitude of cooperation rather than rivalry, and it also depends on how fragmented the market is. Canadian banks do compete with each other, but the pressure for dramatic innovation is likely not as strong as in the U.S. environment. More companies competing in a particular sector

simply make the prospect for competition to be more intense. In particular, it does increase the likelihood that at least some banks are going to try to push innovation to a breaking point, hurting the entire industry if other banks follow suit. They may also engage in risky investments to get a better return. It can be embarrassing for any company to be boring.

We do note in the following table that market dominance is significantly different between the two countries. In actuality, while the Canadian banking industry is dominated by six banks, the United States has really only three or four, and these are of much smaller scale than their Canadian counterparts (the top two Canadian banks are almost equivalent to the top 10 U.S. banks in terms of deposit market share, and ironically the 10th largest U.S. bank is now also a Canadian bank because of its pre-crisis acquisitions).

2009 Rank	2008 Rank	U.S. Institution	US Market Share (%)	Total U.S. Deposits (\$B)
1	1	Bank of America Corp.	12.00	907.4
2	4	Wells Fargo & Co.	10.04	758.9
3	2	JP Morgan Chase & Co.	8.46	639.8
4	5	Citigroup Inc.	4.24	320.8
5	16	PNC Financial Services Group Inc.	2.44	184.2
6	7	U.S. Bancorp	2.02	152.8
7	8	SunTrust Banks Inc.	1.57	118.5
8	12	Capital One Financial Corp.	1.51	114.3
9	14	BB&T Corp.	1.51	114.2
10	11	Toronto-Dominion (TD) Bank	1.39	104.9
		Total of the Big 10	45.18%	\$3,415.8
		Total for Institutions in U.S.		\$7,559.9

The 2009 U.S. data includes bank and thrift deposits at retail and nonretail branches (active and de novo) as of June 30 and is pro forma for all acquisitions that have closed or have been announced at Oct 18. The 2008 data is based on ownership reported by the companies as of June 30, 2008. Source SNL Financial

2009 Rank	2008 Rank	Canadian Institution	Cdn Market Share (%)	Total Deposits (Cdn \$B)
1	1	Royal Bank	21.82	406.4
2	2	TD Bank	21.16	394.0
3	3	Bank of Nova Scotia	18.42	343.0
4	4	Bank of Montreal	12.77	237.7
5	5	CIBC	11.56	215.2
6	6	National Bank	4.15	77.3
		Total of the Big 6	89.88%	\$1,673.7
		Aggregate for Canadian Banks		\$1,862.1

Source: Office of the Superintendent of Financial Institutions Canada (OSFI), August 31, 2009 Data

// WHEN COMPETITION IS VERY STRONG, THE PRESSURE TO COME UP WITH NEW PRODUCTS AND IDEAS CAN BE SUBSTANTIAL. //

As mentioned earlier, the United States has over 7,000 commercial banks, but it also has an additional 1,200 savings institutions insured by the FDIC. Of course, many of these U.S. financial institutions are of varying sizes and many do not dominate the market at all. Canada in contrast has 22 domestic banks, 26 foreign banks, and 29 foreign bank branches. In addition, Canada has 66 trust and loan companies (but many of these are also owned by the big six Canadian banks).⁵ Once we remove the top six Canadian financial institutions from the Canadian financial system, the remaining players are rather insignificant. Also, if we compare the two countries and assume all of the Canadian entities are separate and independent (which they are not, but this may also be the case for some of the U.S. institutions) we have 60 times as many financial institutions in the United States. This is quite a stark difference in the number of organizations operating within the two countries.

When you have many companies (banks) fighting for a market, it does change some of the dynamics. If there are too many, they have to compete vigorously. They offer higher deposit rates and lower charges (perhaps too low) as there are many other institutions that would otherwise take the business. Thus some (perhaps many) of the banks have to get into risky investments elsewhere in their overall book of business, because they make poor returns on basic offerings and services. For example, a regional bank which has a limited branch network and is thus unable to expand, may engage in riskier financial activities in order to achieve growth. When you have 7,000 U.S. banks (or even 60) which have to compete with each other, you can envision a scenario where they feel forced to become more risky in order to remain at the same position or to get ahead of their peers, or even to achieve a similar share return to Canadian banks. I have to wonder how different things would be if instead of six major banks, Canada had the equivalent of 60 banks fighting for the Canadian market with none being dominant—I strongly believe that Canada would have a much weaker and more fragile banking system. The Canadian banks would be induced to come up with more

provocative and more challenging products and ideas, some of which could fail miserably.

I should point out that Canada also has deposit insurance (the Canadian Deposit Insurance Corporation) which has similarities to the FDIC, so that on its own insurance may not always prove to be a negative. But combine that with too many (and smaller) institutions, and we can produce a market efficiency problem.

COMPETITION LEADS TO INNOVATION— BUT SOME GOOD AND SOME BAD

Competition does benefit society as it produces incentives to come up with new innovations that benefit the consumer. Such innovations also benefit the company that produces them, since it will achieve a relative advantage to its peers.

When competition is very strong, the pressure to come up with new products and ideas can be substantial. We see for example, in times of warfare, technological advances are more rapid and are of much greater magnitude than in times of peace. However, given the complexity of our world, competition can also lead to developments that are much farther ahead than our ability to comprehend and manage effectively. When the competition becomes severe, it can cause a company to go farther than it should go into innovative products that are not completely understood.

COMPETITION CAN LEAD TO GREATER RISK-TAKING

An organization, in order to distinguish itself from its peers, may at times be motivated to take on excessive risk. Depending on the incentives in place, certain individuals or divisions can be motivated to take chances based on the risk-reward payoff matrix. If a person faces limited downside risk if a decision is wrong (such as just losing a job) but has substantial upside, then the risks undertaken can be worth the gamble. These wrong incentives are not truly tied to the size of the institution,

CONTINUED ON PAGE 10

even though a large organization has a large distribution network which can generate higher returns for a successful idea. But I do not consider risk-taking to be unduly influenced by the government put option for larger organizations, but rather misaligned corporate incentives. For smaller organizations however, it may become more of an issue, as there is less to lose and more to gain given the much smaller corporate asset base, especially given the presence of deposit insurance.

SUMMARY

There have been two conflicting themes operating in the U.S. banking system, and this tends to be a similar problem in many world economies. We have a financial system where organizations may be protected from failing which results in inefficiencies. We also encourage more risk taking as too many financial institutions are doing the same thing, and they therefore become motivated to look for ways to develop a relative advantage. Some institutions may be content with making a limited return on their investment, while others will become very aggressive in order to win market share over their peers.

Competition on its own promotes innovation and efficiency. However, it also promotes an environment, especially in today's world, where developments and products can move beyond our ability to understand and monitor them. An organization tries to achieve a competitive edge, but without understanding its real cost. Here competition becomes a detriment to the well-being of the sector as a whole and the population it serves.

If there are cracks in our risk management systems or an organization has improperly aligned incentives (especially in terms of time periods, and where benefits or gains are too short-term in nature) then we can find an organization running somewhat loose in its revenue generating enterprises, without realizing that its products and services have hidden costs which no one

truly understands, and is not being provisioned for via the balance sheet.

Under a totally free market framework, being small normally results in a company ceasing to exist unless it can achieve a competitive advantage. If there are too many institutions in any particular sector, it has been understood that the weakest can and do fail. Unfortunately many forget these other principles of competition as they wish to break-up larger organizations into smaller components while protecting organizations through government insurance programs.

In summary, we may not always know what number of companies of any type may be the ideal in any particular sector of the economy, and what is the appropriate size of an institution, but it does cause us to wonder. But targeting large organizations because of their absolute size relative to the economy is flawed if we do not address many of the other technical and practical problems that have been created by inappropriate government safeguards and intervention. **■**

FOOTNOTES:

- ¹ Paletta, Damian, "U.S. Seeks Power to Force Even Strong Banks to Shrink", *Wall Street Journal*, October 30, 2009, page A8.
- ² Fridson, Martin S., *Unwarranted Intrusions: The Case Against Government Intervention in the Marketplace*, Hoboken: Wiley, 2006. 251, 262.
- ³ "Historical Statistics on Banking, Commercial Bank Reports, CB02: Changes in Number of Institutions", <www2.fdic.gov> [path: <http://www2.fdic.gov/hsob/hsobRpt.asp>]
- ⁴ Routledge, Peter, "Moody's Investors Service – Canadian Bank Overview", *Canadian Banking Sector: Fixed Income & Equity Perspective*, (luncheon seminar sponsored by Toronto CFA Society), June 11, 2009.
- ⁵ "Who We Regulate, Federally Regulated Financial Institutions", <<http://www.osfi-bsif.gc.ca/>> [path: http://www.osfi-bsif.gc.ca/osfi/index_e.aspx?DetailID=568]



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TWO FOR THE PRICE OF ONE

By Brett Gallagher

Normally, the saying “two for the price of one” is associated with a good deal; something to be desired. Across the global financial markets, “two for the price of one” also nicely describes the price action in 2009—periods of both extreme distress and incredible euphoria. Whether it was something to be desired is another matter.

Through March 9th of this year, the poor returns of 2008 continued across a variety of asset classes. Equities were particularly distressed as fixed income markets had already begun to stabilize late in 2008. Since early March, however, we have seen strong rallies across typically “riskier” classes in what can only be described as a once-in-a-lifetime bull market rally for a number of them.

Return Performance December 31st – March 9th

ML US High Yield Master	-2.1%
ML US Corp BBB	+1.2%
ML Global High Yield Euro Issuer	+3.9%
ML Global EM Sovereign	+0.0%
MSCI World	-24.9%
MSCI Emerging Market Equity	-20.7%
MSCI All Country World Equity	-23.4%
Oil	+5.5%
Copper	+31.6%
Euro vs. US\$	-9.7%

Combine the following table with the one above

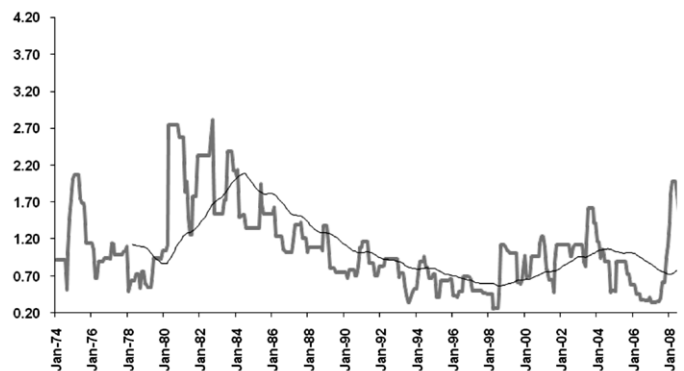
Return Performance March 9th – September 30th

ML US High Yield Master	+50.8%
ML US Corp BBB	+27.1%
ML Global High Yield Euro Issuer	+65.4%
ML Global EM Sovereign	+33.9%
MSCI World	+66.2%
MSCI Emerging Market Equity	+113.7%
MSCI All Country World Equity	+68.9%
Oil	+50.0%
Copper	+52.5%
Euro vs. US\$	+16.1%

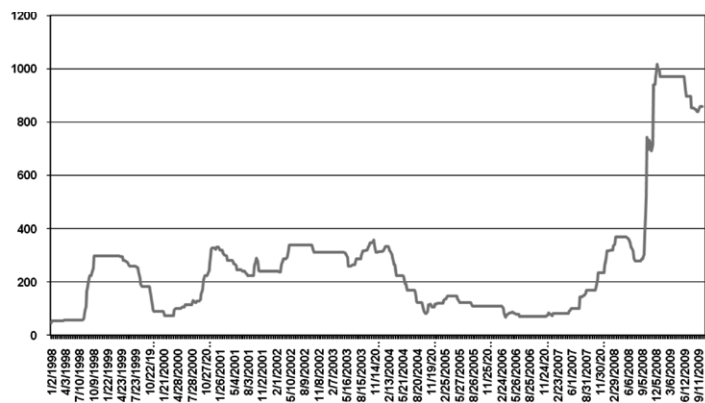
Source: Bank of America Merrill Lynch, MSCI Barra, Bloomberg, Artio Global Investors

The reversals we experienced from asset class lows, to their highs have not been seen in decades. In some cases (equities) we witnessed the biggest moves since the 1930s.

