

# Risk management

ISSUE 30 ■ AUGUST 2014



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# Risk management

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This newsletter is free to section members.  
Current issues are available on the SOA website  
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To join the section, SOA members and non-  
members can locate a membership form on the  
Joint Risk Management Section Web page at  
<http://www.soa.org/jrm>

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## JOINT RISK MANAGEMENT SECTION

## ARTICLES NEEDED FOR RISK MANAGEMENT

Your help and participation is needed and  
welcomed. All articles will include a byline to  
give you full credit for your effort. If you would  
like to submit an article, please contact David  
Schraub, JRMS Staff Partner, at [dschraub@soa.org](mailto:dschraub@soa.org). The next issues of *Risk Management*  
will be published:

### PUBLICATION DATES

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### PREFERRED FORMAT

In order to efficiently handle articles, please use  
the following format when submitting articles:

- Word document
- Article length 500-2,000 words
- Author photo (quality must be 300 DPI)
- Name, title, company, city, state and email
- One pull quote (sentence/fragment)  
for every 500 words
- Times New Roman, 10-point
- Original PowerPoint or Excel files  
for complex exhibits

If you must submit articles in another manner,  
please call Kathryn Baker, 847.706.3501, at the  
Society of Actuaries for help.

## Do you have a Risk Management question?

Ask us! Please send us your questions ([dschraub@soa.org](mailto:dschraub@soa.org)) and we will publish the questions and  
answers for everyone's benefit.

## Members Speak!

Love an article or strongly disagree with the opinion  
developed in another paper? Please share any  
comments or feedback on the JRMS newsletter with  
David Schraub at [dschraub@soa.org](mailto:dschraub@soa.org).

# Chairperson's Corner

By Barry Franklin

**AS WE ENTER THE HOME STRETCH OF THE CURRENT OPERATING YEAR FOR THE JOINT RISK MANAGEMENT SECTION (JRMS)** it's natural to assess how well we are doing in meeting the primary objectives established for the section council this year:

1. Increase level of communication and interaction with section members
2. Expand ERM educational opportunities for section members and sponsoring organizations
3. Continue to foster risk management research
4. Support promoting the actuarial profession as risk managers.

Before looking at each of these objectives, it's useful to consider that the JRMS is a collaborative undertaking of three independent sponsoring actuarial organizations—the Casualty Actuarial Society, the Canadian Institute of Actuaries and the Society of Actuaries—each organization having a unique perspective and unique set of member and stakeholder needs and priorities. In the competitive landscape within which we operate today it is a testament to the sponsoring organizations and the JRMS membership that we continue to be a model for collaboration and cooperation. Each sponsoring organization acts independently to meet the unique needs of its own members in the foregoing areas, while coming together under the banner of the JRMS to advance the science of risk management in general and promote the role of the actuarial profession within risk management.

So, now...how are we doing?

## INCREASE LEVEL OF COMMUNICATION AND INTERACTION WITH SECTION MEMBERS

This represents the third issue of Risk Management published so far this year (available in French and English). We are about to publish a series of essays on "How to Review an ORSA Process," and have sent multiple email blasts and social media based messages to JRMS members regarding research opportunities, upcoming risk management related events and other items of interest. More than 600 JRMS members have now joined the JRMS LinkedIn group. We have also sponsored several JRMS networking events as well as CERA receptions

at large meetings of sponsoring organizations. In short, your section is doing a lot to reach out to members and encourage interaction and networking.

Expand ERM educational opportunities for section members and sponsoring organizations

Aside from the articles and essays published in Risk Management and e-books, the JRMS provides support for risk management themed sessions at educational meetings held by the sponsoring organizations, identifying topics and recruiting moderators and panelists. The JRMS has long been associated with the successful ERM Symposium, working with the organizing team to provide leading edge content and quality speakers—and this year is no exception. For this year's symposium, the JRMS is providing speakers the opportunity to have a professional coach assist them in preparing their presentations, and is also sponsoring symposium registration for members of the North American CRO Council to enhance networking and learning opportunities for attendees. We also provide web-based learning opportunities, leveraging content from JRMS sponsored research as well as content from other sources. In fact, each of the sponsoring organizations has offered ERM educational events for their members in some form over the past year, and the JRMS is working to share that content with section members through webinars, essays and articles. When it comes to educating actuaries in the discipline of risk management, more is better and quality counts.



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## CONTINUE TO FOSTER RISK MANAGEMENT RESEARCH

Sponsoring and publishing relevant research is an area where the JRMS provides significant value and enhances the profile of the actuarial profession within risk management. Topics addressed by JRMS sponsored research this year include reviewing an ORSA report, challenges in model validation, a survey of emerging risks, the development of a universal taxonomy for risk, and others still taking shape. One exciting research development this past year has been offering free access to a risk management e-library for all JRMS members.

Hopefully members will take advantage of this benefit and we can use this vehicle to provide free access to even more practical risk management research in the future.

Support promoting the actuarial profession as risk managers.

In the end, all of the previous objectives really support this overarching objective of promoting the actuarial profession as risk managers, thereby creating opportunity for all JRMS members regardless of which sponsoring organization they might call home. If we execute the first three faithfully, we will ultimately succeed with

the fourth as well. In the meantime, JRMS will continue to encourage actuaries to pursue the CERA credential, provide networking and education opportunities for actuarial risk management professionals and strive to highlight areas where actuaries are making a difference in risk management.

Now that you know my perspective on the performance of the JRMS, it is your turn to share. Tell us how we are doing, what objectives are important to you, and how section leadership can better serve its members and the profession. ■

## Recent Publications in Risk Management

As an ongoing feature in Risk Management, we will provide recent publications we find noteworthy to our readers. Please send suggestions for other publications you find worth reading to dschraub@soa.org or cheryl.liu@pacificlife.com.

### **Risk Governance and Culture: Principles and Practices in the Insurance Industry North American CRO Council, February 2014**

This paper was developed by the North American CRO Council in collaboration with Oliver Wyman. This paper highlights key considerations in further strengthening risk governance and culture, as well as approaches to implementing sound practices in risk management.  
[http://www.crocouncil.org/images/NA\\_CRO\\_Council\\_-\\_Risk\\_Governance\\_and\\_Culture\\_-\\_February\\_2014.pdf](http://www.crocouncil.org/images/NA_CRO_Council_-_Risk_Governance_and_Culture_-_February_2014.pdf)

### **Summary of Standard & Poor's Enterprise Risk Management Assessment Standard & Poor's, May 2013**

Standard & Poor's Rating Services published this article in May 2013 to help market participants better understand its approach to assessing insurance companies' enterprise risk management.  
[http://www.standardandpoors.com/spf/upload/Ratings\\_US/Enterprise\\_Risk\\_Management\\_5\\_7\\_13.pdf](http://www.standardandpoors.com/spf/upload/Ratings_US/Enterprise_Risk_Management_5_7_13.pdf)

### **Stress Testing and Scenario Analysis IAA, July 2013**

International Actuarial Association Insurance Regulation Committee released this paper in July 2013. This paper provides an actuarial perspective on scenario analysis and stress testing.  
[http://www.actuaries.org/CTTEES\\_SOLV/Documents/StressTestingPaper.pdf](http://www.actuaries.org/CTTEES_SOLV/Documents/StressTestingPaper.pdf)

### **2014 EY Asia-Pacific Insurance Outlook EY, 2014**

[http://www.ey.com/Publication/vwLUAssets/EY\\_-\\_2014\\_Asia-Pacific\\_insurance\\_outlook/\\$FILE/EY-2014-EY-Asia-Pacific-insurance-outlook.pdf](http://www.ey.com/Publication/vwLUAssets/EY_-_2014_Asia-Pacific_insurance_outlook/$FILE/EY-2014-EY-Asia-Pacific-insurance-outlook.pdf)

### **Creating value through enterprise risk management Milliman Risk Institute Survey, May 2014**

Milliman Risk Institute's 2014 enterprise risk management (ERM) survey takes focus on how market participants can understand the value creation resulting from ERM activities.  
<http://www.milliman.com/uploadedFiles/insight/2014/milliman-risk-institute-survey-2014.pdf>

# Letter from the Editors

By Robert He and Ben Neff

**IN THIS NEW ISSUE OF RISK MANAGEMENT**, the editors are pleased to offer readers a few thought-provoking articles on a variety of different topics.

In this installment of our “Talk with a risk management guru” series, Larry Moews, Chief Actuary & CRO of SCOR Americas. Larry shares his views on effective risk management under an evolving regulatory and economic environment with us and provides some advice to actuarial students on career development. We want to thank Bradford Connors and Evan Borisenko for their time interviewing Larry and putting this article together.

“Actuarial Behavior Risks” by Timothy Paris lays out a sketch of a new tool to help life actuaries answer the challenge posed by policyholder behavior risk—it starts with understanding the risk profile of the business, how policyholder behavior risks and stress scenarios affect that, and how this contrasts with the industry.

We continue to work with major banks on the series of “Insights from Wall Street.” For this issue, we worked with Credit Suisse on two interesting articles. “Tail, You Lose: Making Sense of Tail-Hedging Indexes” walks us through the thought process of designing hedging strategies to better manage a challenging task for risk managers: managing tail risks. Edward Tom, Stanislas Bourgois, and Grace Koo illustrated their innovative work by leveraging Credit Suisse’s strength in the equity derivative area. In “Downside of Prudential Regulation: Lower Liquidity,” Ira Jersey shares his insight on a potential issue of the rate market due to regulation. This issue will have an impact on many fronts ranging from bond trading to rates hedging.

In “Down but Not Out: A Cost of Capital Approach to Fair Value Risk Margins,” John Manistre presents a concept on the cost of capital method for calculating risk margins. This is an introduction section from his full paper discussing a number of reasonable simplifying assumptions that allow the risk loaded parameters to be calculated.

In “Risks of Measuring Risk: Dodd-Frank Stress

Testing May Give False Security,” Patrick Richard explores several risks and possible unintended consequence of reliance on the stress testing under Dodd-Frank. A healthy skepticism of stress tests should be the better lesson learned from the recent financial crises.

A group of risk managers share their thoughts about current and future risks in “Seventh Risk Manager Survey of Emerging Risks.” While financial volatility continues to be the top risk (59%), while risks surrounding greater regulatory focus and cyber security are trending up.

Last, we provide a list of recent articles and papers that may be of interest to the members. These pieces can provide further information on a broad range of topics. We would like to give a special thank you to David Schraub, Kathryn Baker, and Cheryl Liu for helping us pull together this August newsletter.

Enjoy reading! ■



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# An Interview with Larry Moews, Chief Actuary & Chief Risk Officer of SCOR Americas

By Bradford Conners and Evan Borisenko

**Bradford:** Larry, thanks for taking the time to speak with us today. Before we dive in to some of the hot risk topics of the day, we'd really like to hear a little about your background and experiences. To start, what are your responsibilities as the CRO of SCOR?



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**Larry:** As a company, we are in the business to take risk, but we want to take the right risks, the right amount of these risks, and we want to get an appropriate return on these risks, so my role involves determining how we can best do that. That includes identifying risks, assuring that proper governance is in place, assuring that appropriate mitigation has occurred

when necessary, proactively optimizing the value of our in force business including the use of retrocession, being as transparent as possible through risk dashboards so that senior leadership can make the best business decisions possible, dealing with regulators in the United States and Europe on risk and solvency issues, etc. Risk dashboards must be useful to help focus attention on the most important risk challenges. The worst thing you can have is a 50-75 page document in 6-point type with no margins, which may have “everything in the world” in it, but it doesn’t crisply communicate key risk messages effectively in order that we can focus on taking corrective action where needed.

**Bradford:** That sounds like quite a challenging job. Can you discuss what your career path has been like and what experiences you’ve had that have led you to your current position?

**Larry:** I think my background is probably ideal because I believe that the most effective risk person is someone that has an extremely broad background. In my career, I’ve been able to do so many things that it’s allowed me to really see the business from so many different

perspectives. I would recommend to anybody who really wants to get into risk to get as much exposure as they can—jump around to as many different product lines (individual & group life, health, disability income, long-term care, auto, homeowners, commercial lines—ideally from a primary and reinsurer perspective) and disciplines (actuarial, finance, ALM, strategy, distribution, investor relations, underwriting, I.T., operations, M&A, etc.) as possible. Depending upon the culture of the company, it is sometimes quite difficult to get some experience outside of the actuarial arena, but go for it if the opportunity is there. I would also say that I can’t imagine being a chief risk officer in an insurance company—particularly a life insurance or reinsurance company—without an actuarial background. I just rely so much on these skills. I’m not saying that a non-actuary can’t perform the CRO role, but I personally would find it quite difficult to be effective if I didn’t have that broad and deep base of knowledge.

