JOINT RISK MANAGEMENT SECTION

Canadian Institute of Actuaries
Casualty Actuarial Society
Society of Actuaries

ISSUE 23 ■ DECEMBER 2011

Risk management

Actuaries
Risk is Opportunity.®

Risk management

Issue Number 23 • DECEMBER 2011

Published by the
Society of Actuaries

This newsletter is free to section members. Current issues are available on the SOA website (*www.soa.org*).

To join the section, SOA members and non-members can locate a membership form on the Risk Management Web page

JOINT RISK MANAGEMENT SECTION

Canadian Institute of Actuaries
Casualty Actuarial Society
Society of Actuaries

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 Ross Bowen, editor, at *Ross.Bowen@allianzlife.com*.

The next issues of *Risk Management* will be published:

PUBLICATION DATES	SUBMISSION DEADLINES
March 2012	December 1, 2011
August 2012	May 1, 2012
December 2012	September 3, 2012

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.

Please send an electronic copy of the article to:

Ross Bowen, FSA, MAAA
Allianz Life Insurance Co. of North America
ph: 763.765.7186
e: Ross.Bowen@allianzlife.com

Letter from the Editors

By Ross Bowen and Pierre Tournier

WELCOME TO THIS ISSUE OF *RISK MANAGEMENT!*

We have a variety of papers this time covering different branches of risk management. First, "Managing Systemic Risk in Retirement Systems" by Minaz H. Lalani discusses ways to mitigate the negative impacts caused by the shifting of retirement obligations towards the individual. The author lays out steps for major stakeholders (government, employer, financial institution, and employee) to help prepare for this shift.

Next, Pablo Fernandez, Javier Agirreamalloa, and Luis Corres have a paper called "Market Risk Premium used in five countries in 2011: a survey with 6,014 answers." This paper shows the size of market risk premium by country and respondent. There's also an interesting excerpt of participant's responses that provides further insight into these figures.

Martin Eling and Hato Schmeiser present "Report on the CAS COTOR Risk Premium Project Update." This article summarizes the work done by the Committee on Theory of Risk within CAS. This project is a follow up of an initial project done in 1999 whose mission was a review of the research of risk assessment in property-casualty insurance.

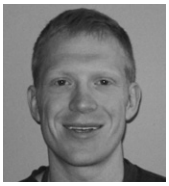
Moshe Milevsky and Huaxiong Huang's article, "Spending Retirement on Planet Vulcan: The Impact of Longevity Risk Aversion on Optimal Withdrawal Rates," speaks about the impacts of risk management to the individual. The article discusses how risk aversion and a guaranteed income stream (pension or annuity) influence an individual's optimal consumption rate over time.

Dave Ingram and Michael Thompson present "Changing Seasons of Risk Attitudes." Their article shows how a firm's economic outlook can influence its success. The article also relates how this outlook can influence risk managers within that firm.

Finally, we have a book review of *Mastering Operational Risk,* by Tony Blunden and John Thirwell. This book is geared towards the individual who is moving into an operational risk position or who needs to become better acquainted with the structure and goals of an operational risk management department.

Enjoy this issue. ■

Ross Bowen, FSA, CFA, MAAA, is vice president, profitability management at Allianz Life Insurance Co. of North America in Minneapolis, Minn. He can be reached at *Ross.Bowen@allianzlife.com.*



Pierre Tournier, FSA, CERA, is an assistant actuary in the Profitability Management area at Allianz Life Insurance Company in Minneapolis. He can be reached at *pierrectournier@hotmail.com.*

Where are your ERM blind spots?

By Stuart Wason

WE ALL HAVE THEM. We may not want to admit that they might exist. We tend to focus on what we have, not on what we might be missing. What well intended incentives might be in play that are misaligning intended behaviors and leading to unexpected consequences and perhaps systemic risk? I am of course referring to our ERM blind spots. Have you given thought to where yours might lie?

We tend to learn from past mistakes. With each crisis or ERM challenge, we identify the problems and change our practices for the future. Inevitably, changing ERM practices (whether they be individuals, companies or regulators) lead to shifting incentives in markets. With the pace of change increasing by leaps and bounds and the inter-connected nature of the world in which we live, it is important that ERM include deliberate consideration of its own blind spots.