Credit Spreads (Baa-UST) 12 Month Difference between Maximum and Minimum



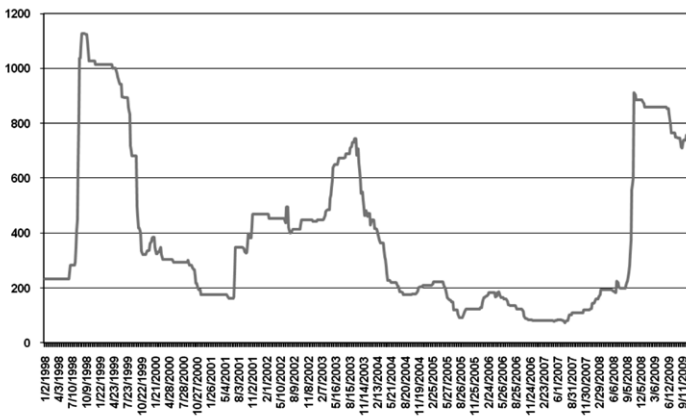
High Yield vs BBB Spreads 12 Month Difference between Maximum and Minimum



Source: Bank of America Merrill Lynch, Artio Global Investors

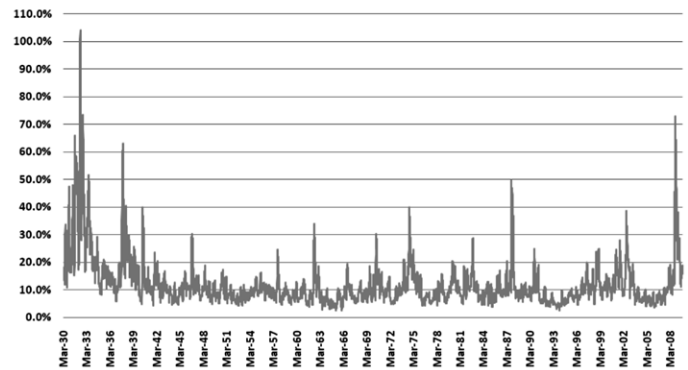
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**Emerging Sovereign Spreads
12 Month Difference between Maximum and Minimum**



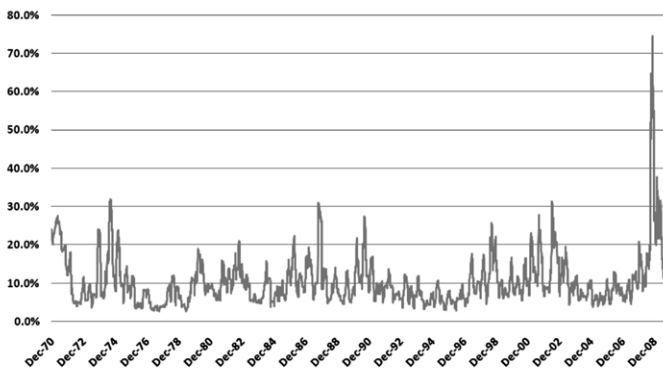
Source: Bank of America Merrill Lynch, Artio Global Investors

**S&P 500 Index
% difference Between 12 Month Hi/Lo**



Source: Standard and Poor's, Artio Global Investors

**MSCI World Index
% Difference Between 12 Month Hi/Lo**



Source: MSCI Barra, Artio Global Investors

Such rapid market turns would seem to reflect a belief that we have avoided the worst possible outcome of the economic/credit crisis (i.e., Armageddon) and that we are on our way to a more typical cyclical recovery. The real question is, “are we”?

BACKDROP

Most of the market’s liquidity-related issues of Q4 2008 had been addressed through the massive and coordinated efforts of governments and central banks around the world. In total, fiscal “stimulus” packages aggregated to approximately 4 percent of Global GDP.



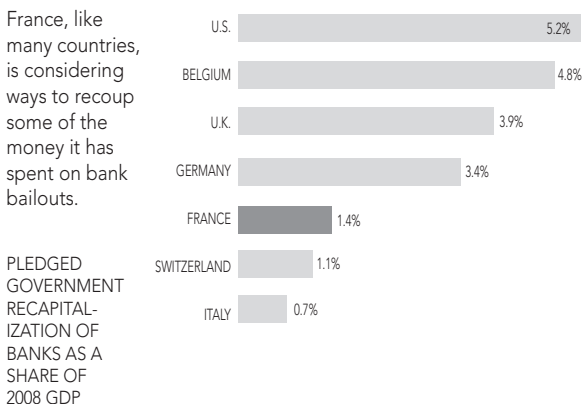
SUCH RAPID MARKET TURNS WOULD SEEM TO REFLECT A BELIEF THAT WE HAVE AVOIDED THE WORST POSSIBLE OUTCOME OF THE ECONOMIC/CREDIT CRISIS. ... //

	US\$ Bn	As a % of National GDP
China*	1171	27%
United States	787	6%
Europe	298	2%
Japan	154	3%
Latin America	149	4%
Emerging Asia	52	2%
Central/Eastern Europe	23	2%
Russia	20	1%
TOTAL		4% Global GDP

Source: Nomura Research. China number includes non-central Gov't spending

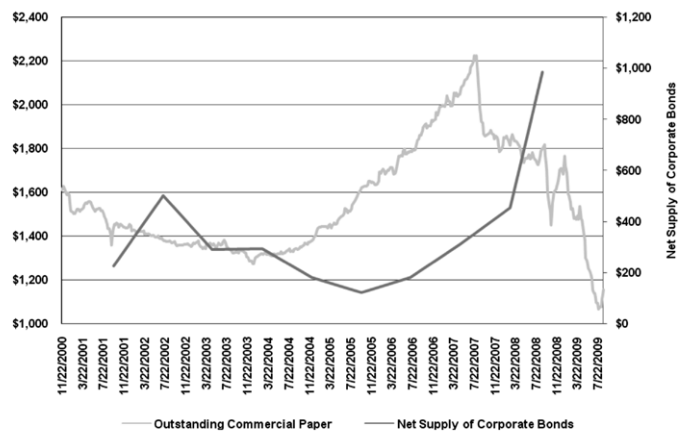
Monetary (including quantitative easing) and bailout programs (the banks, Fannie/Fredie, GM/Chrysler, AIG) provided further fuel to remedy the worst of the credit market woes.

Give and Take



Source: International Monetary Fund

Corporate Funding Alternatives (\$bn)

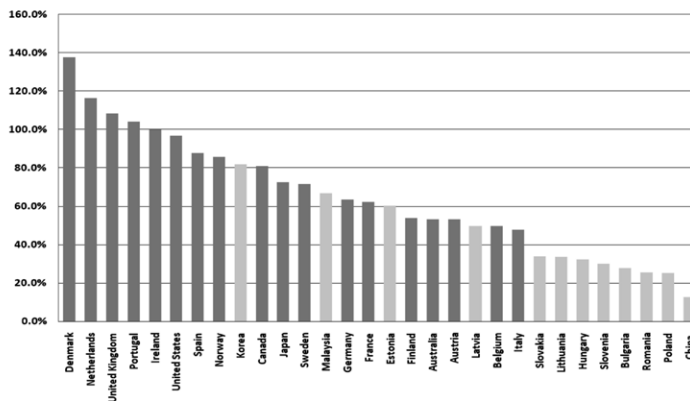


Source: Bloomberg

As a result, credit spreads collapsed and funding markets opened wide. Corporate issuers have taken advantage of the opportunity and, in our opinion, behaved wisely by extending borrowing maturities to take advantage of historically low interest rates while at the same time providing themselves with enhanced financial flexibility.

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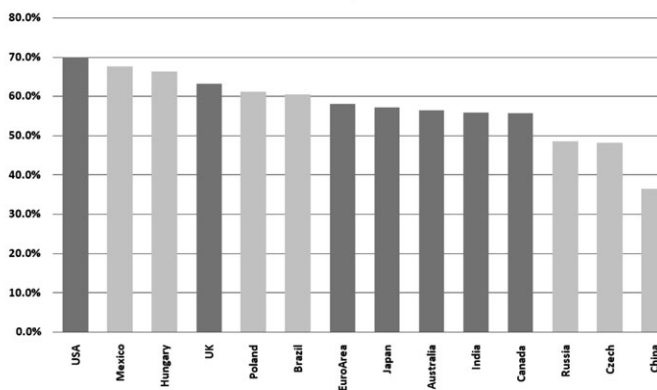
Household Liabilities as % GDP (2007)



Source: Eurostat, Federal Reserve, BIS Papers No. 46, Statistics Canada

What has been neglected throughout, however, and what we fear will guide the future, is massive leveraging—first of the consumer sector in a number of developed countries and now, as these same consumers pull back, their governments. Recent actions in both sectors are likely to result in lower secular growth rates and present the greatest risks to a return to sustainable global growth.

Personal Consumption as % GDP



Source: The Economist Intelligence Unit

Consumers across many developed countries had supported spending, not through incomes, but through borrowing. Household debt levels reached record highs in many countries, notably the United States and the United Kingdom amongst the larger economies.

Some may question our obsession with the consumer that we have voiced consistently throughout our previous commentaries. However, we do not think our concern is overdone given the household's importance to most economies, typically representing between 50 percent and 70 percent of their GDP. In other words, as goes the consumer, so goes the economy.

The mathematics of consumer deleveraging are clear. By way of example, if we assume the U.S. consumer needs to repair their balance sheets to pre-2000 levels, they will have to pay down roughly \$5 trillion in debt (reducing household debt from 97 percent of GDP to 65 percent). If this is accomplished through increased savings, many years will be required to reach the point of stability. Should the U.S. savings rate rise to its long-term average of 8 percent of income (it is currently 5 percent), approximately \$800 billion will be saved annually, implying a six-year debt paydown. Slower economic growth will be the side effect of this prudent activity, as savings become money no longer spent.

A corollary to the retreating consumer lies in the resurgent government sector. However, with the government generally 20 percent or less of GDP, its spending must grow by 3 percent to counter each 1 percent decline in consumer spending. While countries with excess savings, like China, are able to provide such a boost without borrowing, most developed countries have had to resort to the kindness of strangers and have stepped up their borrowing. The hope is that by the time the government needs to withdraw, spirits should be such that the consumer is ready to pick up the baton.

We tend to feel that the amount of stimulus in the pipe today, and what is likely to flow over the next six to nine months (U.S. stimulus spending is approximately 25 percent complete, China approximately 50 percent complete, at time of writing in Nov. 2009), will tend to lend a positive boost to the world

// ... WE FIND GOVERNMENT EFFORTS UNSUSTAINABLE AND DOUBT CONSUMERS WILL BE IN SHAPE, OR IN THE MOOD, TO TAKE OVER WHEN THE GOVERNMENT STEPS BACK. //

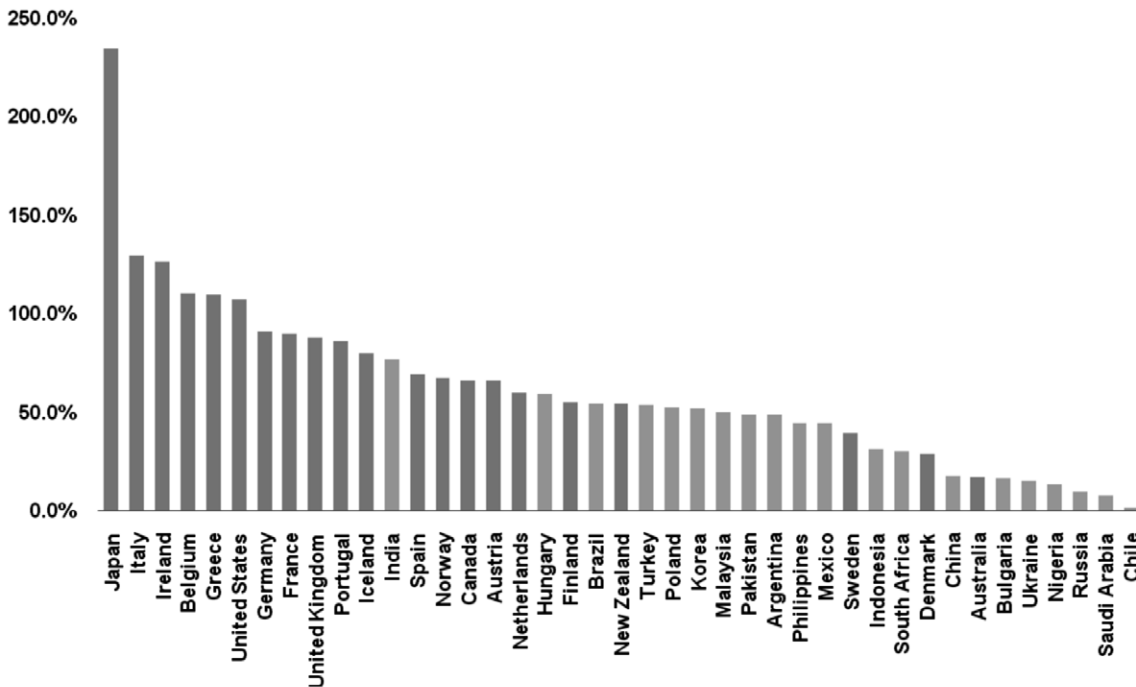
economy. We differ with the consensus in that we find government efforts unsustainable and doubt consumers will be in shape, or in the mood, to take over when the government steps back.

The chart that follows is from the IMF’s June report, “Fiscal Implications of the Global Economic and Financial Crisis,” <http://www.imf.org/external/pubs/ft/spn/2009/spn0913.pdf>. In it, the IMF calculates likely government sector debt/GDP

ratios in five years time, based on current debt levels and forecast spending and growth plans. The reading is sobering.

Developed countries are shown in green, while emerging countries are shaded in grey. What jumps out at even the casual observer is the fact that it is the developed nations who have the most stretched balance sheets—the same observation we made about the consumer side of the ledger.

Government Debt/GDP Estimates in Year 2014



Source: The IMF

CONTINUED ON PAGE 16

... WHILE THE CHINESE HAVE NOT YET LEFT THE PARTY, THEY HAVE CERTAINLY MOVED CLOSER TO THE DOOR.

Secondly, those countries where debt levels approach 100 percent of GDP have a dilemma. It becomes increasingly possible that any growth in wealth (GDP), may be absorbed simply to support the debt service on previously borrowed moneys. Japan's "lost decade" began around the time government debt exceeded 100 percent of GDP (though abnormally low interest rates kept the overall debt service ratios in check and a large current account surplus supported the currency).

This situation is especially worrying in the United States where not only is the debt level high, but also the average maturity of outstanding debt quite low. More than 40 percent of all U.S. Treasury obligations will need to be refinanced by the end of 2010 (and over 50 percent by the end of 2011), leaving America most vulnerable to rising interest rates. Other countries with high debt levels would seem to have a more prudent distribution of debt maturities, most notably the United Kingdom which, though it shares our debt dependence, sees less than 12 percent of their debt roll over before next year end.