**Evan:** I can see how it could take a diverse background to really lead an effective risk management practice. You mentioned earlier that one of the challenges you face is balancing risk and return. What kind of strategy do you take to be able to do that?

**Larry:** There are four key stages that companies and individuals go through when it comes to risk management maturity and effectiveness. Many people initially think that risk management means “thou shalt not do”; the risk management police are coming down the hallway; everybody hide! Getting beyond that is stage one of basic traditional risk management. Enterprise risk management is stage two, where you look holistically at risk throughout the enterprise and not through the lens of individual business divisions or functions. We’ve now covered the easy part.

Then you move to what I call ERRM—Enterprise Risk and Return Management. If you’re going to take on risk, you better get a proper return, and if you’re going to get a good return on something, you better find out what risks you are assuming to get that return; you can’t talk about one without the other as there is no “free lunch.” Then you get to the ultimate stage four, which I call ERRO—Enterprise Risk and Return Optimization. That’s where you really get into determining the best mix of risks that provides the optimal rate of return to maximize the embedded value of the enterprise. This is easy to say but difficult to do, but ERRO is the

“Enterprise Risk & Return Optimization (ERRO) is the ‘holy grail’ or ‘efficient frontier’ that we all should be striving to achieve.”

“holy grail” or “efficient frontier” that we all should be striving to achieve. Do not think you ever fully reach this stage because you never do... always room for continuous improvement and further optimization!

**Evan:** What tools do you use to perform this analysis?

**Larry:** Our most important tool is our Group Internal Model that was developed for Solvency II. This model helps measure our various risk profiles on both a stand-alone basis and on a holistic basis reflecting the various correlations and dependencies among our various businesses.

**Evan:** It sounds like it’s a very sophisticated level of risk optimization that you have at SCOR, but how do you get the culture at SCOR to embed that risk philosophy, and how do you influence senior management to be on board with that kind of a vision?

**Larry:** It happens at the top. Our CEO is very much in tune to risk and return optimization; we even call our three-year strategic plan, “Optimal Dynamics” and our CEO personally chairs our Group ERM Committee. When he came to the company about 12 years ago, SCOR had some difficult financial issues to address in order to get the company back on track. This was the beginning of our very strong risk and return culture that clearly continues to this day. In our public disclosures, we state that we have only two corporate goals—a return goal and a solvency target. There’s no revenue goal although we certainly want to grow profitably with a high degree of discipline. Management is not forced into a situation where we have to write a particular piece of business to get rewarded. We’re a public company, so we want to see the stock price grow, our shareholders get rewarded, and all other stakeholder interests addressed, but it all starts with a strong risk & return mindset. In summary, there’s two overriding goals that shape the whole company—return and solvency—and that’s it!

**Evan:** You’ve brought up how even within the Americas company, there’s a corporate role. How does the nature of SCOR, as a P&C and life company, as well as being such a global firm, affect your role as the CRO of the American unit?

**Larry:** I’m one of the few people in the company that actually has P&C and life experience and responsibility. When we acquired Transamerica Reinsurance and



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Generali U.S. to become the #1 player in life reinsurance in the U.S. and with growth on the P&C side as well, the chairman came to me and said he would like me to be the CRO of all the Americas from a holistic risk and return perspective now that over 40 percent of our global business is in the Americas.

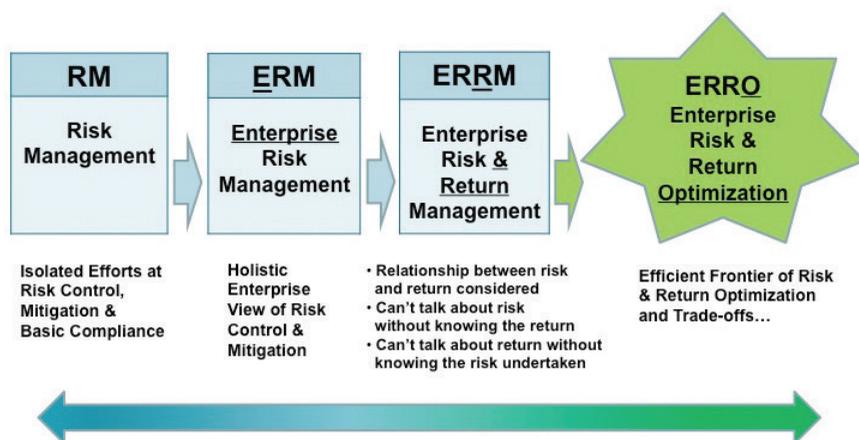
It is not that unusual that the P&C and life sides do not talk to each other on a regular basis. The clients on the P&C side are different from the clients on the life side, and the P&C clients tend to be more global while the life business is more national in scope (within each country). The whole reason we believe so strongly in the global P&C and life reinsurance structure has to do with the diversification of risk. A pure life reinsurer might have a more difficult time being capital efficient without covariance credits from uncorrelated P&C risks... and vice versa.

**Evan:** Regarding the acquisitions of Generali U.S. very recently and TransAmerica a few years back, to what extent did they affect you, and did you have any sort of input into the analysis that went into the acquisition or the integration of the parts since then?

**Larry:** I lived and breathed the acquisitions when they were happening; I was on the sell side of the

CONTINUED ON PAGE 8

## Evolution of a Risk & Return Culture...



equation when I was part of Transamerica being acquired by SCOR, and I was on the buy side when SCOR was acquiring Generali U.S. last year. Risk plays a huge role in this because we run the business through our group internal model capital formulas to see how much capital we need to hold in the enterprise in total once we bring the acquired businesses and the corresponding set of risks into the company.

With acquisitions, we also evaluate their senior management very heavily as far as leadership, integrity, reputation, client relationships, technical skills and industry knowledge. We want them to remain with the team because the people are just as important as the ongoing business that's being purchased. We've been very fortunate in both cases that the senior team has for the most part stayed intact.

**Evan:** It seems that a lot of attention is being paid to the U.S. market; what effect does the market-consistent capital standard of Solvency II have on SCOR's ability to compete against other firms that are playing in the U.S. market?

**Larry:** The market consistent approach in Solvency II tends to penalize businesses with long-term guarantees... particularly long-term capital markets guarantees, whether it's fixed or variable annuities... but those are two product lines for which SCOR has no risk appe-

tite. We're not looking for capital markets risk beyond what you would normally generate from cash flows in running the business. So for us, Solvency II hasn't been a game changer in the U.S.

**Evan:** Are there any other regulatory developments—such as Own-Risk Solvency Assessments or reinsurance collateral regulation changes in the United States—that are on your risk dashboard?

**Larry:** Yes, there are a lot of things in the regulatory arena today that appear on the dashboard in addition to just regularly running the business. There is uncertainty today because the NAIC doesn't necessarily have agreement among all its commissioners on the approach it wants to take in many respects; for example, there's a question of when and if principle-based reserves will be implemented. Also, with outdated redundant statutory reserve requirements, the situation with life insurance captives is certainly a hot issue today. It's all reflected in our risk dashboard, and it's something that wouldn't have been there 10 years ago.

**Evan:** Is there anything that you're trying to do to either prepare or take some sort of preemptive measures in advance of impending regulations or events?

**Larry:** Absolutely. We're doing things so that no matter what scenario comes up, we'll be protected in the best way possible. We should be doing that on all risks—whether it's regulatory risk, economic risk, mortality risk, or even operational risk. For example, we have an office in New York on Water St., and I guess when the name is Water St., that should be a sign that there may be a significant risk there. And there certainly was—when Superstorm Sandy hit, we had seven feet of water in the lobby for a few weeks. That was an operational risk for us in that office; it was out of commission for a while, so it tested our remote capability to an extent we never expected, but we lived through it and further improved our business continuity plans.

**Evan:** What are some of the key elements to creating an effective risk dashboard, and what does SCOR do to accomplish them?

**Larry:** It's critical that dashboards are as transparent and measureable as possible. After all, being "chief transparency officer" might be the most critical part of

“ ... the more experience you have seeing different sides of the business, the somewhat more prepared you’ll be for those “black swans” that just suddenly pop up from nowhere. ”

being chief risk officer. You can put a whole bunch of subjective comments in there, but when you have the tangible measures that support why you feel a risk is a red, yellow or green, I think that helps a lot. I tell my dashboard folks that I want to be tangible, crisp, and measureable—whether its risk limits by individual or the amount of exposure we have in any one building or geographical area. We do utilize heat maps, which really helps communicate to management what’s happening.

**Evan:** A topic that seems to be really prominent in reinsurance discussions today is the role of capital markets in alternative risk transfer mechanisms. From reading SCOR’s annual report, it seems that the company is trying to not just view it as competition, but also to use it as a retrocession tool and to try to help clients structure some of these transactions. What is your role in that process, and what is your view on the future of capital markets activity?

**Larry:** I think it’s here to stay. Both P&C and life companies are looking at both capital markets and reinsurers to help provide certain solutions at a fair price. Some of them are using it to get economical rates, and some to spread out counterparty credit risk—both are valid reasons. We use cat bonds as innovative risk mitigation vehicles on both the life and P&C side. But you’re right—on the other side of it, capital markets become a competitor for us in the traditional reinsurance market space, especially with P&C. There is clearly increasing convergence between reinsurance and capital markets which one could view as both a threat and an opportunity. I think this helps make us a better company overall.

**Bradford:** I’ve noticed that not as many actuarial students go right into reinsurance coming out of college as some of the other fields, but what advice would you give to actuaries who are new to the industry and want to work in reinsurance at some point in their career?

**Larry:** I think it’s very beneficial for anyone to get experience in the reinsurance area. Not only is it kind of fun and you see the industry from a broader perspective, but you also get to see things that different companies are doing. For example, companies that might have the exact same underwriting standards and the exact same target market can have vastly different mortality. That was an eye-opener for me. You wouldn’t get that knowledge if you just stayed in a primary company. I

was somewhat naïve about it before I moved over to reinsurance, but now I certainly see the industry from a different holistic perspective.

**Bradford:** What would you say is the future of actuaries in non-traditional roles such as enterprise risk management?

**Larry:** I would disagree that ERM is a non-traditional role; I think it’s becoming the heart and soul of a lot of insurance and reinsurance companies. You’ll always have product development and valuation actuaries, but I think risk is just as important as either one of those. Like I said before, if you go into risk and just stay there, it wouldn’t give you a broad enough base of knowledge to really be effective. One of the biggest problems with risk is that you don’t know what you don’t know. You can be thinking things are really good—that you have a real good handle on everything—but then something will blow up, and you’ll wonder why you didn’t know about it earlier. But the more experience you have seeing different sides of the business, the somewhat more prepared you’ll be for those “black swans” that just suddenly pop up from nowhere.

**Evan:** Larry, thanks so much again for speaking to us today. Your thoughts have been very insightful and we appreciate your willingness to share your knowledge and experience. Is there anything else you’d like to add before we wrap up?

**Larry:** It’s important to make sure that risk is not considered as just a compliance function. Yes, there are certain compliance standards that you have to meet such as ORSA, but the whole reason you do enterprise risk and return is to make better business decisions to drive optimal business value. You’re not doing it to look good or to put together fancy presentations; you’re doing it to optimize the value of the business so everyone wins—clients, shareholders, employees, agency forces, regulators, rating agencies, society as a whole, etc. ■

# Actuarial Behavior Risks

By Timothy Paris

*Most of us understand that innovation is enormously important. It's the only insurance against irrelevance.*  
- Gary Hamel

## WHY ARE WE HERE?

Not existentially, but as actuaries. What are we supposed to be doing? What is the highest and best use for our special set of skills? To paraphrase the SOA: “actuaries evaluate the likelihood of uncertain future events, design creative ways to reduce the likelihood, and decrease the impact of adverse events that actually do occur.”

As captivating as all that is, I prefer to say that we manage risks. Many of us may not think of our day-to-day work in that way, as it may be disguised as assumption-setting or developing and running sophisticated computer models. These are important functions, but they are means to an end—we are here to manage risks.

Which ones? We all know the roll call: investment risks, mortality risks, asset-liability risks, operational risks, and so forth, each with myriad subcategories and potential interrelationships.

But in just the last few years, the U.S. insurance and retirement security industry has hosted the coming out party for a previously under-appreciated risk—policyholder behavior. Adverse policyholder behavior results for deferred

annuities have been directly responsible for billions in publicly disclosed losses: policyholders have been holding on to their valuable inforce guarantees at much higher rates than before the financial crisis, and in the face of this new experience data, actuaries' assumptions for future policyholder behavior have been updated commensurately, resulting in much higher levels of reserves for future inforce guarantees.