Stuart F. Wason, FSA, CERA, FCIA, MAAA, HONFIA, is senior director at the Office of the Superintendent of Financial Institutions Canada in Toronto, ON. He can be reached *stuart.wason@osfi-bsif.gc.ca.*

Blind spots can occur for many reasons. One might occur due to an over-reliance on a single risk metric. No doubt you have heard the debates over use of VaR or TVaR (CTE). What about the use of different time horizons—quick shocks versus modeling longer term ripple effects? How about reliance on regulatory Pillar 1 measures versus your own independent modeling of the risks and also various Pillar 2 (e.g., ORSA, stress test) type techniques? Which valuation measures, consistently applied across your business, provide a more useful basis for decision making—amortized cost, past experience, current market experience, others, etc.? Will the markets of tomorrow behave as they have in the past (e.g., dependencies, volatility etc)? Will human behavior, individually and collectively, change in the face of future crises? These are just a few examples of key ERM assumptions which need to be continuously reviewed. Over-reliance on one answer to each of these questions can leave us open to an ERM blind spot.

Your section council recently met to consider our services to you, our members, in the coming year. You will be hearing more about the programs we propose in the coming months but our goal is to encourage research and discussion on topics such as ERM blind spots. The planning for the spring 2012 ERM Symposium in Washington DC is well underway and I highly recommend this successful event as an excellent opportunity for ERM learning and networking with experts from a range of ERM perspectives. In addition to our research program, newsletters and sponsoring of ERM sessions at many actuarial meetings, we plan on outreach to regional actuarial clubs. We are particularly excited about a planned series of planned one hour webinars through the coming year on topics such as credit risk, market risk (including ALM), group/conglomerate issues and ORSA. In conducting these webinars, the JRMS focus will be on the ERM aspects of the subjects and we will collaborate with other specialist groups/sections to provide the technical aspects of these topics.

I do hope that you will find value in your JRMS membership this year. I also hope that you will spread the word to your colleagues not only of the JRMS programs but more fundamentally that ERM is a necessary part of our daily lives, for personal and business decision making. The current ongoing global crisis, which has been more severe and long-lasting than many would have expected, is a clear example of the importance of ERM for all decision makers, not just CRO's. Where are your ERM blind spots? ■

Managing Systemic Risk in Retirement Systems

By Minaz H. Lalani

Editor's Note: This essay originally appeared in the "Systemic Risk, Financial Reform, and Moving Forward from the Financial Crisis" essay e-book.

RETIREMENT SYSTEMS ARE BUILT ON THREE FOUNDATIONAL PILLARS:

- employer-sponsored pensions
- government pensions
- pensions provided by personal savings.

Historically, the total pension consists of the following distribution: 50 percent coming from employer-provided pensions; 25 percent from government benefits; and the remaining shortfall of 25 percent being provided from personal savings[1].

Employer-sponsored pensions have gradually been shifting pension risk[2] to individuals by moving from defined benefit plans to defined contribution plans[3]. The effect is that the portion contributed by employer-sponsored pensions toward the retirement pillar is expected to be significantly reduced to around 30 percent (from 50 percent). In addition, government pensions are under review and the long-term expectation is that government pensions will be reduced, or paid at a later retirement age so as to reduce the cost of these government programs. The anticipated shortfall (in excess of 50 percent), due to the reduction in employer-sponsored and government pensions, is expected to be recovered from personal savings.

For the short to medium term, employers and the government will be transferring the provision of retirement to individuals who will be ill-equipped to have adequate savings for retirement[4]. The inadequacy of savings will be compounded by the fact that individuals will require more savings as a result of increased life expectancy, transfer of post-retirement medical costs onto individuals, and the expectation of lower investment returns in the "new normal" world[5]. In combination, these trends will yield unintended consequences. In my view, without any explicit actions, these trends will result in social unrest (society may not accept these changes), sociological impact (e.g., society will have declining living standards), organizational workforce impact (employees will be unable to afford retirement, thus working longer and deferring their retirement age), institutional impact (financial companies will have to restructure their product offerings) and restructuring of the economy (financial regulators will have to deal with the decline of corporate defined benefit pension plans as a major player in the financial market).