It is also worth noting that almost 25 percent of Chinese Treasury holdings have a maturity of under 12 months (up from less than 4 percent just over a year ago). So, while the Chinese have not yet left the party, they have certainly moved closer to the door. There are many who poo-poo the idea of China abandoning U.S. Treasuries. Their simple question is, "what else are they going to do with the money?" They then answer themselves by stating, "certainly they would not stop buying UST for that would damage the \$800 billion worth of debt they already hold which is akin to shooting yourself in the foot." I would argue that **the maturity restructuring of their debt is just step one. Step two will be when the Chinese choose to issue sovereign debt denominated in the U.S. dollar, beginning to currency match their assets and liabilities.** Maybe it's the back door they're looking to sneak out of? The Russians announced their intentions to issue \$18 billion in dollar debt in mid-October, while the Germans decided to do it a few weeks earlier. Can the Chinese be far behind?

While debt levels are certainly a signal, it all really comes down to a country's ability to service its debt. At year-end 2008, the U.S. debt service ratio was 3.1 percent of GDP. Assuming IMF projections are accurate and interest rates do not change (we think that is probably a generous assumption), American's debt service ratio will increase to 4.1 percent by 2014. Should rates also climb, the U.S. may quickly reach the point at which debt service consumes any increase in GDP.

Another way of looking at this is to consider that debt servicing currently has a claim on just less than 40 percent of all U.S. income taxes (which is also equal to just less than 20 percent of total government receipts). It is no longer inconceivable that it could reach a point where new investment or support of government programs is difficult.

The implications of the levered westerner (both at the consumer and government levels) could potentially lead to a scenario where consumers increase their raise savings rate which, while good for the balance sheet, is bad for economic growth. The government, which has already spent and borrowed as much

	USA	Japan	UK	Germany	Aus	Can	France
2009-'10	42.4%	28.8%	11.6%	23.6%	15.2%	42.6%	26.1%
2011-'15	34.4%	39.6%	28.8%	46.4%	44.8%	30.1%	39.1%
2016-'20	15.1%	18.2%	16.9%	17.5%	21.4%	9.7%	20.1%
2021-'30	4.5%	11.0%	17.9%	5.3%	7.8%	7.5%	7.6%
2031+	3.6%	2.4%	24.9%	7.2%	10.8%	10.2%	7.2%

	USA	Japan	UK	Germany	Aus	Can	France
2009-'11	52.8%	40.1%	18.2%	35.6%	24.8%	52.2%	35.6%
2012-'15	24.0%	28.6%	22.1%	34.4%	35.2%	20.5%	29.6%
2016-'20	15.1%	18.2%	16.9%	17.5%	21.4%	9.7%	20.1%
2021-'30	4.5%	11.0%	17.9%	5.3%	7.8%	7.5%	7.6%
2031+	3.6%	2.4%	24.9%	7.2%	10.8%	10.2%	7.2%

France debt includes Social Security Debt Repayment Fund
 Germany debt includes Federal Post, Deutsche Bundesbahn and Treuhand
 Australia debt includes Queensland Treasury, South Australia GFA, Treasury Corp
 Western Aus, Tasmanian PFC, NT Treasury
 Japan debt includes government bonds for individuals
 Source: Bloomberg, Artio Global Investors (as of Oct. 20, 2009)

as they can, must raise taxes while cutting spending, further retarding growth. In short, a number of Western economies, led by the United States and the United Kingdom, have likely gone ex-growth, joining Japan which did so more than a decade ago. Those investors looking for opportunity, are better off focused on companies which do business in the still viable emerging markets and those fewer developed markets where consumers and governments are not as stretched. Interestingly, as Angela Merkel wins another election in Germany, her focus is on cutting corporate tax rates. The balance sheet flexibility of the Germans allows this and is likely to widen the capital attractiveness gap versus the United States—just one of the reasons Continental Europe finds favor in our portfolios.

Our international and global equity teams also continue to have a pro-cyclical bias to sector allocation to take advantage of continued stimulus flows. We also have a bias toward commodity-exposed countries which stand to benefit not only from the increased demand of a rebounding economy, but also as a hedge against a weak U.S. dollar. While we have taken some profits from our recently increased Emerging Markets exposures given their dramatic runs, we still have a relatively positive view of them for the intermediate-term. Further out, we may have to revisit our China exposure as it is likely to

have difficulty given its export dependency and our forecast for slower baseline global growth, but that time is not today. High yield bonds have had a year for the ages. While spreads have compressed dramatically, we are still above longer-term spread norms and while we do suspect the future normal will be about wider than before* given the slower rate of global growth (and likely higher defaults), the reason for buying the asset class is still valid—you don't (or shouldn't) buy high yield for the compression (though it was a nice bonus). You buy it for the ongoing yield. We believe that from current levels, the asset class is still likely to outperform equities. ☺

*The historic average default rate for high yield has been about 5 percent and the recovery rate about 40 percent. Given our view for slower global growth, we would expect both higher defaults and lower recoveries going forward (let's assume 6 percent and 20 percent, respectively). That would make the cost of default roughly 480 basis points (6 percent * (1 - .2)). If we further assume an additional 150 bps by way of liquidity premium, we could expect a future normal spread of approximately 630 bps (up from 450 bps today).

The views expressed are subject to change, based on market and other conditions and do not constitute investment advice. This article was previously published as part of the Artio Global Advisors CIO Letter sent in Q4 2009.



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COME THE REVOLUTION! A NEW DAY FOR PENSION RISK MANAGEMENT

By Chad Hueffmeier

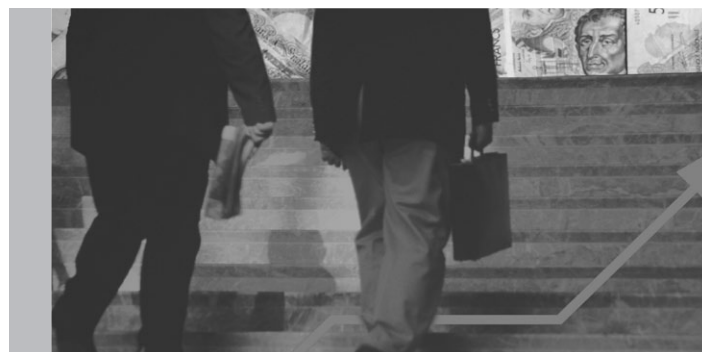
Although investment strategies have not substantially changed for pension plans during the past decade, smoothing mechanisms embedded in accounting standards and funding regulations have been significantly reduced. These changes have increased the transparency of the risk associated with pension plans and reflect a shift in the pension paradigm—from a world heavily reliant on long-term return expectations to a world requiring stronger risk management of short-term volatility. Consequently, plan sponsors are reevaluating the level of risk being taken in their pension plans and their approach to managing it.

That reevaluation should include rethinking the traditional approach of maintaining the same asset allocation regardless of the economic environment, the funded status of the pension, and the financial strength of the plan sponsor. Why? Because the traditional approach does not sufficiently consider the following:

- Avoidance of ruin—that is, avoiding the asset value or funding level to which a plan could not afford to fall.
- Tail risk associated with the investment allocation—that is, the worst types of performance a certain portfolio could experience.
- Limitations on uses of surpluses in pension plans.

When plan sponsors do evaluate these three considerations, it becomes apparent that the attractiveness of any investment risk will vary depending on the situation. For example, if it is difficult for companies to use pension surpluses, it will be less advantageous to take risk in a well funded plan than in a poorly funded plan. It is important to shift the asset allocation to reflect changes in the pension plan's and company's financial situations.

The traditional process of determining the asset allocation for pension plans was developed to identify a long-term asset allocation. Consequently, the process employs models that rely heavily on long-term return and risk assumptions. In a world requiring strong risk management of short-term volatility, long-term expectations are less important because it is important for plan sponsors to understand the levels of risks created in the current markets.



This article does two things. First, it examines circumstances under which plan sponsors' fiduciary responsibilities to participants should cause them to be concerned about the investment risk in the pension plan. Second, it describes a process for dynamically managing risk in pension plans. This process forces plan sponsors to continuously make conscious decisions about taking risk in the pension plan rather than passively relying on static long-term allocations and assumptions. The dynamic risk management approach recognizes and makes adjustment for constraints and/or competitive advantages that pension sponsors have relative to other investors. It makes these adjustments by following a four-step risk management process:

1. Properly define risk,
2. Explicitly budget risk,
3. Efficiently allocate risk, and
4. Implement and monitor performance.

This approach puts a greater emphasis on implementing appropriate solutions after evaluating the best interest of stakeholders.

IMPORTANT PENSION RISK MANAGEMENT CONSIDERATIONS

Balancing Investment Risk Taking with Fiduciary Responsibility

In general, plan sponsors have a fiduciary responsibility to plan participants with respect to the management of pension assets. They have often sought to avoid lawsuits from participants for breach of this fiduciary responsibility by adopting a herd mentality to investing. Unfortunately, the herd's asset allocation does not necessarily represent the best interest of participants or shareholders (See Corporate Finance.).

The fact is that participants would likely have grounds to sue plan sponsors for breach of fiduciary responsibility only in the event that participants lose benefits. Fortunately, participants can only lose benefits if each of the following conditions occur at the same time:

- Benefits are not fully covered by pension insurance;
- The company sponsoring the plan declares bankruptcy; and
- The pension plan is underfunded as defined by the pension insurer (e.g., PBGC).

// ... PLAN SPONSORS SHOULD ADJUST INVESTMENT RISK TO REFLECT THEIR PLAN'S FUNDED STATUS AND, THEREBY, IMPROVE BENEFIT SECURITY. //

As long as participants' pension benefits are fully covered by pension insurance,¹ participants should generally² have little interest in how much investment risk the plan sponsor takes in the pension plan. However, if participants' pension benefits are not fully covered, plan sponsors could improve the security of benefits by reducing the chance that the three conditions described above are met at the same time.

For example, if participants are not fully insured and their pension plan is poorly funded, plan sponsors could improve benefit security by taking investment risk because doing so would increase the likelihood that the plan would be well funded³ even if the plan sponsor declares bankruptcy. On the other hand, if a plan is well-funded, plan sponsors could increase benefit security by taking minimal investment risk. Consequently, plan sponsors should adjust investment risk to reflect their plan's funded status and, thereby, improve benefit security.

Before plan sponsors take investment risks in their pension plans, they should spend considerable time understanding how risks could be taken without significantly impairing the security of pension benefits. This requires plan sponsors to understand the extent to which they can withstand negative results from the pension plan, how to guard against certain levels of negative results (e.g., higher contribution requirements), and how to implement and monitor their exposure to risks.

Corporate Finance⁴

The mere act of taking passive risk (e.g., large cap equity exposure) in an underfunded plan sponsored by a financially weak plan sponsor should create value for shareholders. However, since it is difficult to access surplus assets in pension plans, the upside of creating surplus can be quickly outweighed by the downside of increasing a deficit. Consequently, as a financially weak plan sponsor's funded status improves, the investment risk in the pension should be adjusted to reflect a plan's funded status.

There is a common misperception that taking passive risk creates shareholder value for financially strong plan sponsors. In a transparent world, shareholders would demand additional returns at least commensurate with the higher expected returns from the pension plan (by discounting plan sponsor's stock price) because shareholders need to be compensated for the additional risk.

Current accounting standards allow plan sponsors to book expected asset returns and smooth experience gains (losses) on their income statement book. This creates artificial stability on the income statement; hence, it essentially hides risk. Although there is only an economic argument for taking passive risk in underfunded plans with financially weak plan sponsors, financial statements drive perception which can create economic consequences (e.g., stable earnings tend to be rewarded by the markets).

¹ In the United States, the PBGC guarantees benefits of qualified plans up to certain limits. Based on two studies, one of which is "PBGC's Guarantee Limits – an Update" (can be found at <http://www.pbgc.gov/docs/guaranteelimits.pdf>), participants of plans taken over by the PBGC received the vast majority of benefits earned under their plan and benefits for 84 percent of participants were not reduced by any of the limitation provisions.

² If participants have a strong claim on assets (e.g., certain regulatory jurisdictions, union plans, etc.), participants effectively have a free put option against the plan sponsor and the pension insurer. Consequently, risk becomes more attractive to participants as the plan sponsor's credit strengthens and the level of benefits protected by pension insurance increases. Note that if plan sponsors are not required to sponsor pensions, this type of pension system is likely unsustainable.

³ Well-funded should be based on the definition used by the pension insurer (e.g., PBGC's measure of liabilities).

⁴ As described in Morgan Stanley Investment Management's August 2008 white paper Asset-Liability Management within A Corporate Finance Framework, which was co-authored by Michael Peskin and Chad Hueffmeier.

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Management needs to determine whether taking advantage of an accounting anomaly justifies the economic consequences associated with risk. To facilitate informed decisions, it is important for management to continuously understand risk relative to their liabilities and potential asymmetries associated with taking the risk. However, overanalyzing this trade-off may be futile because recent trends indicate accounting standards are migrating away from artificial smoothing mechanisms.

Avoidance of ruin

It is vital for plan sponsors to avoid ruin which occurs when plan sponsors find themselves in situations they cannot survive financially. For example, pension funding regulations and/or debt covenants may require pensions to maintain certain funding thresholds that, if not satisfied, would trigger adverse consequences (e.g., higher contribution requirements). If investment risk causes the pension's funding level to fall below these thresholds at a time when the company's business is performing poorly, the pension could lead to the demise of the company. Furthermore, its ability to tolerate the impact of certain cash flow requirements will be driven by its ability to attain credit. Consequently, plan sponsors should consider enterprise risk management (ERM) and credit market factors when they analyze the level and type of risk taken in the plan.⁵ These may become dominating considerations as the size of the pension plan relative to the plan sponsor's business increases because it becomes more difficult for the business to finance pension deficits.