So that's it—a good blood-letting, bygones, then onward with updated assumptions, fingers-crossed? That would be pretty weak, and unworthy of our man-

date to manage risks. Hope is not a risk management strategy. The insurance and retirement security system is too large and important to individuals and families to fail or endure repeated trauma like we have experienced in the last few years. But in order to manage policyholder behavior risks, we actuaries first need to manage our own behavior—our risk of being too comfortable with the status quo. We need to stoke our own ambition, expand our thinking, and develop new tools to actually manage these risks, for the dual benefit of improving our companies' and clients' ability to offer vital insurance and retirement security products to individuals and families, but also to improve our profession's value proposition in an increasingly competitive and fluid global employment market.

The gauntlet has been thrown. What are we going to do about it?

I would like to share a sketch of a powerful new tool to help answer the challenge posed by policyholder behavior risks. It starts with understanding large complex data.

Rather than make this overly abstract, let's stay where the problems have emerged, in the deferred annuity industry. Here there is a large body of complex data describing the various aspects of policyholder behavior within these products—such as surrenders, partial withdrawals, annuitizations, mortality, investment fund selection, and optional benefit selection—for each company and across companies for the industry in aggregate. The experience data indicates that these behaviors are complex, with a range of cohorts and multiple drivers such as policyholder age, gender, policy duration, product type, relative value of guarantee features, and distribution channel. And in some cases, it seems that behaviors are interrelated—for example, policyholders that elect rich guaranteed death benefits tend to exhibit higher levels of mortality, as we would expect.

With this high level of complexity, unless we have a rigorous data-driven understanding of the dynamics, we have little hope of managing the risks effectively. This is why analysis of large blocks of each company's business and aggregation across the industry is invaluable—it increases the credibility of analytical refinements and understanding.



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“Hope is not a risk management strategy.”

So the corporate risk management process must have command of the experience data in all of its glory. Do this first! Understand the risk profile of the business, how policyholder behavior risks and stress scenarios affect that, and how this contrasts with the industry.

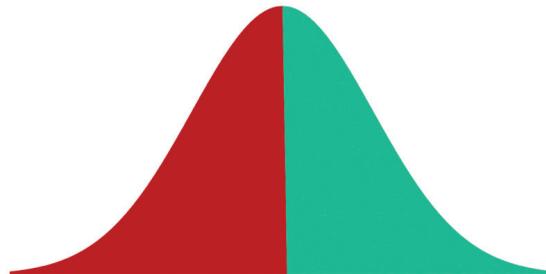
What if we do this? Maybe some of us already have. What if we had a deep and quantitatively rigorous understanding of policyholder behavior for our company’s block of business? What if we completely understood the surrender behavior cohorts and dynamics, so much so that we could convince another actuary of its validity for the future? Of course, we can never be absolutely certain in extrapolating historical data to the future. But if we are going to make serious progress on this issue, we should be asking ourselves what an ideal answer would look like, and then we can determine what type of adjustments to make in order to deal with shortcomings.



The answer would probably be pretty complicated. But intuitively, for each behavioral cohort, we should be able to express the behavior as a function of a benchmark along with random fluctuations. The benchmark would be a multivariate formula based on analysis of the historical data, likely including parameters for the factors noted above—age, gender, duration, product type, value of guarantee features, distribution channel, etc. The nature of the random fluctuations would be highly dependent on the level of variance between the actual historical data and the benchmark.

Much easier said than done! But think of this like an old fashioned simple linear regression model, where we are trying to fit the best trend line to some data points in two dimensions. Similar thinking applies here, but it is a surface in multiple dimensions—this is a difficult analytical step, and Generalized Linear Modeling techniques will likely be vital, the details of which are beyond the scope of this article. Results will vary between products and companies. But if we could do this, or if some of us have done it already, what would we do with it? Could we go beyond assumption-setting and use it to actually manage the risk?

Yes, I think so! If the benchmark really captures the non-random dynamics for the cohort, then the risk is really in the distribution function for the random fluctuations. As actuaries, surely we know how to construct financial transactions around random fluctuations. With deferred annuity guarantees, as noted above, the sort of behavioral fluctuations that tend to draw the most concern are low surrender rates, which increase the cost of guarantee features even net of the increase in fee or spread income for the base product. Let’s consider a simple example.



Suppose that for the next quarter, we are interested in the probability that a block of policies are in the left side of the surrender rate distribution—lower than the benchmark. And suppose that if this happens, it means an average of 1 percent lower surrender rates, which would be a significant deviation in this context. We should be able to use the historical data to estimate the probability of this happening. Let’s call this probability  $p$ . Depending on the shape of the distribution function for the random fluctuations,  $p$  may take on a range of values. If the distribution function is symmetric around zero, then  $p=0.5$ , which would mean that the surrender rate fluctuations are akin to a coin toss.

For one quarter, if the proverbial coin flipped tails and surrender rates were lower than the benchmark, would this have a large financial impact? Probably not. Most of us would probably view one quarter of deviation as noise, and although it would draw our continued attention, we would not be inclined to change our long-term assumptions for the future.



CONTINUED ON PAGE 12

What if this happens again the next quarter, and the next? What if it is sustained, say for six quarters in a row? In our simple example, this is a plausible outcome that could occur with probability  $p^6$ , which is about 1.5 percent.

If this happened, then what would we think? We would probably change our expectation of the future in the face of this sustained and significant adverse deviation. This means that we would update our modeling assumptions for new business and inforce, and we would see reserve increases like the ones noted earlier—potentially costing billions. Again.

Unless we bought protection in advance.

Protection? Don't stifle creative thinking with legal and regulatory details just yet—we are working with big concepts right now. Start with the economics. If we could buy protection, how much would it cost? How much should it cost?

Suppose we wanted \$200 million of protection in the event that this event of sustained low surrender rates actually happened over the next six quarters. We would intend this to help defray the impact of the reserve increase when assumptions are updated. The probability of the event is about 1.5 percent. So the net premium for the protection should be about \$3 million.

Of course, this would need to be loaded with a margin to cover expenses, risk, and profit for the risk taker. For an innovative type of “catastrophe” risk transaction

which this is, it is difficult to be overly precise, but the margin might be about double the net premium. So the gross premium may be about \$10 million to provide \$200 million of protection for the next six quarters.

Can we buy decades-long protection for the life of the deferred annuity? Very unlikely. This is a data-driven transaction, and since the industry does not have decades of relevant policyholder behavior experience data to bring to bear for these types of products, the length of the protection period will be limited by that. But even a few years of coverage is a start, and can conceivably be pieced together and renewed sequentially. This would be an important new tool in the risk management toolbox, with high financial value and high strategic value for deferred annuity writers and their stakeholders.

Perhaps most importantly, are there risk takers that would consider doing this? Bright ideas and hypothetical examples are fine, and there certainly should be demand for this type of protection on the part of deferred annuity writers who are beset with this risk and have so recently experienced its costly downside. But we need a counterparty to make a transaction—where is the supply?

As noted above, this type of transaction has a catastrophe risk profile and is data-driven with hard analytics, so we would be well advised to look to risk transfer markets with similar characteristics, like P&C “cat” and specialty reinsurers. The P&C reinsurance market is widely known for its cyclical nature, and one of its important features is that it continues to provide capital to the market even after catastrophes make capital scarce, although the cost of this capital will naturally be higher. P&C and specialty reinsurers tend to opportunistically consider unusual types of opportunities to deploy excess capital, as is their well-documented situation now, especially when they fit their risk profile, they can underwrite and price based on first principles, and there is a diversification benefit with other lines—the situation with deferred annuity policyholder behavior risk fits the bill! Each company will have its own views on new types of opportunities and may consider them quietly, and each potential transaction will stand or fall on its own merits, but this certainly seems like a natural and promising area for supply.



“ It is up to us to lead our companies and clients away from catastrophe to safety. ”

It is up to us to lead our companies and clients away from catastrophe to safety. Actuaries should continue to design new products that are mindful of policyholder behavior risks and that are priced appropriately. But let's not stop there with our fingers crossed. Let's try something new—actively manage these risks. It will

not be easy, but the solutions to the most important problems rarely are. It will require technical know-how, creativity, connectivity to the right market participants, and business savvy—exactly the behaviors needed by actuaries to be successful in the 21<sup>st</sup> century. ■

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# Tails, You Lose: Making Sense of Tail-Hedging Indexes

By Edward K. Tom, Stanislas Bourgois and Grace J. Koo

**THE THREE-YEAR PERIOD DEFINED BY THE START OF THE CREDIT CRISIS IN 2008**, the intervening Flash Crash, and the subsidence of the Sovereign Debt Crisis in 2011 marked one of the most volatile regimes in market history. Of particular note were the successive waves of “tail events,” market dis-

locations deemed a priori, to be statistically improbable. Although differing in both intensity and duration, these events, collectively known as “fat tail” or “black swans,” precipitated abrupt and immense draw-downs as stock prices unraveled from company and macroeconomic fundamentals.

the four-month period from Aug 2008–Dec 2008, the market experienced ten such declines—negating in the span of four months, six years of equity growth. On the surface, therefore, the most obvious and oft-cited reason to hedge against tail events is to mitigate the severity of the market drawdown.



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## WHY HEDGE TAILS?

As an example of the potential impact of tail events upon a market portfolio, consider the magnitude of the drawdowns experienced during the heart of the Credit Crisis in 2008. As seen in Figure 1, under the assumptions of normality embedded into modern portfolio theory, it is anticipated that over the course of a trading career, one would observe at most one one-day drawdown in excess of four standard deviations (i.e., 5+ percent). Yet as shown in Figure 1 and 2, during

**Figure 2: A Priori Probability of One-Day Market Declines**

Date	SPX Decline	Pre-Crisis Expected % Occurrence
9/29/08	-8.79%	763,083,992 years
10/7/08	-5.74%	584 years
10/9/08	-7.62%	2,011,100 years
10/15/08	-9.03%	3,180,535,165 years
10/22/08	-6.10%	2,501 years
11/5/08	-5.27%	96 years
11/12/08	-5.19%	96 years
11/19/08	-6.12%	2,501 years
11/20/08	-6.71%	34,267 years
12/1/08	-8.93%	1,550,262,586 years

Source: Credit Suisse Derivatives Strategy

A more subtle and arguably more important benefit of a tail hedge however, is that it addresses the most disruptive feature of a tail shock—specifically, the impact associated market distortions that often accompany tail events. These following market distortion undermine 1) the underlying principles of financial valuation—causing a departure of asset prices from their “fair” values and 2) the stabilizing assumptions of portfolio construction including:

- breakdown in portfolio diversification (via correlation)
- negative feedback loops (via volatility clustering)
- beta instability (via cross-asset contagion)
- discontinuous trading

## Volatility Buffer

Often during these events in which in-house volatility based risk limits are suddenly breached, portfolio managers (“PMs”) and traders are forced to sell out of tactically unattractive but strategically desirable positions. Tail hedges can provide a volatility buffer to slow the exit of positions (or lessen the impact).

**Figure 1: A Priori Probability of One-Day Market Declines**

Sigma	Expected Frequency Outside Range	Frequency for Daily Trading Event
1	1 in 3	Twice as week
2	1 in 22	Once a month
3	1 in 370	Once very 1.5 years
4	1 in 15,787	Once very 63 years
5	1 in 1,744,278	Once very 7,000 years
6	1 in 506,797,346	Once very 2 million years
7	1 in 390,682,215,445	Once very 1.5 billion years

Source: Credit Suisse Derivatives Strategy

“The primary challenge during the current low volatility environment, however, is that the cost of static, “always on,” tail insurance is often expensive to hold.”

### Credit Reserve

It is somewhat ironic that downside tail events also provide the best opportunity to outperform. In fact, a historical analysis of returns shows that there are almost as many upside tail shocks and of similar as there are downside tails. Take for example the Crash of 87 in which the market collapsed 23 percent over the course of one day but recoups the bulk of the losses over the course of the next two days. A good way to recover returns lost due to a tail shock is therefore to invest during times of market duress. However, in many cases, trader positions are often drastically pared down as the aforementioned risk limits are breached. An important function of tail hedges is therefore to provide a source of funding which accrues as the market is in decline and which can then be used to lever into a long position to allow the portfolio to more quickly recover.

### *Algorithmic (Signals-Based) Tail Hedging*

The primary challenge during the current low volatility environment, however, is that the cost of static, “always on,” tail insurance is often expensive to hold. Accordingly, if a tail event fails to materialize, the buyer of a systematic tail strategy risks significantly underperforming his unhedged peers. To moderate the cost of carry, hedgers often shift towards dynamic tail risk strategies during times of market stability.