In this essay, potential actions are recommended for key stakeholders to manage the unintended consequences of a systemic risk "brewing" within the retirement system today.

Minaz Lalani, FSA, CERA, FCIA, FCA, is a consulting actuary and managing principal at Lalani Consulting Group in Calgary, Canada. He can be contacted at *minaz@lalanicg.com*.

GOVERNMENTS

In countries where a pay-as-you-go approach is used to deliver government pensions, it is imperative that such governments stay at arm's length and facilitate a process to fund future pension obligations through a separate trust apart from the general revenues of the government. Countries may want to adopt Canada's approach, as it has in place an effective working model consisting of a separate trust and robust governance structure. In addition, all countries should remove uncertainty and have a long-term policy clearly articulated in legislation that states the level of government pension, which individuals can expect to receive. This would allow individuals and their pension advisors to better focus on retirement planning for the future. Since the expectation is that individuals should be directly responsible for a significant portion of their retirement income, governments could also provide meaningful incentives (e.g. tax credits) to individuals who attain a threshold level of savings for adequate retirement as prescribed (after collaboration and agreement with pension experts), or to individuals who participate and complete a certain prescribed set of educational courses on retirement planning. Governments could consider sponsorship of voluntary programs to facilitate provision of retirement for small to medium size companies who currently do not provide pensions to their employees[6].

CONTINUED ON **PAGE 6**

Managing Systemic Risk in Retirement Systems | from Page 5

EMPLOYERS

In most countries, it is a fact that employers have been moving to defined contribution plans. This is due to increasingly complex pension funding rules and unclear, ambiguous surplus ownership rules for defined-benefit plans. The result has been the underfunding of pension plans to minimize future actuarial surpluses. It may be too late to reverse the trend away from defined benefit plans; however, simplicity and clarity of pension legislation could slow the trend. Most employers have introduced auto-enrolment, auto-deductions and other auto-features in defined contribution plans to ensure that their employees adequately save for retirement. This is a great start; however, the underlying issue is that employer contributions to defined-contribution plans are significantly less than defined-benefit plans. Employers should be voluntarily asked to revisit their defined contribution plan designs and mirror the aggregate contributions paid into the defined benefit plans. Failing that, minimum defined contributions should be legislated so that all employers contribute toward an employee's retirement account whether it is in a registered/qualified or non-registered/non-qualified account. Of course, there will be push-back and resistance from employers, but governments need to consider the long-term social and societal impact of inadequate retirement income. Some forward-looking employers may welcome such an initiative, as it could allow such organizations to effectively manage their workforce. In other words, employers will be able to develop robust growth plans to manage attrition and retirement in a socially acceptable manner (employees would have adequate income to retire on).

FINANCIAL INSTITUTIONS

Investment managers/counsellors, life insurance companies and trust companies are key stakeholders in the retirement industry. Traditionally, each of them has fulfilled an important role of managing assets and/or administering defined benefit pension plans. Also, in the emerging defined contribution market, these stakeholders have continued to be major players fulfilling similar roles. However, these institutions need to switch their focus on delivering innovative retirement and investment products, and implementing creative retirement educational programs. For example, an innovative retirement retail product would allow employees to manage their longevity risk and crystallize their retirement income by an annual/periodic purchase of deferred annuities over the employee's working lifetime. Creative retirement education programs could incorporate dynamic modelling of employee's retirement income, taking into account employee's income from all sources, and incorporating expenses from personal data and comparative mainstream data. Currently, pension funds are very active in the financial markets from an investment and governance standpoint. With the decline of defined-benefit plans, and subsequently the maturity (pension outflows will exceed contribution, expenses and investment) of these plans, there will be a material impact on the role of pension funds in the financial marketplace. It would be prudent for market regulators to anticipate the consequences and develop strategies for a revised financial infrastructure.

INDIVIDUALS

Retirement risk has the most impact on individuals who have to make provision for their retirement either as pension plan members or non-pension members, and as citizens who have to fund government pensions directly (via pension contributions) or indirectly (via tax payments). Unfortunately, individuals do not have the ability to take actions to minimize systemic risk. However, individuals can take steps to understand their personal affairs and make adequate provision to save for retirement. An individual can be helped with retirement with proper education from the government, employer and financial institutions (as stated earlier). Collectively, individuals who care about retirement risks can vote out non-performing governments, or choose their employer, however, this is a "tall-order" and it is easier said than done.