In addition, it is important for plan sponsors to realize that the distribution of potential funding levels resulting from investment performance changes radically as the ratio between benefits and assets rises. Although two different sequences of returns can lead to the same geometric return, the introduction of cash flows can cause these paths to generate significantly

different asset levels. For example, let's assume we have \$101 today and could make an investment that will pay 10.0 percent in one of the next two years and -9.1 percent in the other.

- Assume no cash flows => $[\$101 \times (1.1) - \$0] \times (0.91) = [\$101 \times (0.91) - \$0] \times (1.1) = \$101$

Although the investment's value would fluctuate over the period, we would not consider this investment to be risky because the final outcome is known (i.e., the value would be \$101 at the end of two years). However, the order of the returns becomes important when cash flows are introduced. As you will see below, the introduction of a \$50 cash flow at the end of year one would create uncertainty about the final outcome (i.e., the value would be \$55.60 or \$46.10 at the end of the two years); hence, we would consider the investment risky.

- Assume a negative cash flow of \$50 at the end of the first year => $[\$101 \times (1.1) - \$50] \times (0.91) = \$55.60 > [\$101 \times (0.91) - \$50] \times (1.1) = \46.10

Finally, when we introduce another negative \$50 cash flow at the end of year two, it creates the possibility of ruin. If the return is -9.1 percent in year one, we would not be able to make the full payment at the end of year two. Consequently, it should be unattractive to the investor to take risk in this situation since the risk could lead to ruin.

For any level of risk, the probability of ruin increases as cash flows increase as a percent of assets. Pension funding requirements and pension insurance may make it impossible for certain pensions to come to ruin by actually running out of money. However, plan sponsors may wish to define ruin as the funding thresholds at which they are required to make accelerated plan contributions to certain levels.

⁵ Note that if credit spreads are considered in funding regulations (e.g., incorporating credit spreads in the measurement of liabilities or in the targeted funding level), it makes the availability of credit less of a concern.

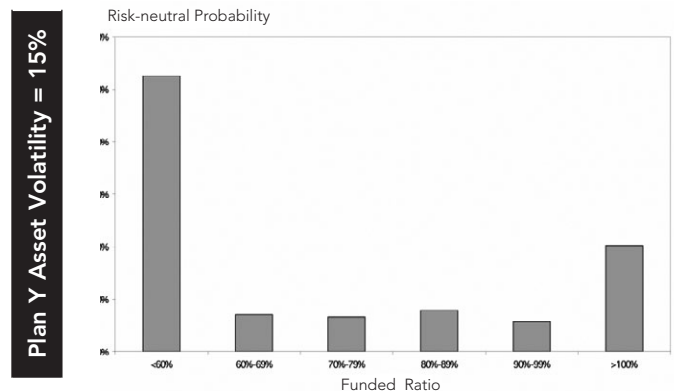
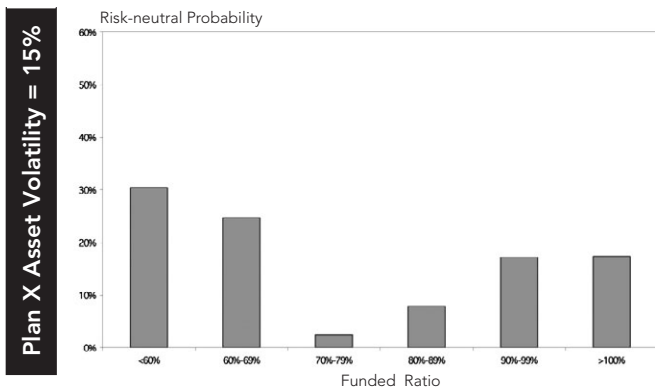
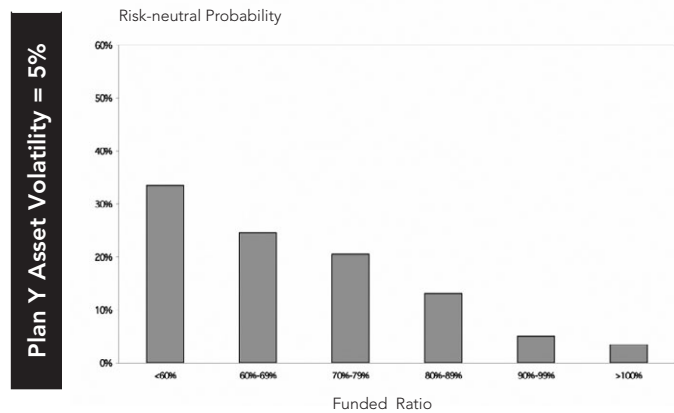
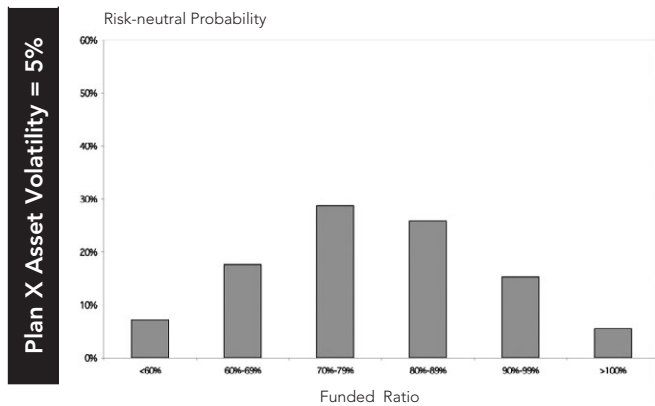
For example, a plan sponsor may define ruin as falling below a certain funded ratio (60 percent) at the end of seven years. The graphs below illustrate the projected funding ratios of two frozen plans with \$1 billion in assets and \$1.2 billion in liabilities: (1) Plan X has annual benefit payments of \$50 million, and (2) Plan Y has annual benefit payments of \$100 million. Since benefit payments from underfunded plans like Plan Y always cause the funded status to deteriorate, plan sponsors should expect Plan Y's funded status to deteriorate more quickly than Plan X's. In this example, the probability of ruin is 7 percent and 33 percent for Plan X and Plan Y, respectively.

Increasing risk in the plan would cause the tails (i.e., the worst types of experience) to fatten with exaggerated results. In this

example, increasing volatility from 5 percent to 15 percent causes the probability of ruin to increase to 30 percent and 53 percent for Plan X and Plan Y, respectively.

Assumptions:

- Seven year projection period
- Risk free rates of 5.0 percent
- Paths and probabilities were created using a risk-neutral lattice model
- Asset volatility is assumed to be 5 percent and 15 percent (as indicated)
- Interest rate risk in liabilities has been hedged
- No contributions are made to the pension plan



CONTINUED ON PAGE 22

Once plan sponsors define ruin, they should evaluate the chances of it happening. In general, the plan sponsor should want to avoid any chance of ruin. However, the cost associated with eliminating the possibility (e.g., buying insurance) may be prohibitive and cause the plan sponsor to retain some risk of ruin.

Tail Risk

It is crucial for plan sponsors to understand the tail risk in their portfolio. While plan sponsors would consider various factors about the plan's unique circumstances when they define ruin, tail risk describes the worst types of performance the pension plan could experience in isolation. If plan sponsors chose to take investment risk, they are exposed to tail risk. Consequently, they can only be certain of avoiding ruin when they fully understand and properly manage tail risk.

Management needs to evaluate the economic/accounting trade-off for both normal economic environments and less stable environments that are often linked to the poorest types of portfolio performances. Modern portfolio theory is useful for understanding and managing risk in normal environments because volatility is an appropriate (but not necessarily sufficient) risk metric and diversification is a relatively good risk management tool during those times.

However, it may be difficult for management to weigh the trade-off between tail risk and the cost of hedging or insuring tail risk because it is impossible to make an informed decision without understanding the risk. In general, normal distributions and Value at Risk (VaR) has been used most often by institutional investors when contemplating tail-risk. Although these measures are easy to understand, there are at least three important shortfalls that prevent them from helping us make informed decisions about taking risk in the real world.

- (1) VaR does not describe the tails, it describes a certain percentile event;
- (2) The percentile is not correct—there is a reason why one in 20 events seem to occur every five or six years—the models are wrong; and

- (3) The process does not consider the financial strength of the plan sponsor during the tail event (i.e., tail events often coincide with poor business performance).

In general, a good rule of thumb may be that if plan sponsors do not understand the risk, they should not take it. It is difficult to reconcile the fulfillment of fiduciary responsibilities with taking risks that are not understood. Consequently, plan sponsors should seriously consider hedging/insuring against tail risk or implement a process, described in the second part of this article, to ensure the risk is better understood.

Limitations on Uses of Surplus Assets

As described earlier, pension insurance may cause participants to be indifferent to investment risk taken in the pension plan. In this situation, plan sponsors may choose to take investment risk to help finance the pension plan.

In most countries, participants do not own⁷ the excess assets in the pension. Shareholders are generally able to receive value from excess pension assets by using it to pay for future benefit accruals (i.e., contribution holiday). However, with fewer participants accruing pension benefits than in the past, plans today need fewer assets for this purpose. Outside of using assets to pay for future benefit accruals, it tends to be difficult for shareholders to realize the full value of pension assets. When the cost of annual benefit accruals decrease, shareholders require less assets to pay for future accruals.

Although shareholders can try to access pension assets by terminating⁸ the plan to have assets (when owned by the plan sponsor) revert back to the company, in the United States the company would be required to pay excise taxes on any reverted assets.

⁷ In the United States, by law, surplus in contributory pension plans is owned in part by participants.

In addition, surplus is often considered during labor negotiations and effectively causes surplus to be partially or fully owned by participants.

⁸ Generally this is a situation where the plan sponsor purchases group life annuities to transfer their liability to an insurance company.

// IN GENERAL, A GOOD RULE OF THUMB MAY BE THAT IF PLAN SPONSORS DO NOT UNDERSTAND THE RISK, THEY SHOULD NOT TAKE IT. //

Pension assets that shareholders cannot recoup full value on will be referred to as excessive assets. Value for shareholders decreases when plan sponsors take risks that could create excessive assets. Essentially, the taxing authority is provided a free call option on a portion of the excessive assets at the expense of shareholders. And when plan sponsors maintain the same allocation of assets regardless of the plan's funded status, they increase the chances of creating excessive assets.⁹ For example, if participants have no claim on the surplus and excise taxes are 50 percent of the value of reverted assets, the taxing authority would have a call option on 50 percent of excessive assets. Using Black-Scholes option pricing and the following assumptions, we have estimated the shareholder value destroyed by continuously maintaining a constant asset allocation in four examples.

	Value of Tax Authority's Option (\$ millions)	
	80% Funded	100% Funded
Frozen Plan	\$10.8	\$56.8
Closed Plan with future accruals equal to 10%	\$4.8	\$33.3

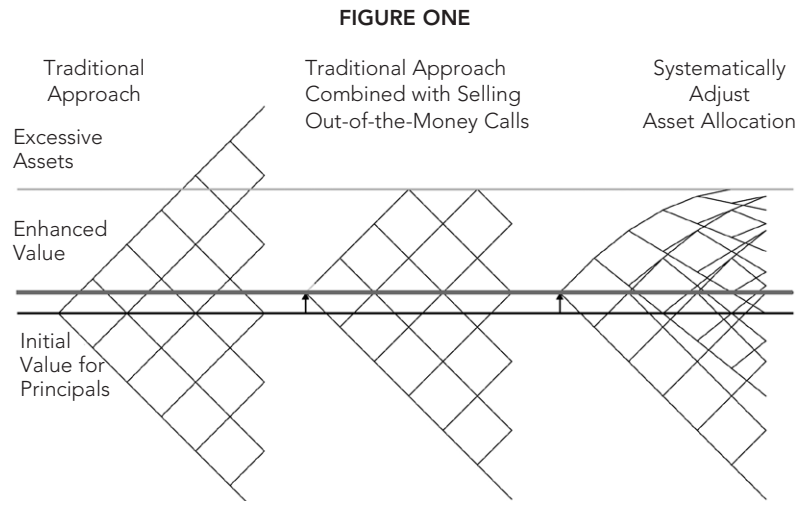
Assumptions:

- Liabilities of \$1 billion¹⁰
- Demographic experience will match expectations
- Interest rate risk in liabilities (and future accruals) is fully hedged
- Liability tracking error¹¹ of 10 percent
- Risk-free returns are 4 percent
- The plan will be terminated in five years

From the perspective of shareholders, assets are less valuable due to the taxing authority's free call option. In our example of a frozen plan that is 100 percent funded, the assets would only be worth \$943.2 million (i.e., \$1 billion less \$56.8 million) to shareholders.¹²

In certain situations,¹³ participants essentially own pension assets; hence, the free call option is provided to participants rather than the taxing authority. We would need to modify our assumption to reflect that participants own 100 percent of excessive assets (rather than the taxing authority owning 50 percent of it). In this situation, the assets of a frozen plan that is 100 percent funded would only be worth \$886.4 million (i.e., \$1 billion less \$56.8 million x 2) to shareholders.¹⁴

As illustrated in Figure One below, management (i.e., agents) could enhance value for its shareholders by dynamically managing risk: by either selling out-of-the-money call options to capture premiums (second approach in Figure One) or systematically adjusting asset allocations (third approach in Figure One). Either approach should avoid the creation of excessive



⁹ In the United States, excise taxes can be limited to 20 percent by taking certain actions.