Over the last few years, a vast number of dynamic strategies in the form of algorithmic indices<sup>1</sup> have been designed to profit from the realization of tail events and offered as a hedging product to end investors. Algorithmic indices (algos) are liquid, transparent and easily investable through delta-one wrappers such as swaps, notes or more advanced products involving the use of derivatives and/or leverage in order to produce a highly asymmetrical payoff.

### *Algorithmic Tail Risk Construction*

As of the time of writing, the marketplace currently has over 200 active tail risk algorithm (algo) products spanning five asset classes. However, due to the leverage to downside shocks and the greater liquidity offered by equity volatility products in times of market distress the majority of algo products invest in equity volatility. Figure 3 provides a cross-section of Credit Suisse’s more popular tail hedging algos (by

notional invested), its asset class exposure, and a short description of the trading rules.

### *Algorithmic Tail Risk Construction*

Algorithmic tail risk construction generally follows a five-step process.

1. Tail Definition
2. Benchmark Selection
3. Trigger Design
4. Simulation
5. Test of Efficacy

In the following pages, we will use the development of our Equity Dynamic Tail Hedge Index (Ticker: DYTL) as a case study to illustrate the process of constructing a tail risk algo.

### **Step 1: Tail Definition**

The obvious first step to developing a tail risk algo is to first define what is meant by “tail.” Given the breadth of investment styles, the definition of the term “tail-risk” itself (and therefore the solution) may vary greatly among investment professionals. Take for example, the “Flash Crash” in which the market plummeted 10 percent over the course of one hour and then recovered 8 percent over the next hour to finish down 2 percent for the day. For an investor such as a high frequency trader or an active delta-hedger who was actively trading during that period and so realized profit and loss (“P&L”) during those volatile two hours of the day, such an event may in fact qualify as a tail event. However, if one were a “low-frequency,” long-term investor such as a pension fund that did not trade during that day, then a tail event may refer to a protracted deterioration in one’s portfolio caused by a breakdown of the core investment strategy. For the purposes of this case study, we will define a tail risk as **a sizeable abrupt market decline which triggers a persistent volatility regime shift from a low to high volatility environment.**



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**Figure 3: Credit Suisse Tail Hedging Algos**

Index	Short Name	Bloomberg Code	Underlying	Dynamic/Static	Source of Tail Exposure	Short Description
Credit Suisse Advance Defensive Volatility	ADVOL	CSEAADVL	Equity	Static	Long VIX Futures	The index offers efficient long volatility exposure by systematically going long short- or medium-term VIX futures based on current levels of VIX futures
Credit Suisse Dynamic Tail	DYTL	CSEADYTL	Equity	Dynamic	Long SX5E Volatility Skew	The index dynamically allocates to the Credit Suisse Equity Tail Hedge based on the level of the SX5E Skew or the iTRAXX credit index
Credit Suisse Equity Tail Hedge	TAIL	CSEATAIL	Equity	Static		The index offers efficient long SX5E skew exposure by going short delta-hedged put ratios
Credit Suisse Dynamic Tail S&P	DTSP	CSEADTSP	Equity	Dynamic	Long S&P Volatility Skew	The index dynamically allocates to the Credit Suisse Tail Hedge S&P based on the level of the S&P Skew or the CDX credit index
Credit Suisse Equity Tail Hedge S&P	TLSP	CSEATLSP	Equity	Static		The index offers efficient long S&P skew exposure by going short delta-hedged put ratios
Credit Suisse Cheapest Slide	CHPS	CSEACHPS	Equity	Static	Long SX5E Forward Variance Swaps	The index offers efficient long volatility exposure by systematically going long the cheapest-to-carry SX5E forward starting variance swap
Credit Suisse Advanced Volatility Index - Foreign Exchange Opportunistic Vol	AVI FX	CSVI	FX	Static	FX Volatility	The index opportunistically goes long/short volatility across 12 major currency pairs based on a Jump model, with a systematic net long volatility bias
Credit Suisse Tail Risk Overlay Protection Strategy	TOPS	CSEATSERUS	Fixed Income	Static	Long Treasury, German Bonds; Long Euro rate futures	The index offers exposure to tail events by opportunistically going long CBOT Note Futures, Eurex German Bond Futures, or Euronext and CME Euro rates futures
Benchmark	Benchmark	NA	Equity	Static	Long SX5E and S&P Volatility	The index goes systematically long 2-month 90% put options on SX5E and S&P and carries them to maturity

Source: Credit Suisse Derivatives Strategy

### Step 2: Benchmark Selection

The second step is to create a “naïve” or systematic hedging benchmark index (the Benchmark) using a plain-vanilla options strategy in order to gauge the relative performance of the tail hedging strategy. In our example, our Benchmark is designed as follows:

- Strategy: On every listed expiry, we purchase new S&P-500 90 percent-struck put options with a two-month maturity. At any time we would therefore have two options in the portfolio with maturities equal to front month and back month expiries. All options are either 1) let to run until they expire or 2) unwound in the event that the delta reaches 100.

“The objective in employing a trigger mechanism is to decrease the weighting (and therefore the cost) of the downside hedge in times of quiet markets and ratchet up exposure in anticipation of a tail event.”

- The notional of the purchased options is equal to one-fourth of the mark-to-market value of the Benchmark on that same day in order to match exposures.
- Performance calculation: the Benchmark is calculated in USD. Payoffs or premiums are paid in and out of a synthetic USD cash account earning Fed Funds.

The simulated history of the benchmark is shown on Figure 4. We also show the cumulative P&L of the S&P-500 index, the cumulative P&L of the S&P with a one-to-one overlay of the Benchmark as a hedge.

Figure 4 demonstrates the conundrum faced by many systematic plain-vanilla hedging strategies:

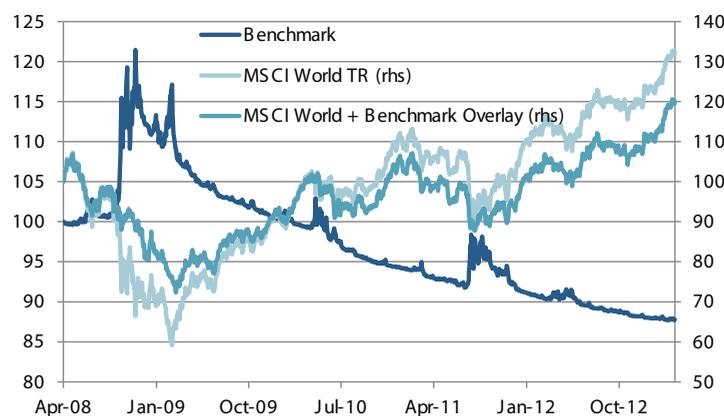
When a tail event does materialize, such a strategy can successfully cushion the initial blow of a tail event. In our example, for \$100 invested in the portfolio in April 2008, the hedging strategy would have saved the investor up to \$20 by November 2008. However, if a tail event does not materialize, it also shows how the long-term running cost (the Carry) of the strategy may gradually eat-up the accrued hedging benefits. During our five-year backtesting period, implementing the Benchmark hedge would have left the investor worse-off by \$12 per \$100 investment at the end of April 2013.

This then illustrates the disadvantage of a static tail hedge strategy: by systematically investing in the same notional, it tends to be under-invested in the period leading up to the shock, causing the investor to be under-hedged, and it tends to be over-invested immediately after the tail event when the price of options is high and the risks have dissipated, resulting in higher performance drag.

### Step 3: Trigger Mechanism

To enhance the performance of the basic “benchmark” tail hedge, we thus introduce the use of a timing indicator or trigger mechanism. The objective in employing a trigger mechanism is to decrease the weighting (and therefore the cost) of the downside hedge in times of

Figure 4: Benchmark Tail Strategy vs. S&P and SX5E ('08-'13)



Source: Credit Suisse Equity Derivatives Strategy

Figure 5: S&P 3M normalized skew vs. S&P index level



Source: Credit Suisse Equity Derivatives Strategy

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quiet markets and ratchet up exposure in anticipation of a tail event. In our example, we discuss the use of two triggers taken from two asset classes: 1) equity volatility skew and 2) CDS spreads from the fixed income markets in the construction of the Credit Suisse Equity Dynamic Tail Hedge index.

#### *Signal 1 – Skew*

Implied equity market skew is defined as the difference between implied volatility for lower strike options (typically put options purchased for protection) and implied volatility for higher strike options (typically call options purchased for leveraged upside exposure). Historically, during severe market downturns implied equity market skew has increased significantly. (Figure 5) This may be explained by an increase in demand for downside protection, pushing up implied volatility levels for lower strike levels.

The indicator analyzes the historical distribution of the three-month 80-100 skew on the underlying equity index, over the last three months. If the skew level is above 1.5 standard deviations from the mean, the signal for a distressed market is activated. This indicator has been historically reactive to market events signaling the beginning of a tail episode.

#### *Signal 2 – CDS Spreads*

The indicator is linked to the five-year CDS spread of companies for the relevant underlying equity market. If the CDS index is above 125 percent of its three-months moving average, the signal for a distressed market is activated (Figure 5, green shaded bars). If the CDS index is below 100 percent of its three-months moving average, the signal for a distressed market is deactivated. Otherwise, the signal remains unchanged. The indicator captures medium-term risk and is reactive to changes in the macro environment.

#### *Methodology*

The underlying fundamental strategy can be broken down into five steps:

1. The algorithm completes a monthly sale of vanilla ratio-put-spreads on the underlying equity index consisting of:

- short a number of three-month 95 percent puts and
  - long a number of three-month 80 percent puts
2. The quantity of puts is chosen such that each leg generates one volatility point (i.e., 1 percent vega exposure) per one point decline in the underlying index. The position thus naturally adapts to the prevailing level of equity volatility. Specifically, during times of low volatility when options' vega is low, the quantity of options needed to generate one volatility point increases, resulting in higher exposure to a tail event before it has happened. Likewise, when a tail event has realized and equity volatility and options' vega are high, the quantity of options needed to generate one volatility point is lower, and the strategy naturally deleverages itself at each reset. The ratio of 95 percent puts to 80 percent puts has a historical average of 1-by-3.15.
  3. The position is delta-hedged. (Once the directional component of the position is removed via delta-hedging, what remains is pure exposure to volatility.)
  4. The puts are unwound a day before expiration to avoid expiration day effects and rolled on a monthly basis.
  5. Any cash balance accrues at relevant rate.

To drive the allocation between cash and Index the two signals are run daily:

- If one of the signals is switched ON, 50 percent of the exposure is allocated to the CS Equity Tail Hedge SPX Index.
- If both signals are ON, 100 percent is allocated to the hedge index. If neither of the signals is ON, 100 percent is invested in cash (US Federal Funds Rate or EONIA).

Historically, at least one of the signals has been ON for 31 percent of the time period. Typically, a distressed macro environment would first activate the CDS signal, indicating that the likelihood of a tail event has

“ One must therefore evaluate the benefit of reducing carry costs in times of stable markets versus the risk of potentially missing the event because the signals have been “switched off” . ”

increased. The skew signal would activate when the market crisis takes momentum and equity skew breaks out of range.

**Step 4: Simulation**

To determine the effectiveness of the tail hedging algo, one would typically divide the dependent data set (in this case daily S&P and Eurostoxx returns) into an in-sample data set which is used to construct the algo and an out-of-sample data set which is used to test the stability and effectiveness of the algo going forward. In our case, given the limited scope of CDS spreads data sets, we created a proxy data set for CDS spreads extending back to 1996 using the Merton model. The algo was then constructed using the in-sample data set from 1996 to 2006 and run out-of-sample using the actual CDS spreads from 2006 to 2013 as shown in Figure 6.

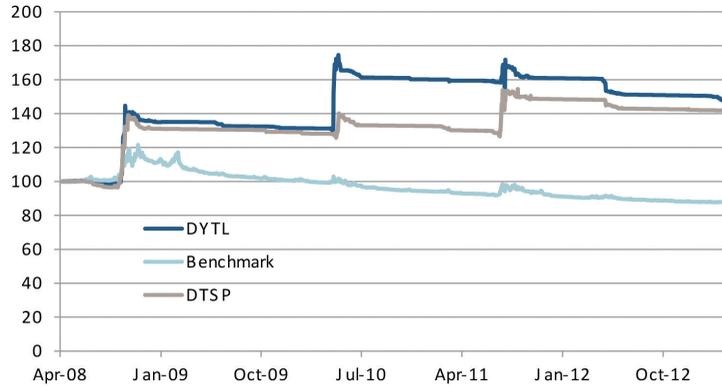
In general, our out-of-sample simulation for the CS Equity Dynamic Tail Hedge Index embodied the two traits we felt was desirable in a tail-hedging algo, delivering outsized returns during periods of market crisis, and efficiently reducing the effect of negative carry over stable market periods via the dynamic signals.