At present, we do not "appear" to be in an immediate crisis mode on retirement, therefore, none of the above approaches may seem relevant. Unfortunately, retirement risk is an emerging and "silent" systemic risk; such a risk if left unaddressed, will creep into our society with damaging consequences. Prudence dictates that all stakeholders should take immediate action to evaluate the systemic risk posed by a retirement crisis. ■

ENDNOTES:

[1] For simplicity, the rounded percentages are determined on a generalized framework of pensions in Canada for a career individual earning $55,000 with 35 years of service. Of course, such percentages will differ by salary bands, service periods, and eligibility to government pensions and by country. Despite this, the commentary in this essay is still applicable for most circumstances and for other countries with a mature retirement system.

[2] Pension Risk: a complex and multi-faceted concept. It incorporates the following key risks: investment, interest rate, inflation, salary, longevity, demographic, retirement adequacy, governance and regulatory.

[3] Defined-Benefit Plan: a plan which provides a pension based on a defined accrual formula based on years of service and salary history; usually, an employer will take most of the pension risk (e.g. volatility of on-going contributions, or payment of any solvency deficiency) related to such a plan. Defined Contribution Plan: a plan based on a defined-contribution formula, which grows with investment return over the individual's working period to provide an accumulated fund for provision of pension; usually the individual is responsible for most of the pension risk (e.g. investment risk) related to such a plan.

[4] Canadian Institute of Actuaries (2007), Planning for Retirement: Are Canadians Saving Enough? CIA and University of Waterloo.

[5] "New Normal" is the phrase coined by PIMCO to describe an economic environment of de-leveraging, re-regulation and de-globalization resulting in slower, long-term economic growth.

[6] Ambachtscheer, Keith (2008), "The Canada Supplementary Pension Plan, Towards an Adequate, Affordable Pension for All Canadians", C.D Howe Institute Commentary No. 265.

Market Risk Premium used in 56 countries in 2011: a survey with 6,014 answers

By Pablo Fernandez, Javier Aguirreamalloa and Luis Corres

THIS PAPER CONTAINS THE STATISTICS OF THE EQUITY PREMIUM OR MARKET RISK PREMIUM (MRP) USED IN 2011 FOR 56 COUNTRIES. We got answers for 85 countries, but we only report the results for 56 countries with more than six answers.

Most previous surveys have been interested in the Expected MRP, but this survey asks about the Required MRP. The paper also contains the references used to justify the MRP, comments from persons that do not use MRP, and comments from persons that do use MRP.

1. MARKET RISK PREMIUM (MRP) USED IN 2011 IN 56 COUNTRIES

We sent a short email (see exhibit 1) in March and April 2011 to about 19,500 email addresses of finance and economic professors, analysts and managers of companies obtained from previous correspondence, papers and webs of companies and universities. We asked about the Market Risk Premium (MRP) used "to calculate the required return to equity in different countries". We also asked about "Books or articles that I use to support this number."

By April 24, 2011, 3,998 of the answers provided a specific MRP used in 2011.[1] Other 2,016 persons answered that they do not use MRP for different reasons (see table 1). We would like to sincerely thank everyone who took the time to answer us.

Table 2 contains the statistics of the MRP used in 2011 for 56 countries. We got answers for 85 countries, but we only report the results for 56 countries with more than six answers[2]. Fernandez et al (2011a)[3] is an analysis of the answers for the United States; it also shows the evolution of the Market Risk Premium used for the United States in 2011, 2010, 2009 and 2008 according to previous surveys (Fernandez et al, 2009, 2010a and 2010b)[4]. Fernandez et al (2011b) is an analysis of the answers for Spain.

Pablo Fernandez, is professor of finance at IESE Business School in Madrid, Spain. He can be reached at fernandezpa@iese.edu.

Prof. Javier Aguirreamalloa, is lecturer in the financial management department at IESE Business School in Madrid, Spain. He can be reached at *JAguirreamalloa@iese.edu*.

Luis Corres, is a research Assistant in the financial department at IESE Business School in Madrid, Spain. He can be reached at *lcorres@iese.edu*.