¹⁰ Based on a termination liability

¹¹ Measures the volatility asset returns have relative to liability returns.

¹² These numbers are not adjusted for corporate income taxes.

¹³ Participants may have a strong claim on pension assets in contributory plans, union plans, or in some jurisdictions.

¹⁴ Note that it is not possible for shareholders with a fully funded frozen plan to benefit from taking risk in these examples.

CONTINUED ON PAGE 24

assets and, thereby, enhance value for the company's shareholders since the free call option would have no value.

DYNAMIC RISK MANAGEMENT PROCESS

Plan sponsors' decisions to take investment risk must be fully informed. That means they should consider the implications of all the concepts and constraints raised so far in this article: the security of participant benefits, ruin, tail risk and uses of surplus. Doing so will help them identify situations that may make risk unattractive. Plan sponsors are likely to understand these implications more clearly when they follow the process described here.

Step One: Properly Define Risk

In general, investment risk in pensions should be managed relative to pension liabilities. Plan sponsors should determine an appropriate liability benchmark against which to manage risk. The benchmark does not have to be the accounting or funding liability. In fact, these types of measures tend to be artificially biased toward certain types of risk (e.g., credit risk) and impossible to hedge.

As an alternative, plan sponsors should consider establishing a liability benchmark for managing risk that is investable and does not bias the risk allocation process toward certain types of risk. The benchmark would be based on projected benefit payments and risk free¹⁵ interest rates. This type of benchmark would help identify two items: (1) the level of assets that would be expected to be sufficient to pay for future benefit payments with relying on neither returns from investment risk nor future contributions; and (2) the level of risk premiums and alpha¹⁶ required to make up the shortfall without relying on future contributions.

The risk management benchmark would not impact accounting and funding calculations. It would only be used to help make decisions about how much risk to take and it could influence the types of risk taken.

Step Two: Explicitly Budget Risk

It is critical for investment committees to understand how

much risk is appropriate for a pension plan's stakeholders (i.e., participants and shareholders). The risk budget is simply the vernacular used when identifying this level of risk and, as such, the crux of the risk management process. As discussed, the security of participant benefits and certain concepts of corporate finance suggest that reducing risk as the funded status improves is appropriate. Consequently, the plan sponsor should not only determine the amount of risk that is initially appropriate, but also develop an approach to assure the level of risk in the pension plan continues to be appropriate over time.

As also discussed, it is necessary for plan sponsors to incorporate ruin into the risk budgeting process. When plan sponsors can clearly define their idea of ruin (e.g., funding levels that trigger certain events), sponsors should dynamically manage risk—by either paying for protection (e.g., put options) or systematically adjusting asset allocations—to avoid ruin.

When benefits are fully insured, the participants should be indifferent to risk taken in the pension plan. If management does choose to take investment risk in this situation, they must understand limitations on uses of surplus assets to identify excessive assets. Doing so should prompt plan sponsors to consider dynamically managing risk by either selling out-of-the-money call options to capture premiums or systematically adjusting asset allocations.

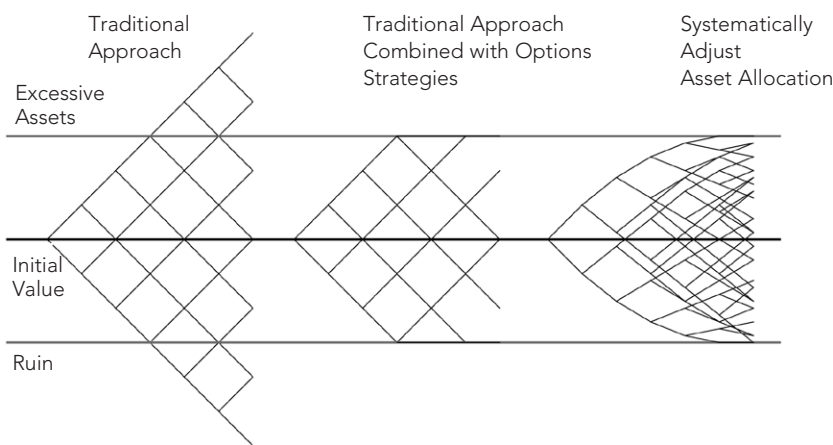
As illustrated in Figure Two, if plan sponsors decide to take investment risk in their pension plans, it is important to manage the risk within the limits imposed by excessive assets and ruin. This is done by dynamically managing risk with option strategies, systematically adjusting asset allocations, or a combination of both.

¹⁵ We have not defined "risk free" because the issue is debatable and would require significant discussion. These rates are commonly defined as interest rates implied in either sovereign debt prices or forward LIBOR/swap markets.

¹⁶ Alpha refers to returns that, theoretically, are not generated by taking risk.

// STATIC ASSET ALLOCATIONS DO NOT LEAD TO STABLE LEVELS OF RISK BECAUSE ALL THE AFOREMENTIONED TRANSFORMATIONS LEAD TO CHANGES IN VOLATILITIES AND CORRELATIONS. //

FIGURE TWO



If funded status improves, systematically adjusting the asset allocation to take less risk may be most practical because the plan sponsor would likely want to permanently reduce risk. However, if funded status deteriorates, it may be more practical to retain the asset allocation and pay for protection (e.g., put options) because the plan sponsor would likely want to return to the previous level of risk once the funded status improves—ultimately the funded status will improve due to funding requirements. Consequently, plan sponsors may favor a dynamic risk management strategy that protects against ruin through option strategies and against excessive assets by systematically adjusting the asset allocation as their plan's funded status improves.

As we know, plan sponsors can improve the security of benefits by reducing the likelihood of having plan underfunding coincide with corporate bankruptcy. Plan sponsors should consider constraining the correlation between pension plan performance and business performance. For example, the plan sponsor could choose to invest in a manner that provides a funded status volatility of 10 percent (i.e., a one standard deviation event would cause the plan's funded status to fluctuate by 10 percent) and has a correlation of less than 0.5 with the plan sponsor's stock price.

Step Three: Efficiently Allocate Risk

As witnessed in 2008, economic environments can change rapidly. Furthermore, asset classes and new asset categories continue to evolve. Static asset allocations do not lead to stable levels of risk because all the aforementioned transformations lead to changes in volatilities and correlations. A disciplined risk management process requires plan sponsors to modify asset allocations to reflect changes in the portfolio's risk.

Plan sponsors should seek to maximize risk-adjusted returns (i.e., efficiently allocate risk). Explicitly budgeting risk from the outset forces the plan sponsor to weigh the trade-off between taking one type of risk rather than another type. Under the traditional approach, it has been difficult for plan sponsors to make decisions to reduce interest rate risk (i.e., hedging the interest rate risk inherent in liabilities) because they have not been forced to evaluate opportunity costs. In a dynamic risk management framework, it is easier for plan sponsors to make this decision because reducing interest rate risk allows the plan sponsor to take other types of risks.

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Sponsors, reluctant to deviate from the herd, have been slow both to invest in new asset classes and to utilize state-of-the-art risk management tools. Nevertheless, it is important that plan sponsors reflect the evolution of asset classes and investment tools in their allocation process. Because it is important that plan sponsors understand the risk before accepting it, they should consider partnering with professionals to identify non-traditional investment opportunities.

For example, non-traditional investments are often associated with liquidity risk premiums that should be attractive to pensions.¹⁷ These types of asset classes (e.g., direct real estate, private equity, infrastructure, etc.) require risk management decisions to be integrated within the investment process because it is difficult to manage the risk after the investment is made. Although significant due diligence is essential when evaluating such opportunities, history has shown the risk-adjusted returns can be substantial.

Finally, it requires a sophisticated set of skills to manage tail risk. For this reason, plan sponsors should consider establishing a tail risk portfolio in which a certain percentage of pension assets are set aside to explicitly manage tail risk. Establishing

this portfolio would allow traditional asset managers to remain focused on their specific task and would leave the management of tail risk to someone with the appropriate skills. As risk is reduced in the overall portfolio, the allocation to the tail risk portfolio could also be reduced.

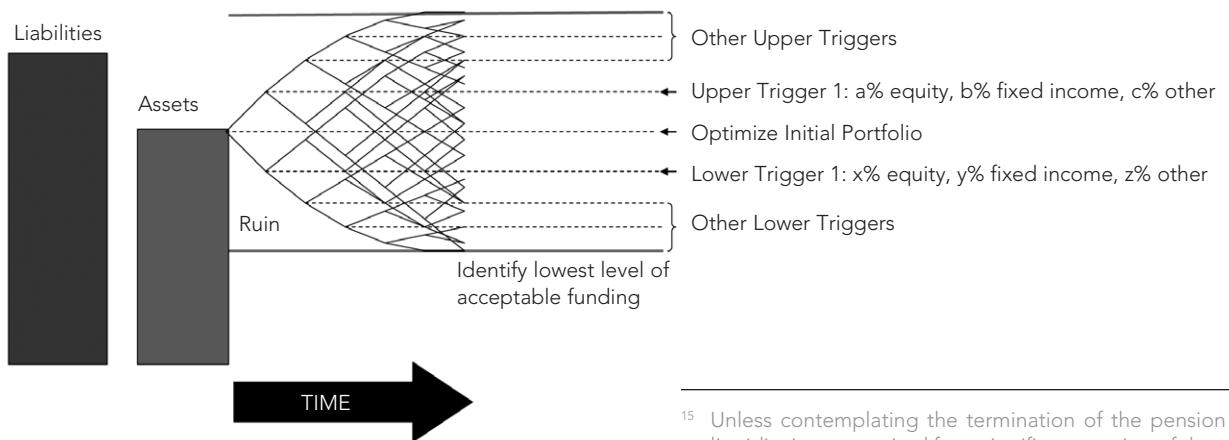
Step Four: Implement/Monitor

Corporate finance must define excessive surplus and ruin and the Chief Investment Officer (CIO) and investment team should allocate assets in a manner that efficiently manages risk within the boundaries established by these definitions.

In addition, the finance and investment teams should work together to identify financial triggers that make risk more or less attractive. Ideally, the allocation of risk within the risk budget should continuously evolve because risk premiums and the relationships among risks change. The development of new asset classes also creates opportunities for diversification and could potentially enhance returns. Practical considerations, such as the pension governance process, may require the investment team to recommend predetermined allocations for each trigger.

Figure Three illustrates how risk would be dynamically managed by systematically adjusting the asset allocation as a pension plan's funded status approaches excessive surplus or ruin.

FIGURE THREE



¹⁵ Unless contemplating the termination of the pension plan, liquidity is not required for a significant portion of the assets. Hence, pensions can receive a premium for holding illiquid assets for little or no risk.

MANAGEMENT HAS COMMONLY SOUGHT PROTECTION BY ADOPTING THE HERD'S INVESTMENT APPROACH RATHER THAN DETERMINING THE APPROACH THAT IS IN THE BEST INTEREST OF STAKEHOLDERS.

Once the investment strategy has been identified, responsibility for monitoring the financial triggers and modifying the asset allocation appropriately must be assigned by the plan sponsor. While liquid assets and pension liabilities can be monitored daily, it may be possible to monitor illiquid assets, such as private equity and direct real estate, only on a monthly or quarterly basis. Finance and the investment team should agree upon a methodology for estimating the value of illiquid assets.

Risk management reports should be developed to keep management informed of the evolving situation. It is critical that these reports provide the returns from risk and remind decision makers why risk is taken. It is possibly more important that these reports remind decision makers that they should view the performance of peers related to passive risk exposures as irrelevant.

CONCLUSIONS

In general, boards and investment committees have both judged investment performance against peer groups and allowed their concern about being sued by participants for breach of fiduciary responsibilities to outweigh strong financial management decisions. Management has commonly sought protection by adopting the herd's investment approach rather than determining the approach that is in the best interest of stakeholders.

The traditional investment process fails to take into account many issues that plan sponsors should consider if they are to fulfill their fiduciary responsibilities. Often, these issues may be addressed by substantially reducing the risk in pension plans. However, if plan sponsors continue to take significant risk in pension plans, it is in the best interest of all stakeholders that they adopt a strict risk management approach and implement a dynamic strategy. ❧



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STOCHASTIC VOLATILITY AND OPTION PRICING

By Daniel Dufresne

Stochastic volatility models are now routinely used in investments and option pricing. A brief introduction to those models is first given, and then a method for pricing options is described.

The stochastic process that later became known as “Brownian motion” first appeared in Bachelier (1900), as a model for security prices. Bachelier imagined the security price as an arithmetic Brownian motion (defined below); this has the shortcoming of allowing negative security prices. Osborne (1959), apparently unaware of Bachelier’s work, proposed geometric Brownian motion (GBM) as a model for stock prices, in part because GBM cannot be negative. That model was used in economics from the 1960s, notably to value options. Black and Scholes (1973) also used GBM for their risky asset, and since then Osborne’s GBM model for stock prices has often been called the “Black-Scholes model.”

In the sequel, W will stand for a standard Brownian motion, that is, W has independent increments and continuous trajectories, $W_0 = 0$, $W_t - W_s$ has an $N(0, t - s)$ distribution for $0 \leq s < t$. Arithmetic Brownian motion (or ABM) is a process of the type $at + bW_t$, where “ a ” and “ b ” are constants.

The usual financial notation for GBM goes back to Black, Scholes, and their predecessors, and is the familiar stochastic differential equation

$$dS_t = \mu S_t dt + \sigma S_t dW_t.$$

This means exactly the same thing as

$$S_t = S_0 \exp\left[\left(\mu - \frac{\sigma^2}{2}\right)t + \sigma W_t\right],$$

though the latter shows more clearly that log-prices form an ABM.