An important consideration is that tail risk strategies which incorporate some element of market timing regardless of whether it is actively determined by a PM or signal based face the very real risk that a hedge may not be in place when it is needed. One must therefore evaluate the benefit of reducing carry costs in times of stable markets versus the risk of potentially missing the event because the signals have been “switched off.” The final step to the process of algo construction is therefore to conduct an additional test of efficacy above and beyond the basic simulation in order to determine 1) whether the inclusion of the proposed signals provide adequate cost reduction to compensate for the risk of the hedge being “deactivated” during the days leading up to a tail event and 2) how the chosen algo stacks up against alternative tail risk algos.

**Step 5: Additional Tests of Efficacy**

The primary criteria we use to evaluate the efficacy of tail risk algos is to compare the tail-to-carry ratio of

**Figure 6: CS Dynamic Tail (DYTL) and CS Dynamic Tail S&P (DTSP): Simulated Performance 2008 - 2013**



each strategy with one another. The tail-to-carry ratio is computed by dividing the average performance during tail events by the negative annualized carry. The metric essentially conveys how many years of negative carry can be paid for by one single tail event. The higher the ratio, the more efficient the hedge.

*Efficacy of Signal Overlay*

In our first example, we test the efficacy of our signal overlay, by comparing our signal based Dynamic Tail strategy index (DTSP), to its unconstrained parent strategy, the Tail Hedge S&P index (TLSP), which is 100 percent invested at all times. DTSP is invested 100 percent in cash when no risk indicator is on, 50 percent in cash, 50 percent in TLSP when only one risk indicator is activated, and 100 percent in TLSP when both risk indicators are on.

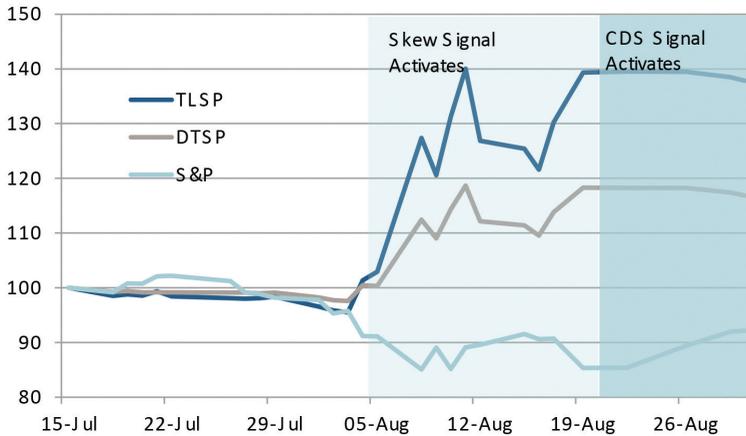
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**Figure 7: DTSP vs. TLSP performance during Quiet markets (Carry) and Tail events (Tail)**

From	To	Tail/Carry	DTSP	TLSP
22-Apr-08	1-Sep-08	Carry	-9.3%	-28.7%
1-Sep-08	1-Dec-08	Tail	36.4%	39.6%
1-Dec-08	1-Apr-10	Carry	-2.1%	-25.2%
1-Apr-10	31-May-10	Tail	7.9%	5.5%
31-May-10	1-Jul-11	Carry	-5.5%	-19.2%
1-Jul-11	30-Sep-11	Tail	15.5%	33.4%
30-Sep-11	3-Mar-14	Carry	-4.1%	-17.0%
		Average Tail	-5.2%	-22.5%
		Average Carry	19.9%	26.2%
		Tail To Carry Ratio	3.8	1.2

Source: Credit Suisse Equity Derivatives Strategy

**Figure 8: Signal Activation during 2011 US Debt Downgrade**



Source: Credit Suisse Equity Derivatives Strategy

Figure 7 compares the performance of DTSP vs TLSP from 2008 to 2011. At first glance, one might conclude the unconstrained “always-on” strategy is superior given that DTSP provided comparable returns to TLSP during the Lehman Collapse and the emergence of Greek Sovereign crisis in 2008 and 2010 but as shown in Figure 8, because the CDS signal activated late into the Tail strategy in summer 2011, DTSP underperformed. Note, however, that during periods of market stability, DTSP reduced the cost of carry, on average by a factor of five, producing a higher and therefore efficient tail to carry ratio.

### FUNDING A TAIL RISK STRATEGY

The bane of every tail risk hedger is managing the punitive decay profile of their held options. Or put another way, tail risk strategies can be very costly over time, especially if there is no payout. Therefore, investors continue to explore ways to help defray the cost of maintaining a tail risk hedge—one of which is to overlay a mean-reversion strategy to the portfolio. For example, in market regimes where we observe side-ways, or “saw-toothed” trading patterns, an investor could benefit from mean-reversion harvesting, and can convert a negative decay profile into one of positive accrual.

The CS Fixed Mean Reversion on S&P 500 is an algorithmic strategy that monitors the most recent five-day performance of the S&P 500, and if that performance is negative, a long position is established. Otherwise, it takes a short position. Moreover, the size of position is subject to caps and floors to avoid over-leverage.

“Dynamic tail-hedge strategies in the form of algorithmic indexes can provide a liquid, transparent, and easily investable solution to mitigate the impact of a “fat tail” or black swan market event.”

In Figure 9, we present a 100 percent overlay of the CS Fixed Mean Reversion on S&P 500 on an underlying position of the CS Equity Dynamic Tail Hedge of the S&P 500.

We note that combining the two strategies augments the performance of the tail hedge significantly. Furthermore, we also observe that the correlation between them has historically been low, except during the second half of 2011 when the Eurozone crisis intensified. But, even in that instance, as the dynamic tail hedge performance spikes, the mean reversion strategy corrects, after declining sharply for a short period of time (see Figure 10).

### CONCLUDING REMARKS

An ironic aspect of tail events is that it is not the expected or foreseeable events (the known unknowns) that causes the greatest market upheavals but rather the events from left field (the unknown unknowns). More often than not, true tail events often 1) have little or no historical precedent and 2) are difficult to anticipate a priori. Backtesting, by contrast, is by definition a backward-looking process that is optimized “to fight the last war.” As a result, hedging strategies that are designed for a specific event or asset class that have been responsible for tails in the past may be optically attractive from a backtesting perspective but may not necessarily outperform if a future tail event is greatly dissimilar to prior shocks.

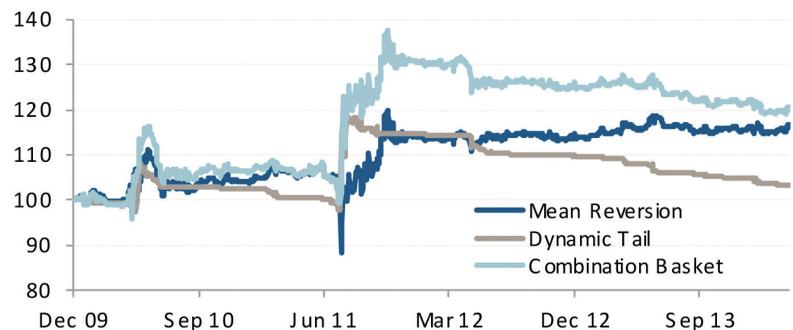
Nonetheless, dynamic tail-hedge strategies in the form of algorithmic indexes can provide a liquid, transparent and easily investable solution to mitigate the impact of a “fat tail” or black swan market event. In conclusion, the volatility buffer provided by a tail hedge not only serves to reduce the downswing in overall portfolio performance, but also could allow a credit reserve to put money to work after a market shock. A systematic tail hedge that also avoids a heavy cost-of-carry can keep PMs off the sidelines during the very time they should be the most active in navigating periods of market duress.

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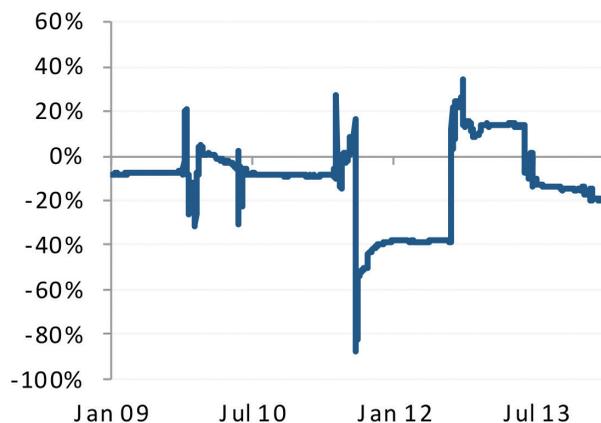
### ENDNOTES

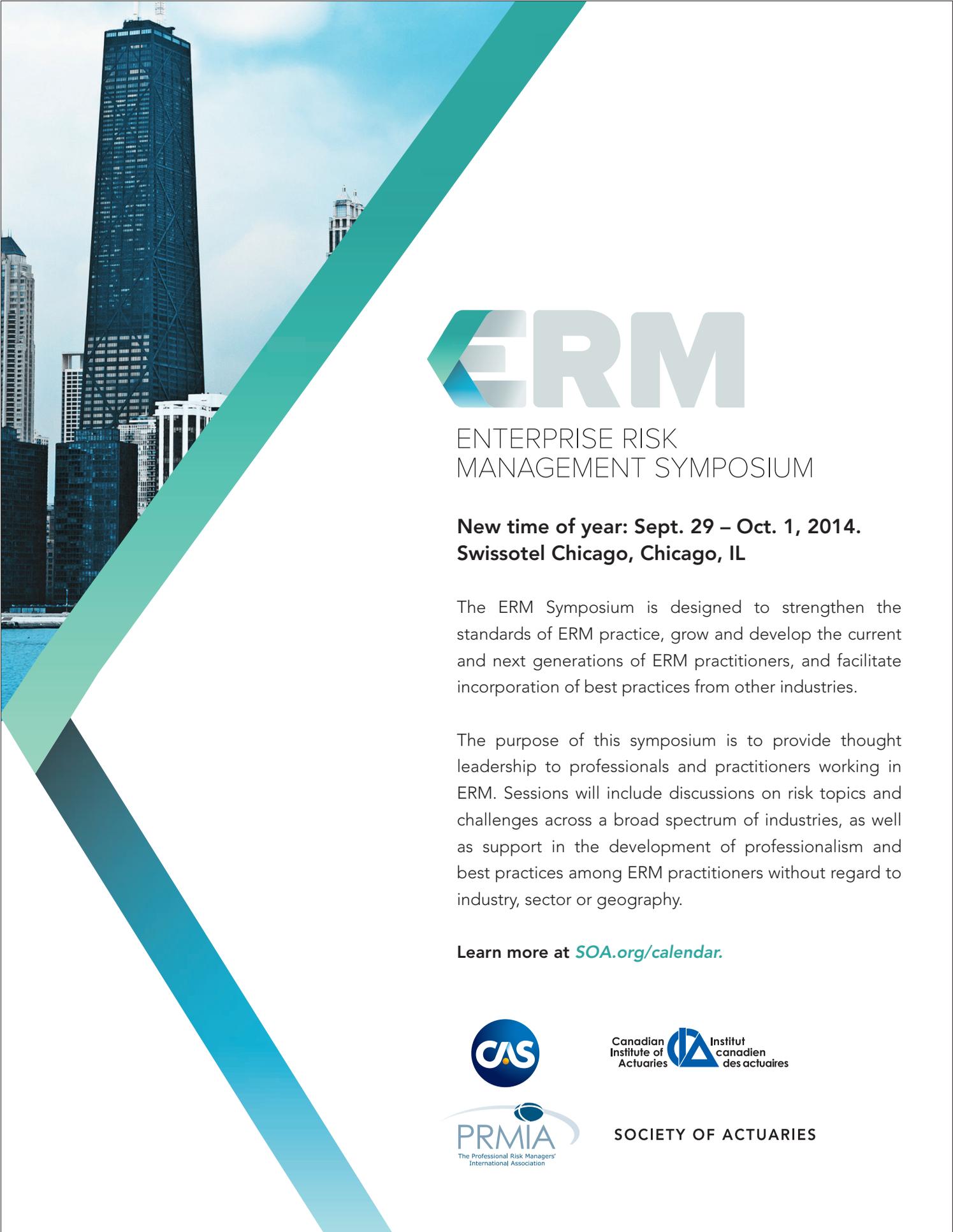
<sup>1</sup> Algorithmic indexes are rules-based, systematic investment strategies that are created to be transparent, liquid and investable. These indexes can, in turn, be packaged into structured notes, OTC swaps and options, and even funds. Algorithmic indexes differ from “trading algorithms” which typically focus on the execution of stocks and baskets of stocks.