Table 1. MRP used in 2011: 6,014 answers

	Professors	Analyst	Companies	Total
Answers reported (MRP figures)	850	1,462	1,562	3,874
Outliers	41	12	71	124
Answers that do not provide a figure	731	310	975	2,016
Total	1,622	1,784	2,608	6,014

Answers that do not provide a figure:

"I think about premia for particular stocks"	137	5	39	181
"MRP is a concept that we do not use"			390	390
"I use whatever MRP is specified in the textbook"	31			31
"The CAPM is not very useful nor is the concept of MRP"	145		76	221
"I did not have to use an estimate of the MRP in 2011"	38			38
"I am an academic, not a practitioner"	17			17
"I teach derivatives: I did not have to use a MRP"	39			39
"The MRP changes every day", "weekly" or "monthly"	34	102		136
"It is confidential"		16	83	99
Use a Required Return to Equity	71	38	22	131
Use a minimum IRR	36		242	278
Use multiples	41	127	89	257
Other reasons	142	22	34	198
SUM	731	310	975	2,016

Table 2. Market Risk Premium used for 56 countries in 2011

	Average	Median	St. Dev.	Q1	Q3	P10%	P90%	Max.	Min.	No. of answers
United States	5.5	5.0	1.7	4.5	6.0	4.0	7.0	15.0	1.5	1,503
Spain	5.9	5.5	1.6	5.0	6.0	4.5	8.0	15.0	1.5	930
United Kingdom	5.3	5.0	2.2	4.0	6.0	4.0	7.2	22.0	1.5	112
Italy	5.5	5.0	1.4	4.6	6.1	4.0	7.2	10.0	2.0	76
Germany	5.4	5.0	1.4	4.5	6.1	4.0	7.2	12.4	3.0	71
Mexico	7.3	6.4	2.7	5.9	9.1	5.0	10.2	16.0	1.4	56
Netherlands	5.5	5.0	1.9	4.4	6.2	3.9	7.2	12.5	2.5	48
France	6.0	6.0	1.5	5.0	7.0	4.8	7.2	11.4	2.0	45
Switzerland	5.7	5.5	1.3	5.0	6.6	4.0	7.2	9.6	3.8	44
Australia	5.8	5.2	1.9	5.0	6.0	4.0	7.1	14.0	3.0	40
Colombia	7.5	7.0	4.3	5.5	8.0	2.0	14.6	20.5	2.0	38
Sweden	5.9	5.5	1.4	5.0	7.2	4.8	7.2	10.6	3.9	38
Russia	7.5	6.5	3.7	5.5	8.0	5.0	11.0	25.0	1.3	37
Canada	5.9	5.0	2.1	5.0	6.0	4.0	8.0	14.5	3.5	36
Brazil	7.7	7.0	4.6	5.3	8.0	4.3	10.5	30.0	1.5	35
Greece	7.4	7.2	2.7	5.0	8.3	5.0	11.7	15.0	3.0	34
South Africa	6.3	6.0	1.5	5.6	6.5	5.0	7.0	11.8	4.5	34
Argentina	9.9	9.0	3.4	8.0	11.0	7.2	14.6	20.0	5.0	33
Portugal	6.5	6.1	1.7	5.0	7.2	5.0	7.2	14.0	4.5	33
Austria	6.0	5.7	1.8	5.0	7.2	4.6	7.2	14.3	3.5	32
Belgium	6.1	6.1	1.0	5.0	7.2	5.0	7.2	8.0	5.0	31
Chile	5.7	5.3	2.1	5.0	6.0	5.0	6.5	15.0	1.3	31
China	9.4	7.8	5.1	6.5	10.7	6.0	14.5	30.0	4.0	31
Norway	5.5	5.0	1.6	4.5	6.0	4.0	7.0	11.7	3.5	30
India	8.5	7.8	2.8	6.8	9.3	6.0	13.1	16.0	5.0	28
Poland	6.2	6.0	1.1	5.2	7.5	4.9	7.5	8.0	4.5	28
Turkey	8.1	8.2	3.0	5.5	10.0	5.0	11.2	15.0	2.5	25
Luxembourg	6.1	6.1	1.3	5.0	7.2	4.5	7.2	8.7	4.5	21