A discrete-time equivalent of arithmetic Brownian motion is the random walk

$$X_n = X_{n-1} + \varepsilon_n,$$

where $\{\varepsilon_n\}$ is i.i.d. Here X_n stands for the log-price, $\log(S_n)$. In both cases the variance (=squared volatility) of the returns



(=difference in log-prices) per time period is a constant; both are *constant volatility models*. Observe that in a random walk ε_n may have any distribution, while if S is GBM then $\log(S_t) - \log(S_{t-h})$ necessarily has a normal distribution. (*author’s note*: the name random walk often has a wider meaning in the finance literature but I am stating the classical mathematical definition here.)

Whether log-prices actually do follow an arithmetic Brownian motion was challenged very soon after that model was formulated; Mandelbrot (1963) and then Fama (1965) suggested a stable Lévy process as a better model for log-prices. Lévy processes are continuous-time processes with independent increments that are not necessarily normally distributed; ABM is the only Lévy process with normal increments. Stable processes may be a good fit to some return series, but they otherwise have an undesirable property, that the expectation of the exponential of a variable with a stable distribution has infinite expectation; this is fatal for option pricing. Stable processes are not used as models of log-prices in option pricing, but other types of Lévy processes have more recently been proposed (at least in the academic literature) to model returns and also to price options. Note that Lévy processes have independent increments, so the *independence* of returns over time was not contested by Mandelbrot and Fama. Interestingly, Black and Scholes (1972) also questioned whether volatility is constant over time.

Volatility is what we denoted σ in the GBM above, or, in the case of the random walk model for log-prices, it is the standard deviation of ε_n . Econometric models appeared in the 1970s and 1980s that refined the random walk model by making the variance of ε_n a stochastic process, leading to the well-known ARCH processes.

OPTION PRICING

Not only does GBM not fit observed stock prices well, it is also unsatisfactory for option pricing, leading to the well-known “smile effect.”

MODELS UNDER WHICH A PARAMETER CHANGES VALUE ACCORDING TO A MARKOV CHAIN HAVE RECENTLY BECOME QUITE POPULAR, AT LEAST IN THE ACADEMIC LITERATURE.

ARCH processes have been suggested for pricing options, but another class of models is found more frequently in the literature, namely those where volatility is a continuous-time process:

$$\begin{aligned} dS_t &= rS_t dt + \sqrt{V_t} S_t dW_t^{(1)} \\ dV_t &= A_t dt + B_t dW_t^{(2)}. \end{aligned}$$

Here r is the risk-free rate of interest (since this model is formulated under the risk-neutral measure), $W_t^{(1)}, W_t^{(2)}$ are Brownian motions (possibly correlated), and A_t, B_t are stochastic processes, that may depend on V_t . In this model the σ of the GBM model has been replaced with the stochastic process \sqrt{V} ; V is the squared volatility process. Several models of this type have been proposed; they raise two problems: estimation and option computation. If a model is to be used to price options, then logically the model should fit observed option prices; more precisely, what is sought is the distribution of the process S under the risk-neutral measure. This is not easy to estimate, because the number of observed option prices is usually quite small. Only in the case of the GBM model is that not a problem; this is because the quadratic variation of log-prices over t time units is in that case the same *constant*, $\sigma^2 t$, under both the physical measure and the risk-neutral measure. Therefore, the GBM stock price distribution under the physical measure implies the GBM stock price distribution under the risk-neutral measure, and the σ is the same under both measures; hence, one only needs to estimate σ from past stock prices; but this applies only to the GBM/Black-Scholes model.

Once the stochastic volatility model has been estimated there usually remains another problem, that of computing option prices under the model. The resulting distribution for S often turns out to be either very complicated or just unknown. Monte Carlo simulation is a possibility, but one soon realizes that the simulation of stochastic differential equations is far from trivial; one must deal with errors arising from both randomness of the sample and the discretization of the differential equation.

(This is a real problem in applications; to make matters worse, some of the early authors on option pricing under stochastic volatility models have suggested methods, especially series, that are of questionable value; *caveat emptor*.)

Perhaps the best-known stochastic volatility model is the one where the squared volatility V satisfy the so-called square-root process:

$$dV_t = (aV + b)dt + c\sqrt{V_t}dW_t^{(2)},$$

where a, b, c are constants. (This process was studied by William Feller and others in the 1940s; it was chosen as a model for interest rates and squared volatility because (i) it is non-negative and (ii) many of its properties are known explicitly.) The distribution of V_t is known in this case (see Dufresne, 2001, for details), though this does not help much in finding the distribution of S_t ; the reason for this is that the solution of $dS_t = rS_t dt + \sqrt{V_t} S_t dW_t^{(1)}$ is

$$S_t = S_0 \exp\left(rt - \frac{1}{2}U_t + \int_0^t \sqrt{V_s} dW_s^{(1)}\right), \quad U_t = \int_0^t V_s ds.$$

What matters in finding the distribution of S_t is that of the integrated squared volatility U_t , and the latter is rarely a simple one.

REGIME SWITCHING STOCHASTIC VOLATILITY MODEL

Models under which a parameter changes value according to a Markov chain have recently become quite popular, at least in the academic literature. A simple stochastic volatility model consists in letting V be a Markov chain that takes values in a set $\{v_1, \dots, v_N\}$. Models of this kind almost always have a very small number of possible states (or “regimes”), say $N = 2$ or 3. This model does not appear to match the visual appearance of graphs of observed volatilities, but it is tractable to a certain degree and a definite improvement over constant volatility models. A notable advantage is that when there are only $N = 2$

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possible values for V the distribution of U_t is known explicitly (this result has been in the literature for a while, see Chin and Dufresne (2009) for details).

PRICING OPTIONS WITH FOURIER INTEGRALS

In the case of the square-root volatility model, Heston (1993) showed that a Fourier inversion formula may be used to price European puts and calls. The idea of expressing option prices in that way was not new. A classical result in probability theory is that the characteristic function of X , $E e^{iuX}$, being the Fourier transform of the probability density function of X , yields the probability density function of X by the inversion formula

$$f(x) = \frac{1}{2\pi} \int_{\mathbb{R}} e^{-iux} E e^{iuX} du.$$

(\mathbb{R} is the real line and i is the imaginary unit, $i^2 = -1$.) Under some conditions, Parseval's theorem gives a similar expression for the expectation of a function of X :

$$Eg(X) = \frac{1}{2\pi} \int_{\mathbb{R}} \hat{g}(-u) E e^{iuX} du, \quad \hat{g}(u) = \int_{\mathbb{R}} g(x) e^{-iux} dx.$$

This technique is studied in detail in Dufresne et al. (2009). Since the payoffs of some reinsurance contracts are the same as those of call options (i.e. $(S - K)_+ = \max(S - K, 0)$), the same ideas apply in reinsurance and in option pricing. A formula proved in that paper is

$$E(S - K)_+ = E(S) - \frac{K}{2} + \frac{1}{\pi} \int_{\mathbb{R}} \text{Re}[h(u)] du, \quad h(u) = \frac{K^{-iu+1}}{iu(iu-1)} E(S^{iu}).$$

($\text{Re}(z)$ is the real part of z ; the only assumptions are: the random variable S is positive and has finite mean, the constant K is positive.) There are similar formulas in terms of $E(e^{iuS})$. The computational advantage of this type of formula is that it is not necessary to find the distribution of S first before computing the option price (or stop-loss premium); if $E(S^{iu})$ is known, then a single integral gives the price of a European put or call. This is quicker than finding the distribution of S and then

computing the expected payoff, and is also faster than Monte Carlo simulation.

One way to apply this idea is described in Chin and Dufresne (2009). Suppose V is independent of the Brownian motion driving S (denoted $W_t^{(1)}$ above), and that the characteristic function of integrated squared volatility, $E(e^{iuU_T})$, is known. Then, one may condition on V to get the price of a call:

$$e^{-rT} E(S_T - K)_+ = e^{-rT} E\{E[(S_T - K)_+ | V]\}.$$

(This means conditioning on the whole process $\{V_s \geq 0\}$.) Now, given V , the value of both V_s and U_T are assumed known, and the stochastic integral

$$\int_0^T \sqrt{V_s} dW_s^{(1)}$$

has a normal distribution with mean zero and variance

$$\int_0^T V_s ds.$$

Hence, the price of the call is

$$e^{-rT} E[\exp(rT - \frac{1}{2}U_T + \sqrt{U_T}Z) - K]_+,$$

where Z has a standard normal distribution and is independent of U_T . At this point one recognizes the no-arbitrage price of a call option in the ordinary Black-Scholes model, if σ is replaced with $\sqrt{U_T/T}$. Denote the price of such a call $g(\sqrt{U_T/T})$. We thus see that the price of the call in the stochastic volatility model is the same as $E[g(\sqrt{U_T/T})]$. Once the Fourier transform of $g(\cdot)$ is found, Parseval's Theorem may then be used to find the following formula (Chin and Dufresne, 2009, Theorems 2.1, 2.2).

Theorem. Suppose $E e^{\alpha^* U_T} < \infty$ for some $\alpha^* > 0$. Then, for any $0 < \alpha < \alpha^*$,

$$e^{-rT} E(S_T - K)_+ = \frac{1}{2\pi} \int_{\mathbb{R}} \hat{g}(\alpha, -u) E e^{(\alpha+iu)U_T} du,$$

where

$$\hat{g}(\alpha, -u) = \begin{cases} \frac{S_0(1-\bar{k})}{\alpha + iu} + \frac{S_0 \bar{k}^{(1+\sqrt{1+8\alpha+8iu})/2}}{(\alpha + iu)\sqrt{1+8\alpha+8iu}} & \text{if } Ke^{rT} < S_0 \\ \frac{S_0 \bar{k}^{(1-\sqrt{1+8\alpha+8iu})/2}}{(\alpha + iu)\sqrt{1+8\alpha+8iu}} & \text{if } Ke^{rT} \geq S_0. \end{cases}$$

A similar formula is obtained for puts. The regime switching stochastic volatility model was used to test this formula against Monte Carlo simulation and also the explicit formula for the distribution of U_T (in the case where volatility takes $N=2$ values). The Fourier integral beats both alternatives easily, in computing time as well as coding effort. The only downside is that there is a free parameter α in the theorem, and that some trial and error is required to find a good range for it. This is a common feature of Fourier integrals that involve oscillating functions. \square

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This article is available at
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SUMMARY OF PRESENTATION DELIVERED AT THE SOA 2009 ANNUAL MEETING “HEDGING FOR LIFE INSURERS – WHAT’S NEXT FOR VARIABLE ANNUITIES?”

By David J. Maloof

Hedging programs have become a mainstay in the risk management arsenal of life insurers seeking to mitigate the capital markets risk associated with their products, especially variable annuities. The recent financial crisis has placed significant stresses on variable annuity (VA) hedging programs and the lessons learned in responding to these stresses will likely play an important role in shaping future developments. This talk focuses on four key topics in this regard: a) management of severe adverse movements in underlying asset values; b) treatment of volatility risk; c) management of fund mapping related basis risk; and d) credit risk as an emerging area of concern.

A brief review of VA hedging model basics is a good place to begin in developing an understanding of the problems encountered by hedging programs in the financial crisis. VA hedging models are generally simulation based and work by first generating a set of risk neutral economic scenarios using parameters appropriate to current market conditions. The paths are then used in conjunction with a detailed model of the structural features of the guarantee and policyholder information to value the guarantee as the expected value of the present value of its future cash flows.

Successful dynamic hedging of VA market risks relies upon the ability to acquire effective risk off-setting positions in a timely manner. In order to do this, it is necessary to compute sensitivities, or greeks, which measure the response of the economic value of the guarantee to changes in market parameters. Key greeks that are usually considered for hedging are delta and gamma—first and second order derivatives measuring equity price level sensitivity respectively, rho and convexity—first and second order derivatives measuring interest rate sensitivity, and vega—a first order derivative measuring sensitivity to (equity) volatility.

MANAGEMENT OF SEVERE MOVEMENTS IN UNDERLYING ASSET VALUE

The recent financial crisis is notable for the magnitude of



severe market movements occurring over short periods of time. Such movements can be problematic for dynamic hedging programs both mathematically and operationally. The mathematical issue turns on the use of greeks to create market risk neutralizing positions based on a Taylor series like approximation which becomes less accurate for larger market movements. This problem can be somewhat mitigated by using higher order greeks, e.g., gamma. The operational issue concerns the fact that execution of required hedging transactions may not be feasible in the presence of sufficiently large and rapid market movements. This issue can be addressed by prepositioning hedging instruments, e.g., out of the money options, to neutralize greeks in prescribed market stress scenarios. This type of catastrophe or macro hedging has been widely used in banking and is now being more actively considered by insurers.

Life insurers' near term responses to the hedging challenges posed by large adverse market movements may constitute a prolog to the future. These responses include programmatic reviews of risk limits, escalation protocols, system/operational responsiveness, utilization of wider set of greeks, including second order greeks (gamma, possibly convexity), and choice of hedging instruments. Cost/benefit considerations include a greater appreciation of the value of protective strategies coupled with a more acute sensitivity to implementation costs and the transactional difficulties associated with the use of highly specialized instruments in turbulent markets.

TREATMENT OF VOLATILITY RISK

To achieve market consistency, many hedging platforms parameterize their hedging models using implied volatility. The high levels of market implied volatility characterizing the recent financial crisis have motivated greater scrutiny of the treatment of volatility in VA hedging programs. The volatility dependence of VA guarantees is significant and unhedged volatility can be an important source of hedge slippage. However, the complete treatment of implied volatility is complex as this quantity depends on both tenor and moneyness. The relative paucity of traded data at distant tenors and moneyness is an issue.