**Figure 9: 100% CS Fixed Mean Reversion Overlay (CSEAFMRS) and CS Dynamic Tail S&P (DTSP): Historical Performance December 2009 – March 2014**



**Figure 10: 12 month Rolling Correlation between CS Fixed Mean Reversion Overlay (CSEAFMRS) and CS Dynamic Tail S&P (DTSP): December 2009 – March 2014**





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# Downside of Prudential Regulation: Lower Liquidity

By Ira Jersey

**IN ORDER TO COMPLY WITH BASEL CAPITAL RULES**, many financial institutions had to choose to raise capital and to cut risk weighted assets—including assets that once did not have any risk weighting, but do today. With the implementation of further rules, such as leverage ratios (LR), liquidity coverage ratios (LCR), and net stable funding ratios (NSFR), balance sheets at banks' dealer businesses will likely change even further. Already, trading assets amongst the ten largest U.S. and European firms by trading assets have fallen 17 percent (Exhibit 1) from the 2010 peak. One would suspect balance sheets to be cut further as additional bank rules are implemented.

Rates businesses have been particularly hard hit. From the 2010 peak in trading assets, balance sheets of rates trading books have fallen by nearly one third—some \$200 billion (Exhibit 2). Rates businesses briefly grew as a portion of trading assets in 2011, but over the past two years, fell from over 19 percent of trading assets to less than 16 percent (Exhibit 3). Rates businesses have faced particular pressure due to new regulations concerning over-the-counter derivatives and the leverage ratio—which impact gross balance sheet and do not take into account the risk weight of an asset.

As a portion of revenue, rates businesses have also been shrinking compared with credit and EM businesses (Exhibit 4), which is consistent with the ability of shrinking assets to generate income. Rates basically subsidized other FICC segments in 2008 during the height of the financial crisis with rates totaling 75 percent of FICC revenues.

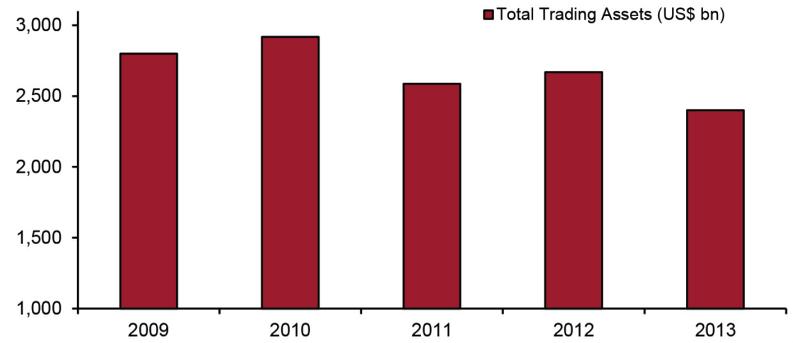
**The implication of the shrinking rates business is that liquidity in some rates related products—including Treasury securities themselves—may be challenged by the smaller balance sheets.** In the pre-Basel III period, dealer balance sheets were relatively elastic so dealers were able to facilitate trading in most fixed income product without dramatic prices moves, unless dealers thought such facilitation would lose them significant revenues. Prices might move around, but the balance sheet was not sticky, particularly for Treasuries and other low risk weighted assets like Agencies and Agency Pass-throughs. If prices fell enough, dealers would be willing buyers of “cheap” paper.

Today it is not as obvious that balance sheets are nearly as elastic. This suggests that in times of mutual fund outflows or risk aversion, markets will become choppier, less liquid and more volatile. The opposite is also true—with smaller balance sheets, dealers do not hold inventory at the levels they once did meaning continued demand will beget continued demand and prices will rise seemingly for little fundamental reason.



## Exhibit 1: Trading assets have been trimmed 17%

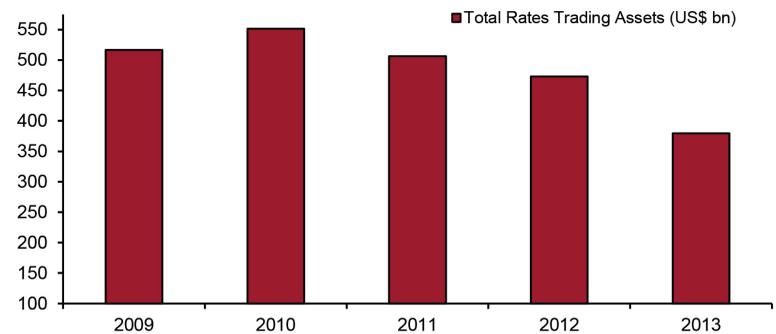
Year-end FICC and Equity Trading Assets for 10 largest US & European banks by trading assets, US\$ bn



Source: Credit Suisse, Company reports

## Exhibit 2: Rates trading assets have fallen by about one third – some \$200 billion

Year-end Rates Trading assets for 10 largest US & European banks by trading assets, US\$ bn



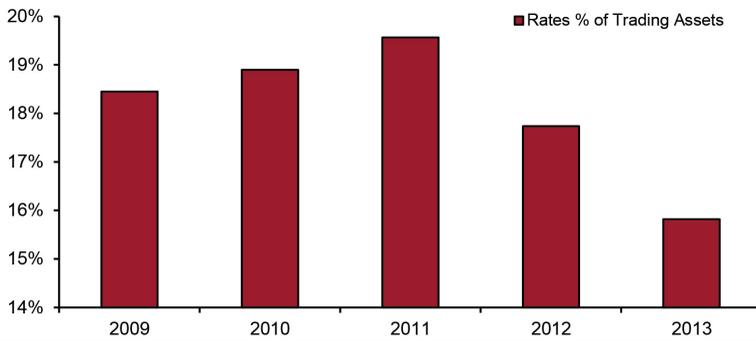
Source: Credit Suisse, Company reports

Source: Credit Suisse, Company reports

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**Exhibit 3: Rates businesses account for less than 16% of trading assets, down from near 20% in 2011**

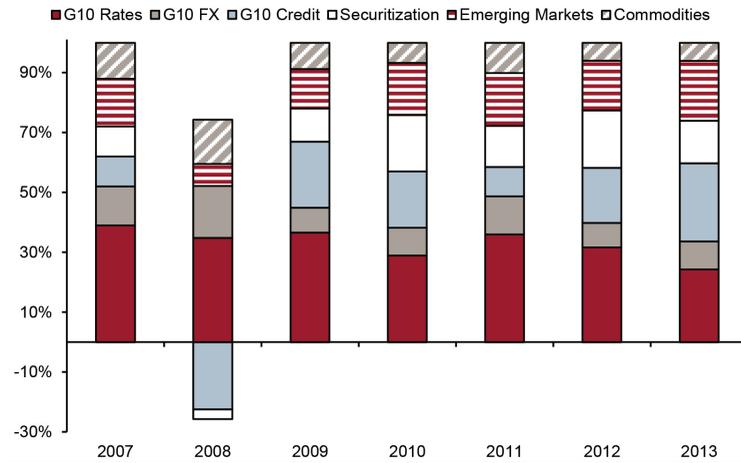
Rates Trading assets as a percent of total trading assets for 10 largest US & European banks by trading assets



Source: Credit Suisse, Company reports

**Exhibit 4: Revenue by FICC business segment, rates shrinking**

For 10 largest US & European banks by trading assets



Source: Credit Suisse, Company reports

In fact, we can empirically see that balance sheets are not very elastic. We use corporates as a case in point because over the last year, dealer balance sheets responded contrary to what one would expect, and indeed hope, from a liquidity perspective. As last year’s heavy bond-fund outflows forced substantial selling of assets on the part of funds, one would have anticipated dealer balance sheets to swell as they stepped up to take down the paper and warehouse the risk as prices fell. This was far from evident, however, as many of the weeks with the most severe outflows from bond funds actually saw dealer balance sheets toward corporates shrink (Exhibit 6).

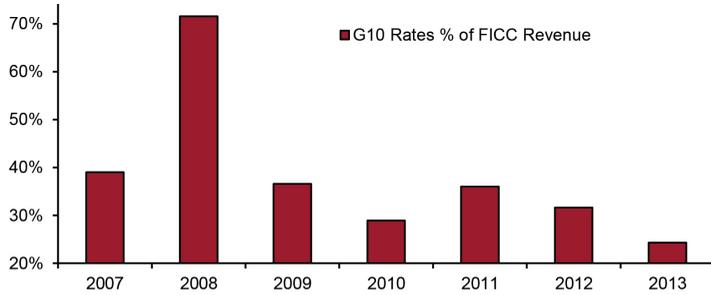
Below we provide a theoretical representation of how dealer balance sheets should react to other market participants’ flows. As noted above, in an ideal environment, if bond funds encounter pressure to liquidate thanks to redemptions, dealers should provide liquidity and be ready to intermediate and warehouse the risk. For a \$1 outflow from bond funds, dealer balance sheets would increase some proportion of that—presented below as \$0.67—over the same timeframe. Similarly, if demand picks up, dealers would be expected to be willing sellers of their inventory, causing balance sheets to contract.

**Last year’s experience (shown in Exhibit 7 as the “New Regime”) suggests that dealers have a reduced capacity to function as safeguards of liquidity.** In reality, we suspect that the relationship may be somewhat steeper—in other words, dealer balance sheets are simply not responsive to large selling on the part of the buy-side, and instead they are more of a pass-through entity of risk than one that warehouses it. Such an environment carries substantial negative implications for broader liquidity, and, correspondingly, the speed of sell-offs. ■

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**Exhibit 5: Rates revenues were 75% of FICC in 2008, down to under 25% today**

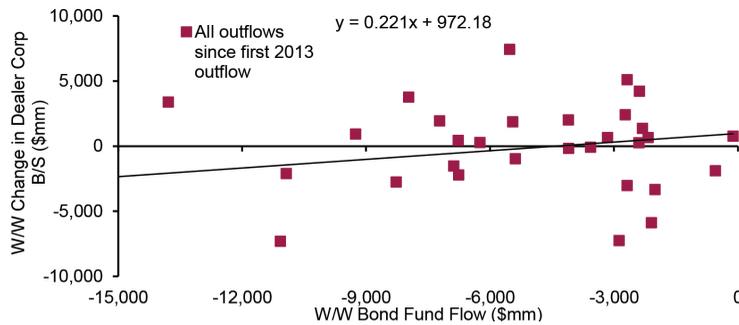
For 10 largest US & European banks by trading assets



Source: Credit Suisse, Company reports

**Exhibit 6: Dealer balance sheets toward corporates failed to expand to accommodate the outflow from bond funds last year**

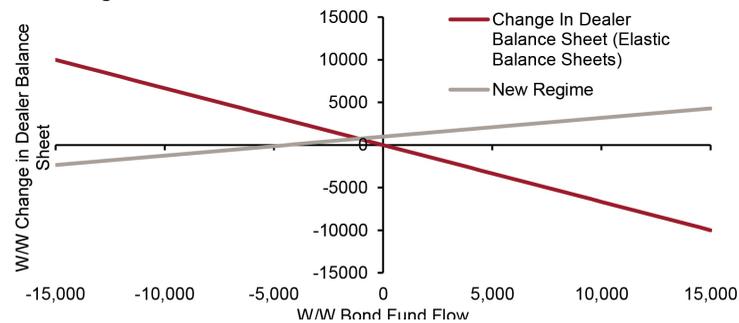
Change in Dealer Balance sheet for weeks with Bond Fund Outflows, from June 2013 to present



Source: Credit Suisse, Company reports

**Exhibit 7: Dealers once had the capacity to expand their balance sheet and buffer fixed income selloffs on buyside selling – this is true today**

Theoretical representation of Dealer Balance Sheet Elasticity under pre-crisis and the new regime



Source: Credit Suisse, Company reports



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# Down But Not Out: A Cost of Capital Approach to Fair Value Risk Margins

By B. John Manistre

Editor's Note: *This is a conceptual introduction to a much longer technical paper with the same title to be presented at the 2014 ERM Symposium.*

## INTRODUCTION

There is a well-known quote, due to George E.P. Box, which goes, "All models are wrong but some are useful."<sup>1</sup> All of the methods outlined in this article take this concept to heart in the sense that the model structures themselves recognize that the models are wrong and will require adjustment as new information becomes available. The models are therefore intended to be applied in the context of a principles based, fair valuation system where continuous model improvement is an integral part of the process. One possible application would be to an internal economic capital model or an Own Risk and Self-Assessment (ORSA) process.