// COUNTERPARTY CREDIT RISK IS AN AREA OF HEIGHTENED FOCUS FOR VA HEDGING OPERATIONS. ... //

In light of recent market experience, a number of writers who initially chose to hedge only delta, or delta and rho, are revisiting their decision to not hedge vega. In doing this, the elevated cost of hedging instruments, given recent levels of implied volatility, and the increased operational complexity associated with vega hedging, must be weighed against the added risk management benefits. Hedging instruments tend to be vanilla options, but variance swaps are also receiving attention. Volatility modeling is becoming more sophisticated to capture the full volatility surface. Modeling paradigms span the gamut from ad hoc strike dependent volatility adjustments to the use of more complex stochastic processes, e.g., local volatility or stochastic volatility.

MANAGEMENT OF FUND MAPPING RELATED BASIS RISK

The funds underlying a variable annuity contract are typically not themselves directly hedgable. In practice, they are usually linked to hedgable market indices via linear relationships called fund mappings, which are essentially multifactor linear regressions expressing the returns of a given fund in terms of the returns of a prescribed set of hedgable indices. The effectiveness of a hedging strategy making use of these mappings depends critically on their explanatory power. This explanatory power can become attenuated over time, especially as a result of market turbulence or changes in fund strategic objectives, thereby giving rise to fund mapping related basis risk and potentially significant hedge slippages.

Product design is the first line of defense that VA writers have against the basis risk engendered by ineffective fund mappings. Hedge friendly designs utilize underlying funds with risk/return characteristics that are well described by hedgable market indices with broad and deep associated derivatives markets. The importance of ongoing fund mapping management is becoming more widely recognized among VA writers. This is evidenced, for example, by increased allocation of dedicated staffing resources to monitor and improve fund mapping performance and establishment of more formal risk management protocols requiring regular fund mapping assessment and recalibration if needed.

CREDIT RISK—AN EMERGING AREA OF CONCERN

Recent well publicized defaults, or near defaults, particularly within the banking and broker/dealer communities, have motivated a renewed awareness of the importance of credit risk management in general. Counterparty credit risk is an area of heightened focus for VA hedging operations, somewhat in contrast to the situation prior to the recent financial crisis. Effective management of credit risk is an emerging area of practice among life insurers, and VA writers in particular. Possible avenues of approach include: strengthened, more formalized, monitoring of obligor credit quality and exposure concentration; imposition of more rigorous credit risk limits; and utilization of modern market-based credit quality metrics in addition to traditional ratings. **■**



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INTEGRATING ROBUST RISK MANAGEMENT INTO PRICING: NEW THINKING FOR VA WRITERS

By Frank Zhang



The variable annuity (VA) industry is rebuilding and even making a concerted effort to reinvent itself after many insurers incurred large losses, experienced increases in guaranteed minimum benefit reserves and required capital and accelerated DAC write-offs. As VA writers work to take advantage of growing demand for a new generation of guaranteed income products, they should look carefully at the lessons learned from the recent financial crisis. Most writers have modified their products by raising fees, reducing guarantees, and requiring more restrictive asset allocations. Some insurers have even stopped writing VA guarantees in certain markets. Throughout the industry, hedging programs are being modified and strengthened. Most reinsurance companies have exited the VA market or are acting very cautiously.

There are plenty of cautionary tales about the impact of volatility on hedging costs and product profitability, and the resulting higher statutory capital requirements. However, thus far, less has been written about the more robust pricing of the newest generation of VA products that satisfies consumer needs, reflects recent lessons learned about volatility and risk and ensures the acceptable profitability of those products. As insurers continue to design new products to reflect new market realities and uncertainties, it is time for capital market and actuarial minds to work together on integrating risk management and pricing.

RECOGNIZING FACTORS AFFECTING VA GUARANTEE PRICING

One legacy of the financial crisis is a deeper and more granular recognition of key factors that impact the pricing of VA guarantees. Of particular importance are the potential impact of policyholder behavior on the hedging of embedded guarantees, lower risk-free rates on risk-neutral pricing of embedded guarantees, lower long-term expected equity growth rates, higher volatility (implied and realized), higher basis risk and increased accounting complexity.

Policyholder behavior: Higher persistency means higher potential revenue and profitability for most non-lapse-supported products and usually for VA base contracts. On the other hand, all embedded guarantees (death or living benefits) are exotic derivatives and higher persistency has the opposite effect on their profitability; they are lapse-supported and the notional value of liability options increases as more contracts stay in force. Because either over- or under-hedging can result in losses, it is critical for insurers to monitor changes in policyholder behavior and dynamically adjust their hedging positions to reflect those changes. Experience analysis and robust attribution analysis of hedge program performance are critical in understanding the impact of policyholder behavior on the hedging of VA guarantees.

Interest rate risk in a period of lower risk-free rates: Many economists foresee an extended period of low interest rates; therefore insurers will need to manage product design very carefully, given the current mismatches between low risk-free rates and higher roll-up rates. Roll-up or bonus rates that are significantly higher than the risk-free rates are creating embedded losses every year and are obviously not sustainable. One risk mitigation tactic has been to design products that have floating roll-up rates that are linked to risk-free rates.

Lower long-term expected equity growth rate: Given the capital market crisis, it is unrealistic to assume a return to the strong long-term equity returns of the 1990s. Faced with uncertainty about expected returns, insurers could encounter higher earnings volatility, lower profits, and higher claims, reserves and required capital. Insurers will have no alternative but to price more conservatively to deal with the likelihood of reduced profitability (specifically, ROE) of their products.

Higher implied and realized volatility: Along with uncertainty about equity return rates, potential higher volatility will significantly impact the pricing of embedded guarantees in VA products and thus challenge normal VA pricing methods. Fair value and marked-to-market accounting will increase the demand for

// INSURERS NEED TO DEVELOP INTEGRATED APPROACHES THAT INCORPORATE ROBUST AND REAL-WORLD RISK MANAGEMENT INTO THE PRICING PROCESS. //

derivatives to reduce the earnings volatility. The unbalanced supply of, demand for, and lack of liquidity of long-dated options render implied volatility higher. Higher implied volatility has made it more costly to hedge using options, and sometimes unaffordable relative to the guarantees priced in VAs.

Recently, realized volatilities have been catching up with implied volatilities, resulting in higher realized hedge costs. This increase in realized volatility has increased delta-hedging costs as compared to the cost of short-term options. Real-world pricing based on higher long-term volatility assumptions will place more pressure on profitability and capital positions, particularly as both VACARVM and C3 Phase II are directly impacted by the expected long-term volatilities of asset classes.

Higher basis risk: In late 2008 and early 2009, many hedgers—insurance companies and banks—incur losses from basis risk (i.e., tracking errors between changes in the VA liability and corresponding hedge assets), with some hedgers losing 300 or more basis points of assets under management. While most hedgers experienced positive tracking errors in 2009, insurers have become more active in their management of basis risk through a more careful selection of underlying mutual funds. It will be critical to continue managing the basis risks directly, beginning with the selection of the underlying funds. Despite the recent occurrence of more positive tracking errors, pricing and/or volatility assumptions will need to be adjusted to account for basis risks.

Accounting complexity: Continuing uncertainty and increased complexity in accounting requirements will impact insurers' financial performance and product profitability and, ultimately, market competitiveness. Under more benign economic conditions, insurers and rating agencies focused primarily on minimizing GAAP earnings volatility. Many insurers did not implement economic hedges for GMDB and GMIB benefits, and only a few priced these benefits as derivatives marked-to-market under SFAS 133 or 157. Since the financial crisis, however, insurers have become much more concerned about their statutory capital. With the liquidity crisis and high credit/counter party risks, capital has become expensive and funding

costs higher. Regulatory requirements, such as VACARVM and C3 Phase II, may continue to complicate efforts to integrate risk management positions (such as hedging) that make sense economically, but could increase statutory requirements.

RISK MANAGEMENT AND PRICING

With so many unknowns and variables, particularly related to future volatility in the capital markets, VA writers must once again address the systemic and structural risks to the profitability of new products. VA guarantees, particularly, should be treated as derivatives in the pricing calculation. Unlike traditional insurance liabilities, which are not leveraged to the market and that can be managed by pooling risk, derivatives must be managed differently. In fact, the systematic risk associated with derivatives cannot be diversified away. Insurers will need to determine and manage the trade-offs between earnings volatility and capital optimization, as well as those between marked-to-market profitability (based on forward-looking implied or expected volatility) and trading profitability (based on realized volatility).

There is an urgent need to develop pricing strategies that can withstand long-term uncertainty. Insurers need to develop integrated approaches that incorporate robust and real-world risk management into the pricing process. This will require careful alignment and collaboration between the pricing and risk management functions and a careful mix of actuarial science and financial engineering disciplines. The approaches must be diversified and designed for both the short and long term, and can include:

- Diversification that addresses both actuarial and capital issues over the short and long term.
- Capital market solutions, typically managed by hedging/derivatives teams, which might include dynamic hedging, semi-static hedges, and such.
- Insurance options, typically managed by actuaries, including reinsurance whenever possible and affordable.
- Structured hedges, which are often hybrids between a dynamic hedge and full reinsurance.

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An integrated approach to risk management must include better integration of financial engineering and actuarial science and utilize robust modeling of hedges and derivatives in pricing systems. One example is the use of nested stochastic simulations to price the products and incorporate hedging strategies in pricing runs.

The challenge is to ensure that risk management and hedging strategy development optimize the trade-offs among capital management, financial risk management, derivatives management and product management. To effectively optimize the trade-offs, it will be prudent to plan for the possibility that

“black swan” events may occur much more frequently than normally distributed events and that many long-term actuarial pricing assumptions will no longer be as relevant or reliable. Integration of pricing and hedging processes will enable pricing models that reflect more realistic hedge outcomes and reveal hedge ineffectiveness.

Designing and executing an integrated risk management and pricing framework before another crisis will provide protection that is neither too late nor costly, and should help ensure better profitability in the long run. ☛



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MANAGING INVESTMENTS IN A MARKET CONSISTENT FRAMEWORK

By Craig Buck

Market Consistent Embedded Value (MCEV) is the present value of the future shareholder transfers determined on a risk adjusted basis. It is also the market value of assets less the market value of liabilities, where the market value of liabilities is determined on a risk-adjusted basis. Managing a book of life insurance policies on an MCEV basis can have broad implications for product strategy, pricing and investment strategy. This article focuses on the implications and uses of MCEV in developing investment strategy.

REPLICATING PORTFOLIOS

The concept of a replicating portfolio is critical to the theoretical underpinnings of MCEV reporting and can be helpful in understanding and evaluating the impact of a particular investment strategy. A replicating portfolio is the investment portfolio that best replicates the features of the liabilities, e.g., the liability cashflows across a wide range of economic scenarios or the value of the liabilities under various financial stress tests and sensitivities.

This is not to say that the replicating portfolio, once identified, is the portfolio we should invest in. Insurers are risk-taking entities. Investing in an alternative portfolio involves taking on more economic risk (relative to the liabilities), but this can be justified as long as the expected return from taking on this risk exceeds the return required for the additional risk capital. Any excess return earned will ultimately enhance the enterprise value once the return is earned and the risk has been released.

Replicating portfolios with a very close fit to complex insurance liabilities may be difficult or impossible to construct. Achieving a close fit, particularly in the distribution tails, may require the construction of theoretical exotic, non-traded derivatives and may require the inclusion of a rebalancing. As such, the theoretical minimum risk portfolio may include assets that cannot be practically or cost-effectively secured. In that case, the best an investment manager can do to minimize investment risk is to digress from the theoretical minimum risk portfolio and acquire assets that are obtainable in deep and liquid markets—the investable replicating portfolio. Both the investable and theoretical replicating portfolios have their uses and the difference between the two can be seen as a product related risk

rather than an investment risk (as the product design forces this minimum level of mismatch).

Impact of the Liquidity Premium

The consideration of a liquidity premium in MCEV is a hotly debated topic that will likely have a significant impact on investment strategy. The recently released updated MCEV principles allow for consideration of a liquidity premium, though specific guidance on how to determine the liquidity premium is not yet prescribed.

When there is no liquidity premium, an investable risk-free position exists for fixed cashflows—either Treasuries or swaps, depending on the definition of risk-free. But if a liquidity premium is included, an equivalent investable risk-free position may or may not exist. For example, if liquidity premium is defined as long corporate bonds plus CDS protection on those names, this negative basis trade is investable. However, if the liquidity premium is defined by reference to a structural model then an investable position may not exist.

If the risk-free position is not investable, then management must make a choice between:

- investing in liquid risk-free assets and foregoing any liquidity premium, thereby locking-in a loss position, or
- investing in risky assets (potentially with some default protection) in an effort to extract a liquidity premium that approximates the liability liquidity premium, but thereby introducing exposure to credit risk.

IMPLICATIONS FOR INVESTMENT STRATEGY

If managing to MCEV, the aim is maximize MCEV earnings which are the growth in MCEV on a risk-adjusted basis. Risk can be measured by volatility in MCEV or percentile moves in MCEV, so our approach to investment management can be very similar to what many investment departments already do: measure the risk in terms of volatility or a specified percentile for the selected metric (MCEV), measure return expectations

CONTINUED ON PAGE 38



under the selected metric (expected MCEV earnings) for alternative investment strategies, define an efficient frontier and look for the intersection with the risk appetite.