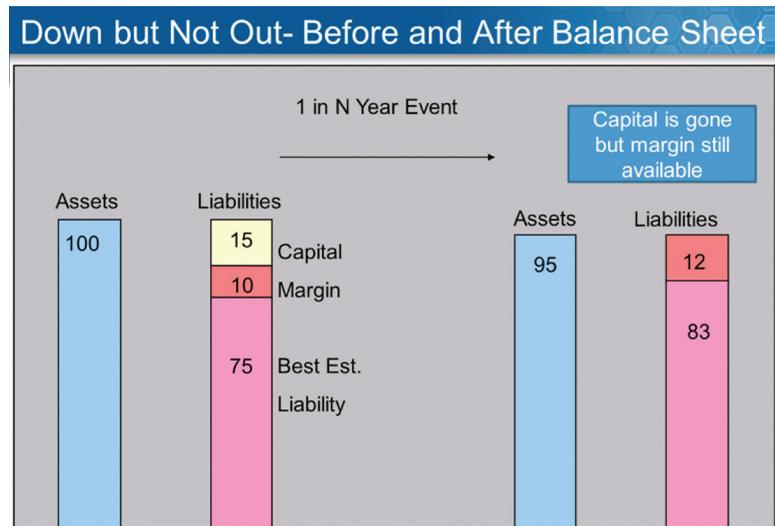
The cost of capital concept itself has been part of actuarial culture for many decades and this paper assumes the reader already has some familiarity with the idea. At a high level, the idea is that if a contract requires the enterprise to hold economic capital in the amount  $EC$  then we need to build an annual expense  $\pi EC$  into the value of the contract to price in the risk. The quantity  $\pi$  here is the cost of capital rate and it can vary from application to application. For non-hedgeable life insurance risk a typical cost of capital rate is  $\pi = .06$ .

## THREE THEMES

There are three themes or common denominators that run through all of the methods presented in the complete research paper. These are (1) Down but not out, (2) Linearity and (3) The basic risk modeling process.

### 1 - Down but not Out

The idea is that if a 1 in N year event wipes out the economic capital of a risk enterprise there should still be enough risk margin on the balance sheet that the company can either attract a new investor to replace the lost capital or, equivalently, pay a similar healthy enterprise to take on its obligations. The chart at the top of column 2 illustrates the idea graphically.



On the left side of the chart we see the risk enterprise's economic balance sheet at the beginning of the year. The right side of the chart shows the fair value balance sheet after a bad year. As a result of both poor experience in the current year and adverse assumption revisions all of the economic capital is gone. The risk enterprise is down. However, the economic balance sheet is still strong enough that it can either attract a new investor to replace the lost capital or pay another enterprise to take on its obligations i.e., the risk enterprise is not out because appropriate risk margins are still available.

This is clearly a desirable theoretical property for a model to have. In order to actually work in practice the revised balance sheet on the right must have enough credibility with the outside world that a knowledgeable investor would actually put up the funds necessary to continue. One way to get the needed credibility is for the actuarial profession to devel-



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op standards of practice that are rigorous enough for the shocked balance sheet to be credible.

## 2 - Linearity

All of the methods considered here can be formulated as systems of linear stochastic equations. This has two very general consequences.

1. As is well known, a linear problem usually has a dual version. If you can solve the primal problem you can also solve the dual to get the same answer. In this case the primal version of the problem looks like an “actuarial” calculation where we project capital requirements into the future and then compute margins as the present value of the cost of capital.

As formulated here, the dual version of the problem looks more like a “financial engineering” calculation. The process above is reversed by starting with a concept of risk neutral or risk loaded mortality, lapse etc. and then determining the corresponding implied economic capital by seeing how the margins unwind over time.

Put another way, if the present value of margins  $M$  and the economic capital  $EC$  are related by an equation of the form

$$\frac{dM}{dt} = (r + \mu)M - \pi EC,$$

then the primal version of the method starts by projecting  $EC$  and then uses the above relation to calculate margins by discounting. The dual approach calculates  $M$  first and then uses a version of the relation above to estimate an implied economic capital  $EC$ .

2. A second useful consequence of using linear models is that they allow us to avoid the “stochastic on stochastic” issue that bedevils many other approaches to the margin issue. Linear models can be calculated scenario by economic scenario. Any errors we make by ignoring the “stochastic on stochastic” nature of the problem average out to zero when we sum over a large set of risk neutral scenarios.<sup>2</sup>

With this result we can develop the cost of capital ideas in a simple deterministic economic model, and be confident that the results developed will continue to apply when we go to a fully stochastic economic model.

Looking at the dual approach gives us both new theoretical insight and an alternative way to compute any given model. In particular, the dual approach adds transparency in the sense that it tells us what the implied “risk neutral” assumptions for mortality, lapse etc. are.

For any particular application, the primal and dual approaches are equivalent but can differ in practice for a variety of reasons. One of the paper’s general conclusions is that solving the primal problem works well for simple applications but the dual approach can be preferable as the complexity of the application increases. The main problem with the dual approach is the effort required to understand why the theory works. The actual implementation is not that difficult.

We take the view that both the primal and dual versions of a model should make theoretical sense and this leads to a critique of some approaches. For example, the primal version of the prospective model used in Europe usually looks simple and reasonable but the dual version may not. This is illustrated in the main paper by looking at the example of a lapse supported insurance product. It is possible for the dual problem to exhibit negative risk loaded lapse rates. We offer a modification to the method, as well as several other approaches, that can resolve this issue.

## 3 - The basic risk modeling process

This article assumes a three step process for putting a value on non-hedgeable risk. In a bit more detail, the steps are:

1. Develop a best estimate model that is appropriate to the circumstances of the application. Detailed discussion of this step is outside the scope of even the main paper although we do provide a number of examples from life insurance. The key assumption we make is that our best estimate models are not perfect and are subject to revision.

**“The risk enterprise is not out because appropriate risk margins are still available.”**

2. Hold capital and risk margins for a contagion event i.e., the risk that current experience may differ substantially from our best estimate.

Imagine, for the sake of clarity, that our best estimate model is a traditional actuarial mortality table. Even if our table is right on average, we could still have bad experience in any given year. The classic example of a contagion event would be a repeat of the 1918 flu epidemic—hence the name contagion risk.

More recent examples of contagion risk events would be the North American commercial mortgage meltdown in the early 1990s<sup>3</sup> and the well-known problems with the U.S. residential mortgage market that led to the financial crisis of 2008.

A risk enterprise should have sufficient capital and margins that it can withstand a plausible contagion event and still be able to continue as a going concern without regulatory intervention. We show that traditional, static, risk loadings in our parameters can usually deal with this issue.

3. Hold capital and margins for parameter risk: new information might arrive in the course of a year that causes the risk enterprise to revise one or more models. To the extent these model revisions cause the fair value of liabilities to increase, we need economic capital to absorb the loss. Again we need a margin model that allows the risk enterprise to withstand the loss and carry on without regulatory intervention. To deal with this issue, we introduce the concept of a dynamic margin which arises naturally out of the dual approach.

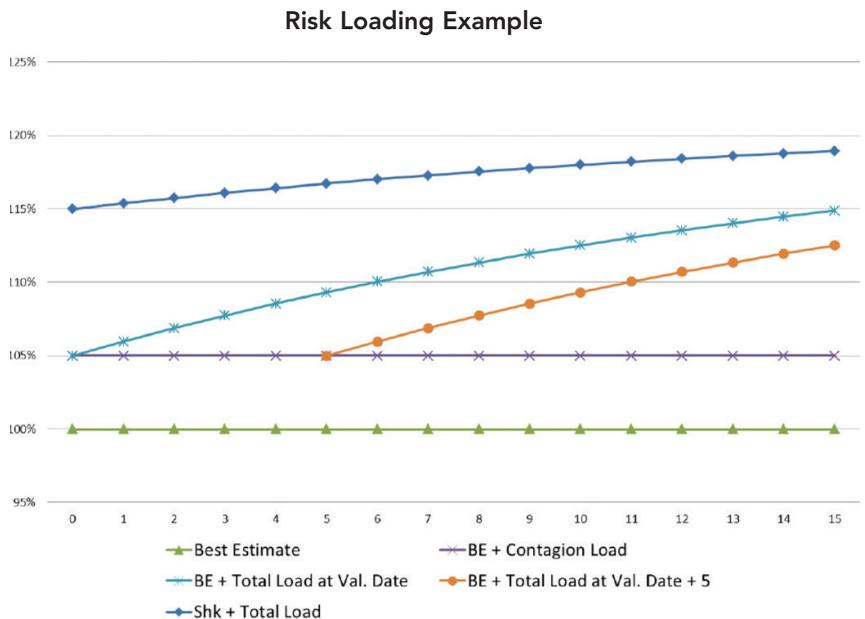
Static and dynamic loadings differ in the way margin gets released into income over time. If best estimate assumptions are realized, then any static margin emerges as an experience gain in the current reporting period. The risk loading is engineered so that the resulting gain is equal to the cost of holding capital for contagion risk. This is what most actuaries would expect.

By contrast, a dynamic margin is a time dependent loading to a parameter which is equal to zero at the valuation date and then grades to an ultimate value we discuss later. There is very little experience gain in the

current reporting period. The risk margin gets released into income by pushing out the grading process as time evolves i.e., when we come to do a new valuation, we establish a new dynamic margin which restarts from zero at the new valuation date. If we get the math right, this process releases the correct amount of margin to pay for the cost of holding economic capital for parameter risk, while still leaving sufficient margin on the balance sheet for the future.

Chart 1 below shows a simple example of the risk loading ideas introduced above.

In this example we have a model parameter whose best estimate value is  $\theta_0 = 100\%$  and a static contagion loading of 5% has been added. At the valuation date



( $t = 0$ ), we have added a dynamic load that takes the parameter up to the value of 115% over a 15 year period. This is the parameter path used to compute a fair value. A shocked fair value is calculated assuming a shocked path that starts at 115% (base + 10%) and then grades to about 119%. Economic capital, for parameter

CONTINUED ON PAGE 30

risk, is the difference between the shocked and base fair values.

When we come to do a new valuation five years later, the contagion loading has not changed but the dynamic loading for parameter risk has been recalculated to start at zero again. The risk margin released into income, if the assumptions do not change, is engineered to provide a target return on the risk capital.

### SUMMARY

A high level summary of the paper's theory is that the cost of capital method for calculating risk margins is, for most practical purposes, equivalent to using an appropriate combination of static and dynamic risk loadings.

The process described above is much easier to implement than it looks. The full paper discusses a number of reasonable simplifying assumptions that allow the risk loaded parameters to be calculated fairly easily. None of the methods discussed require any computationally expensive "stochastic on stochastic" or "projection within projection" algorithms.

Two additional versions of this paper are available for further reading: 1) a condensed version which summarizes the theory of this approach and provides several practical examples, and 2) a full detailed theoretical development. The condensed version is available on the Risk Management website at: <http://www.soa.org/Professional-Interests/Joint-Risk-Management/Joint-Risk-Management-Section.aspx>. The full version of the paper is forthcoming, and will be introduced at the SOA ERM Symposium in September 2014. ■

### ENDNOTES

- <sup>1</sup> George E.P. Box (FRS) in 1987.
- <sup>2</sup> This is a standard result in stochastic calculus which is outlined in the main technical paper.
- <sup>3</sup> This was caused by the overbuilding of office space during the 1980's in many North American cities. When the oversupply became apparent, office rents plummeted. This dragged down property values and triggered defaults on many of the mortgages used to finance the office towers.



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# Risks of Measuring Risk: Dodd-Frank Stress Testing May Give False Security

By Patrick Richard, Esq.

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**WHILE THE RECENT DODD-FRANK STRESS TEST RESULTS OF THE NATION'S 30 BIGGEST BANKS MIGHT SEEM REASSURING, PRUDENT POLICY MAKERS AND PRACTITIONERS SHOULD BE WARY.** Like airport security, many are asking, "Are we safer?" After all, the only thing worse than no security is bad security that creates a false sense of security. But concerns should not simply be focused on the possibility of accounting errors, even the \$4 billion mistake reported by BofA in late April.

Five years after the failure of IndyMac Bank—followed by the failure of Lehman Brothers, the collapse of hundreds of depository banks and the ensuing financial and credit crises—financial institutions are grappling with the Dodd-Frank Wall Street Reform and Consumer Protection Act and its implementing regulations. One of the tools intended to identify weaknesses early on is rigorous stress testing with "severe scenarios."

From the board room to the court room, decisions made on the basis of stress tests will have real consequences—for the industry, for banks and for individuals. Reliance on stress test results, however, even Federal Reserve-sponsored stress test scenarios, may do little more than create a false sense of security—especially for practitioners whose conduct may be harshly judged in the next downturn.

Appropriate risk management must acknowledge:

- 1) the likelihood that stress tests overlook or underestimate key risks;
- 2) that systemic-focused stress testing cannot substitute for prudent transaction-based analysis; and
- 3) that false assurance of flawed stress testing will lead to greater risk-taking. These risks—and not the risk of mis-reporting—pose the greatest threat and cause for caution regarding Dodd-Frank's stress test regime.

## OVER-LOOKED AND UNDER-APPRECIATED RISKS

Although the Fed keeps the details of its stress test models a secret to prevent gaming the test, several cur-



rent risks fall outside adequate modeling. These risks include the extreme concentration of assets held by bigger banks, the magnification and impact in a crisis of interdependence and the related risks of an apparent credit bubble.

## CONCENTRATION OF RISK

Whether a single bank's high concentration of home construction loans or the consolidation of bigger banks, concentration of risk carries the potential for devastating loss. Federal guidelines expressly address concentration risk for a bank's balance sheet, but offer no guidelines as to systemic concentration and consolidation

## INTERDEPENDENCE

Stress testing assumes a set of crisis-like conditions to evaluate an entity's response. But a major limitation of any stress testing is the uncertainty of which variables are independent of those tested and which are not. For example, a stress test may assume a drop of property or other asset values of 20 percent but conclude that the bank's capital and liquid-



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CONTINUED ON PAGE 32

ity is sufficient to withstand that occurrence. The test will assume as relatively constant the sources of liquidity, whether credit facilities, deposits or investments. Overlooked and unmeasured, of course, is the fact that in a crisis all of these other sources of presumed capital and liquidity will also be severely impacted, especially in the short run.

### ASSET BUBBLES AND FEAR

Behavioral economists like Nobel laureate professor Robert Shiller have for years described the risks and uncertainties of asset bubbles—having observed in June 2005 for example that the California housing bubble would have no “soft landing.” Many credible observers suggest that the Fed’s prolonged low rate policy has created something of a new credit bubble, unsustainable even in the near term. (See, e.g., “Six Years of Low Interest Rates in Search of Some Growth,” *The Economist*, 4-6-13). Indeed, recent history teaches that prolonged low interest rates have contributed to major asset bubbles, followed by dramatic price collapse and downturn.

Just as “irrational exuberance” will drive a market higher than its historical valuation metrics, fear may drive an inflated market far lower than modeling anticipates. Current stress testing does not appear to differentiate whether any particular bank’s assets are more susceptible to the overvaluation of bubble conditions.

Another overlooked risk is simply the unpredictability of the timing and severity of a crisis event, whether a financial crisis or tsunami—what economist Nassim Taleb described as a ‘black swan’ event—events which themselves often depend on a consensus of safety.

### SYSTEMIC-FOCUSED STRESS TESTING AND ENTERPRISE RISK MANAGEMENT

Stress testing is not designed to evaluate the strength of particular assets or the efficacy of key risk functions, such as loan origination, at a particular institution. Rather, stress testing is similar to what many banks described pre-crisis as “enterprise risk management” or ERM.

At IndyMac Bank, for example, its “enterprise risk” philosophy caused it to use billions of dollars of insured depository funds to originate home loans that

no prudent bank would retain on its own balance sheet. Instead of saying no to these high-risk, document-light loans, IndyMac assumed that it could originate and sell the loans indefinitely into the secondary market. When that market stopped buying, IndyMac was left with billions of dollars of losses on loans that it could not sell, swamping its risk-based capital.

Managing risks on an “enterprise” level generally presumes a level of predictable performance over an identified period of time for similar asset classes. For example, a correlation between default rate and loan loss is determined, depending on the risk-rating assigned to particular assets. A pool of loans with an average FICO score of 660 may carry a predicted default rate of 4 percent to 5 percent. But such “risk management” ignores the phenomenon that higher-risk assets are higher-risk in large part because performance under stress is far more unpredictable. Losses may occur more quickly, and more severely, than the straight linear progression the risk managers assumed.

In other words, for high-risk assets, the “worst case” is never the worst case. Quantifying the unpredictable nature of future behaviors is dicey, both for particular transactions and across an entire institution or industry. Stress tests, of course, necessarily make assumptions as to the impact of adverse changes to selected variables, such as asset values. Not only may particular assumptions understate risk, the economic modeling of stress testing may actually compound and obscure rather than reveal the imbedded risks and uncertainties of the institution’s practices.

### FALSE ASSURANCE WILL LEAD TO GREATER RISK-TAKING

Stress testing cannot substitute for standards that require sound underwriting of each risk on an individual basis. The risk-dilution benefits of hedging activities such as securitizations, for example, have now been shown to be largely illusory viewed systemically. As the Office of the Comptroller of the Currency has noted in its Dodd-Frank guidance, stress testing is just one tool available for risk assessment. Rather than relying on hedging, dilution and presumed diversification, prudent risk management of depository institutions should follow “safe and sound” standards and simply pass on particular transactions that fail to meet these standards.

“As Warren Buffet has reminded us, when the tide goes out we see who was swimming naked. But blaming the economy for the fall-out of bad decisions would be like blaming the tide for swimming without a bathing suit.”

The unintended consequence of the current stress testing, however, may be to increase rather than decrease inappropriate risk-taking by depository and other regulated institutions. Just as a flawed annual physical may cause a chain-smoking patient not to cut back, flawed stress-testing may lead to greater risk-taking. Excessive reliance on stress test outcomes will almost certainly underestimate risk and create an inappropriate level of confidence, either as to the depth, duration or likelihood of the negative economic scenario. Dodd-Frank’s focus on capital adequacy and formulaic stress testing falls far short of addressing the fundamental confluence of economic factors and industry practices that gave rise to IndyMac and other failures.

The stress test results announced in March were followed in April with BofA’s discovery of a \$4 billion “accounting” error. While some have cried foul, adequate controls present a challenge for every complex business. Error alone, even material changes requiring a restatement of prior financials, is not cause to criticize rigorous stress testing. Better controls will catch many such potential errors. But beyond the proliferation of written policies and reporting that follows new regulations like Sarbanes-Oxley or Dodd-Frank, the question ought to be whether we’re safer, not simply whether our accounting is more accurate.

Indeed, all of the major institutions, from IndyMac to Lehman Bros., purported to rely on some form of

“stress testing.” If the conclusion learned from these failures is the belief that “better” stress testing will avoid similar catastrophes in the future, we are almost certainly creating a false sense of security.

Banking practitioners and market participants may find their conduct today viewed tomorrow through the eyes of the Securities Exchange Commission, shareholders or jurors. When the high risk of individual loans, investments and other transactions is explored with such hindsight, the errors of judgment may seem obvious. Reliance on stress test results, even those mandated by Dodd-Frank, will not provide a silver bullet defense. As Warren Buffet has reminded us, when the tide goes out we see who was swimming naked. But blaming the economy for the fall-out of bad decisions would be like blaming the tide for swimming without a bathing suit.

Despite many laudable aspects of Dodd-Frank, including stronger balance sheet requirements, stress testing is a limited tool. The better lesson learned from the recent financial crises should be a healthy skepticism of stress tests and other economic models, and of “enterprise risk management,” in favor of sound practices and processes to evaluate the risk of each asset and the wisdom of each potential transaction. After all, the tide eventually will go out. ■

## SOA ELECTIONS 2014

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# Seventh Risk Manager Survey of Emerging Risks

By Max J. Rudolph

**OVER THE PAST YEAR THERE HAS BEEN** lots of publicity about cyber security risk. Data breaches and NSA surveillance may be top of mind, but a host of emerging risks show concerning signs and interaction possibilities. In the 7<sup>th</sup> survey of emerging risks, a group of risk managers shared their thoughts about current and future risks. Trending up are risks surrounding greater regulatory focus and cyber security, with oil price shock trending down as supplies have picked up.



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Emerging risks look across longer time horizons, 10 years or more, and for outliers that would create disruption to business as usual. An earthquake in Los Angeles or a hurricane in Miami could be a horrific event for those living through it, but historical data shows the likelihood of such events to be high when viewed across centuries or millennium. Emerging risks look at events like plague or space weather that tend not to be considered when making business decisions. These risks evolve over many years, so one would expect stability in risks considered.

Over five years have passed since Bear Stearns and Lehman Brothers ceased to be independent. While many risk managers are concerned about the calm in today's markets, the truth is that they have more time to think about risks that might not impact them for 10 years than they did in 2009. This shows up in trend data and the concentration of risk combinations.

In the year since the previous survey, equity markets and oil prices continued their trend upward, while the dollar reversed course and strengthened versus the Euro. Here are the top six responses, when asked for the top five emerging risks (percentages based on number of surveys).

1. Financial volatility (59%)
2. Cyber security/interconnectedness of infrastructure (47%)

3. Blow up in asset prices (30%)
4. Demographic shift (30%)
5. Failed and failing states (29%)
6. Regional instability (29%)

This represents shifting pattern away from geopolitical and economic categories and toward technological, societal and environmental. Here are the top five choices from a year ago.

1. Financial volatility (62%)
2. Regional instability (42%)
3. Cyber security/interconnectedness of infrastructure (40%)
4. Failed and failing states (33%)
5. Chinese economic hard landing (31%)

## TOP FIVE

There were some interesting shifts in the 2013 emerging risk results. While the Economic category of risks continues to be the top choice (when up to five emerging risks were selected) ahead of the Geopolitical, Societal, Technological and Environmental categories, its relative importance continues to drop (33% after a peak of 47% in 2009). The risk *Oil price shock* has fallen consistently in this survey (lower for four consecutive years, down from 31% in 2012 to 7% this year) as oil supply improved due to reduced Middle East tensions and new sources coming on-line in North America. Finishing second (with 27%, down from 32%), Geopolitical risks were mostly down. *Transnational crime and corruption* (8% up from 5%) increased but three risks, *Proliferation of weapons of mass destruction (WMD)* (5% down from 14%), *Failed and failing states* (29% down from 33%) and *Regional stability* (29% down from 42%) all decreased at least 4%. The last two listed remain in the top five choices overall. Other risks with new highs across the survey history were *Natural catastrophes: Severe weather* (11%), *Liability regimes/regulatory frameworks* (23% up from 8%) and *Cyber security/interconnectedness of infrastructure* (47%, second overall). New lows were recorded by risks *Oil price shock* (7%), *Chinese economic hard landing* (28%), *Financial volatility* (59%) and *Proliferation of weapons of mass destruction* (5%).

“What will come next? What emerging risks will we deal with next year, five years from now, or 20 years from now? How will they interact with other risks and events? How will you prepare?”

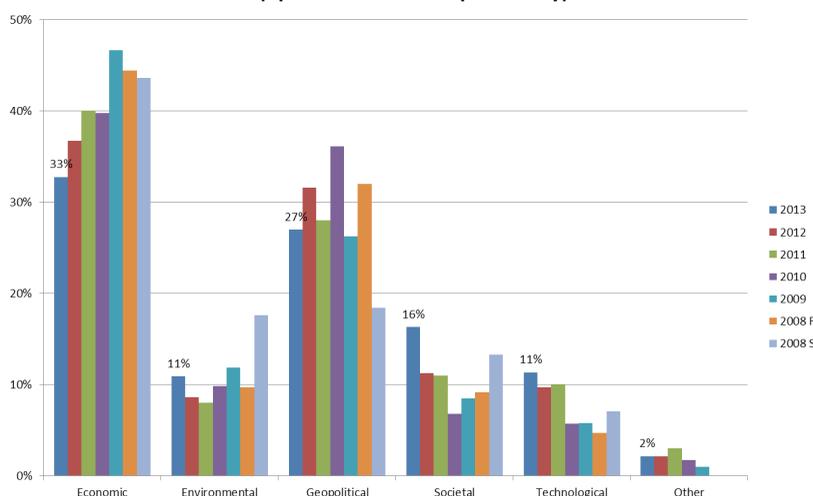
Cyber security has been a risk of growing importance, trending up from 21% in 2009 to this year’s survey where 47% listed it among their top five emerging risks. With the revelations of the National Security Agency (NSA) surveillance program and retail store Target’s breach of confidential credit card information, this heightened awareness has been justified and provided warning of the need for awareness and mitigation of this risk. Prior survey analysis has focused on anchoring, where respondents get pulled toward recent events. This year results do not confirm these tendencies, and the cyber security results point toward a predictive quality of the survey.

As this report was written in early 2014, extreme weather had impacted the United States and the United Kingdom has experienced torrential rains. China had been damaged by an earthquake and Australia by wildfires. The financial world was deleveraging and unwinding the central bank taper. Regional tensions were relatively tame as Russia hosted the Winter Olympics and cyber hacking had become routine. Then came the Ukrainian geopolitical situation. What will come next? What emerging risks will we deal with next year, five years from now, or 20 years from now? How will they interact with other risks and events? How will you prepare?

All articles and research reports can be found at:

<http://www.soa.org/Research/Research-Projects/Risk-Management/research-emerging-risks-survey-reports.aspx>

**Emerging Risks by Category**  
(up to 5 risks chosen per survey)



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# Risk management