MCEV may cause some insurers to question the purpose or value of beta. In an efficient world, the strategic asset allocation will affect the insurer's beta, which should translate directly through to cost of capital. So, value is not generated through beta since any changes to the expected return should be offset by implied changes to the cost of capital. This might imply that strategic asset allocation that focuses on managing beta is not value-adding.

Although investment strategy will not usually directly impact the initial MCEV (only pricing changes will impact the MCEV at the point of sale), investments will impact the emergence of MCEV earnings. Since changes in the economic environment directly impact MCEV it can be a volatile metric. As investment strategy impacts the emergence of earnings and is often the most significant source of MCEV earnings volatility, it can be used as a mechanism to manage that volatility by incorporating strategies designed to hedge MCEV. MCEV results can be analyzed to help make decisions on investment strategy.

As an example, the impact on MCEV of varying equity market returns, yield curves and defaults/credit spread widening can be analyzed.

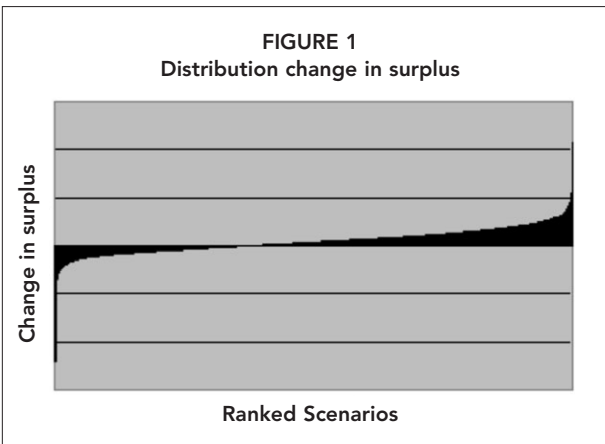


Figure 1 shows the results of these scenarios in rank order from the combination of shocks that produces the lowest surplus to that which produces the largest. In order to drill into these results we can look separately at each risk.

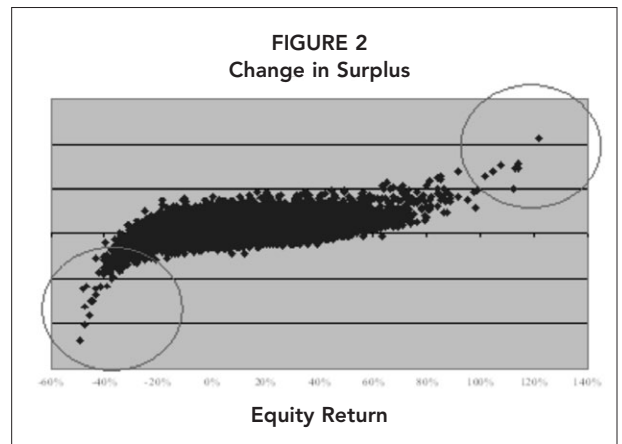


Figure 2 shows the sensitivity of results to equity shocks. It appears that this product is reasonably well-hedged within a range of equity performance, but there may be opportunity to trade off some more of the upside in the extremely high equity returns to protect against some of the downside in the extremely low (see circled results).

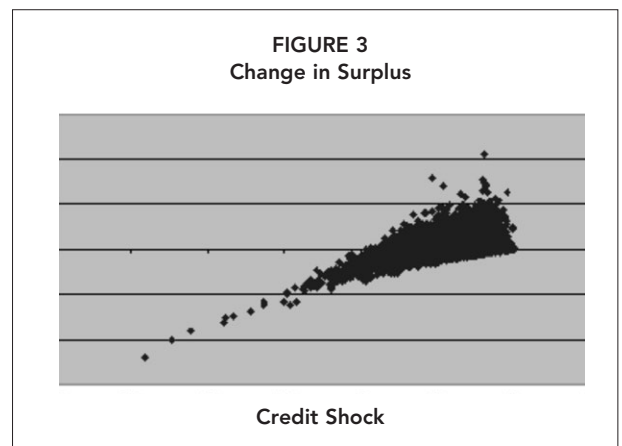
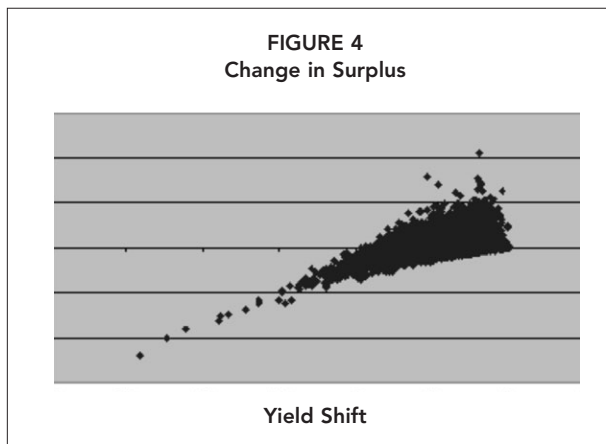


Figure 3 analyzes the impact of credit shocks. It shows that this product is basically unhedged with respect to credit risk. Negative credit shocks produce negative results and positive shocks produce positive results.

// MCEV (MARKET CONSISTENT EMBEDDED VALUE) CAN BE A VALUABLE METRIC IN MONITORING AND UNDERSTANDING THE RISKS TO WHICH AN INSURER IS EXPOSED. //

Finally, Figure 4 summarizes the impact of yield curve shifts. This shows a reasonably well hedged position since there is not a discernable slope to a regression line. Variances in positive and negative results appear to be independent of yield curve shifts.



When reviewing these results in total, potential modifications to investment strategy that could reduce the risk exposure might include:

- To hedge the equity exposure, if an adequate market exists, an investor could sell equity market call options with a high strike price so any payments due under the call option would be offset by the positive MCEV earnings currently seen in Figure 2. The proceeds could be used to buy out-of-the-money put options to protect the extreme downside risk.
- To hedge the credit exposure seen in Figure 3, if an adequate market exists, credit protection could be bought and sold in order to hedge some of the extreme aspects of this position and stabilize results. However, perfect hedges of credit risk are unlikely to be available due to the depth of the market and the exposure to counterparty risk. Reducing the credit exposure seen in Figure 3 would reduce volatility, but may also decrease the ultimate expected returns—unnecessarily to the


extent management believe this risk can be effectively managed.

- While the exposure to yield curve shifts appears reasonably well-hedged, there may be a slight negative slope to a regression line in Figure 4, indicating an opportunity to trade off the positive impact of negative interest rate movements to cover the negative impact of positive shifts (e.g., using interest rate swaps). However, this would not be a priority based on the magnitude of exposures to equity and credit risks.

These actions or some combination thereof, should give more stability to MCEV earnings and may make sense if management was uncomfortable with the distribution summarized in Figure 1.

CONCLUSION

There are many other implications of managing to MCEV—including implications for performance measurement and investor communications. Strategic asset allocation and decisions to deviate from the replicating portfolio imply taking on various levels of risk and will impact the emergence of MCEV earnings. In some cases, there will be opportunities to manage volatility in this metric. Complicating matters are issues such as liquidity premium that are still being debated.

Nonetheless, MCEV can be a valuable metric in monitoring and understanding the risks to which an insurer is exposed. When properly utilized and determined, MCEV can provide a basis to articulate and disclose the risks as well as a clearer line of sight to the role of the investment actuary in managing these risks. 



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WHY WE NEED TO TRANSFORM OUR VIEW OF RISK

A summary of the talk given by Andrew Lo at the 2009 SOA Annual Meeting in Boston

By Gary Hatfield

Among the many interesting sessions at the 2009 SOA Annual Meeting in Boston was a lecture presented by Professor Andrew Lo. I had the distinct pleasure of introducing Professor Lo to the audience. Andrew Lo is the Harris & Harris Professor of Finance at MIT's Sloan School of Management and the Director of the MIT Laboratory for Financial Engineering. His list of research accomplishments and awards is very impressive; I had to leave out most of the details and I will do so here as well. I will simply mention that he is a prolific author, edits several important finance journals, and has won many awards. Given his background, he did not disappoint. For me, it was one of the most entertaining and interesting presentations I have ever witnessed at a professional meeting.

He began with a summary of the crisis and the long list of people and institutions that share blame. He asked, "Is there a common denominator?" As a hint, he quoted from a very good article titled, "Confessions of a Risk Manager" that appeared in the Aug. 7, 2008 edition of *The Economist*. In that article, a risk manager of a large investment bank speaks frankly as to why risk management failed to stop the excessive risk-taking. An important point is that the banks often kept AAA tranches of the CDO's they created on their own balance sheets. A key quote, "We were most eager to sell the non-investment-grade tranches [of CDO's created by the investment bank], and our risk approvals were conditional on reducing these to zero." And who bought these non-investment-grade tranches? Hedge funds.

To better understand the importance of the above observations, Professor Lo gave a very simple example of how CDO tranching works. The example features two identical bonds that either pay \$1000 with 90 percent probability or \$0 with 10 percent probability. He then observes that the (expected) value of each bond is \$900 (ignoring interest for simplicity). Now, assuming independence of defaults, a portfolio of two such bonds will have three possible payoffs: \$2000 with 81 percent probability, \$1000 with 18 percent probability and \$0 with 1

percent probability. But if the portfolio is divided into senior and junior tranches of \$1000 each, the payoffs are as follows: senior tranche pays \$1000 with 99 percent probability and \$0 with 1 percent probability while the junior tranche pays \$1000 with 81 percent probability and \$0 with 19 percent probability. So, under the independence assumption, the value of the senior tranche is \$990 while the junior tranche is worth \$810.

What's the point? The senior tranche is like the AAA CDO tranches retained by the investment banks and the junior tranche is like the non-investment-grade tranches sold off to hedge funds. Professor Lo then showed what happens when the independence assumption is wrong. To take it to an extreme, if we suppose that the bonds are 100 percent correlated, then the buyer of the senior tranche will have paid too much and the buyer of the junior tranche got a very good deal. And this is what happened to the banks. They lost on both counts—they held the overvalued tranches and sold the undervalued ones.

This leads to one of the key points of the lecture: risk is not just market risk; systemic risk matters. What is systemic risk? It is risk to the financial system. Systemic risk differs from market risk in a number of ways. Systemic risk arises from unexpected losses. The kinds of losses that the system was not designed to tolerate. Systemic risk is nonlinear, dynamic and complex. The markets have become increasingly complex in recent history. Indeed, the world itself has.

Professor Lo then asked, "Why does crisis happen in other technology-based industries?" Here, he is thinking about catastrophes such as Chernobyl and Three Mile Island, the shuttle disasters, and transportation failures like the Minneapolis bridge collapse. He also tells us about Perrow's (1984) Theory of Normal Accidents. According to the theory, whenever there are two conditions present, 1) complex systems (nonlinearities), and 2) tight coupling (i.e., high levels of interdependence), we should expect large failures. We should therefore prepare for these failures. He then gave a few examples from finance to illustrate the high level of complexity involved. He then added a third condition which he first proposed in 2004:

CONTINUED ON **PAGE 42**

// ... NO MATTER HOW YOU LOOK AT IT, IT IS HARD TO COME UP WITH A COURSE OF ACTION THAT WOULD NOT HAVE COST THE CRO HIS OR HER JOB OTHER THAN RECOMMENDING TO 'STAY THE COURSE'. //

absence of negative feedback over an extended period of time. Could the current financial crisis have been avoided? Not in his view, because we didn't know something was wrong. Indeed, he shows that more than one observer (including himself and Robert Shiller) raised an alarm as far back as 2005. However, he argues that foreknowledge of the danger could not have prevented the crisis because of what he calls the psychology of greed. In short, our psychological makeup prevents us from avoiding these kinds of risk. To set things up, he asked us to imagine the plight of a CRO at an investment bank in 2006. Suppose they correctly recognized the growing systemic risk from the subprime CDO business. They could have recommended an unwinding of the very business responsible for over half of the bank's profits for the decade. Or perhaps they could have ordered the exposure hedged with resulting losses over the next year or so. But no matter how you look at it, it is hard to come up with a course of action that would not have cost the CRO his or her job other than recommending to "stay the course."

To even more powerfully illustrate our limitations, he asked the audience to participate in a cognitive experiment. He showed a film of several college students passing around basketballs—some wearing black t-shirts while others were wearing white. The goal for the audience was to only count how many passes occurred between black t-shirted students. To make it even harder, Professor Lo randomly counted along but incorrectly.

When the film was done, he polled the audience and got a dispersion of counts between 15 and 20. He then asked if anyone had seen something else of interest. One person shyly raised her hand and said, "There was some kind of monkey?" Upon inquiry, about 20 percent of the audience said they saw something like a monkey. Well over half did not. Upon replay, a man dressed in gorilla suit strolled into the center of the screen, turned to the camera, beat his chest, and walked off. Professor Lo quipped, "All this talk about Black Swans when we can't even see the black gorilla looking right at you and beating his chest." Humor aside, the point here is that we are incredibly good at focusing on the talk in front of us. So much so that we ignore things that are not part of the task. In the financial context, this means that managers with incentives to make earnings and revenue goals will not see the gorilla (systemic risk) looking at them and beating its chest.

So what are the implications? According to Lo, we need a central body responsible for systemic risk. But, he does not mean to assert that we need more regulation. What he has in mind is something more akin to the role the NTSB plays in aviation. After all, financial regulators often work to increase systemic risk rather than to decrease it. Like the NTSB, the body would objectively report on the causes of failures. And the regulators (e.g., FAA in the case of the NTSB) would not be immune from critique. In the end, crisis preparation may be as important (if not more) than crisis prevention. **6**



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