Czech Republic	6.1	6.0	0.9	5.5	6.5	5.0	7.3	8.0	5.0	19
Peru	7.8	7.5	2.8	6.6	7.7	5.4	10.0	15.0	3.5	19
Finland	5.4	4.7	2.0	4.5	5.0	4.5	7.4	12.0	3.5	18
Israel	5.6	5.0	1.7	4.5	6.0	4.3	7.4	10.0	3.0	17
New Zealand	6.0	6.0	1.0	5.0	6.8	5.0	7.2	7.5	5.0	17
Taiwan	8.9	8.0	3.8	6.0	10.0	6.0	13.4	20.0	5.8	17
Indonesia	7.3	7.5	2.3	5.6	7.5	5.0	10.8	12.0	4.5	14
Japan	5.0	3.5	3.7	3.5	5.0	3.2	7.1	16.7	2.0	14
Korea (South)	6.4	6.5	2.5	6.5	7.0	2.6	8.8	11.1	2.0	13
Denmark	5.4	4.5	3.3	4.4	4.5	3.1	9.3	14.0	2.0	12
Egypt	7.6	7.0	2.3	7.0	7.6	6.6	10.4	13.0	3.5	12
Ireland	6.0	5.1	2.2	5.0	5.6	5.0	7.8	12.3	5.0	12
Singapore	5.7	5.0	1.5	5.0	5.8	5.0	7.3	9.6	4.5	11
Hong Kong	6.4	5.0	2.6	5.0	6.0	5.0	10.4	11.9	5.0	9
Hungary	8.0	8.0	2.4	6.0	8.0	6.0	9.2	13.8	6.0	9
Malaysia	4.5	3.5	2.2	3.5	6.0	3.1	6.8	8.8	1.5	9
Thailand	7.9	6.5	2.8	6.5	7.5	6.5	10.2	15.1	6.5	9
Saudi Arabia	6.3	6.0	0.4	6.0	6.6	6.0	6.8	7.0	6.0	8
Nigeria	6.9	6.0	1.6	6.0	7.1	6.0	8.9	10.0	6.0	7
Pakistan	6.3	7.5	2.3	6.3	7.5	3.6	7.5	7.5	1.5	7
Iran	22.9	19.5	17.8	12.0	24.0	8.5	40.8	56.5	7.0	6
Kazakhstan	7.5	7.5	0.1	7.5	7.5	7.5	7.6	7.6	7.5	6
Kenya	6.2	5.0	2.9	5.0	5.0	5.0	8.5	12.0	5.0	6
Kuwait	6.6	6.5	0.2	6.5	6.5	6.5	6.8	7.0	6.5	6
Philippines	5.6	5.5	0.2	5.5	5.5	5.5	5.8	6.0	5.5	6
UAE	9.7	10.0	0.8	10.0	10.0	9.0	10.0	10.0	8.0	6
Zambia	6.6	6.0	1.6	6.0	6.0	6.0	7.9	9.8	6.0	6
Zimbabwe	6.5	5.5	2.4	5.5	5.5	5.5	8.5	11.4	5.5	6

Figures 1 and 2 are graphic representations of the MRPs reported in table 2.

2. DIFFERENCES AMONG PROFESSORS, ANALYSTS AND MANAGERS OF COMPANIES

Table 3 shows the differences for the 34 countries that had at least two answers for each category (professors, analysts and managers of companies).

3. REFERENCES USED TO JUSTIFY THE MRP FIGURE

1,173 respondents indicated which books, papers… they use as a reference to justify the MRP that they use (375 of them provided more than a reference). Table 4 contains the most cited references.

4. COMPARISON WITH PREVIOUS SURVEYS

Table 4 of Fernandez et al (2011a) shows the evolution of the Market Risk Premium used for the United States in 2011, 2010, 2009 and 2008 according to previous surveys (Fernandez et al, 2009, 2010a and 2010b).

Welch (2000) performed two surveys with finance professors in 1997 and 1998, asking them what they thought the Expected

CONTINUED ON **PAGE 10**

Market Risk Premium... | from Page 9

Figure 1. Market Risk Premium used in 2011 for some countries (plot of answers)

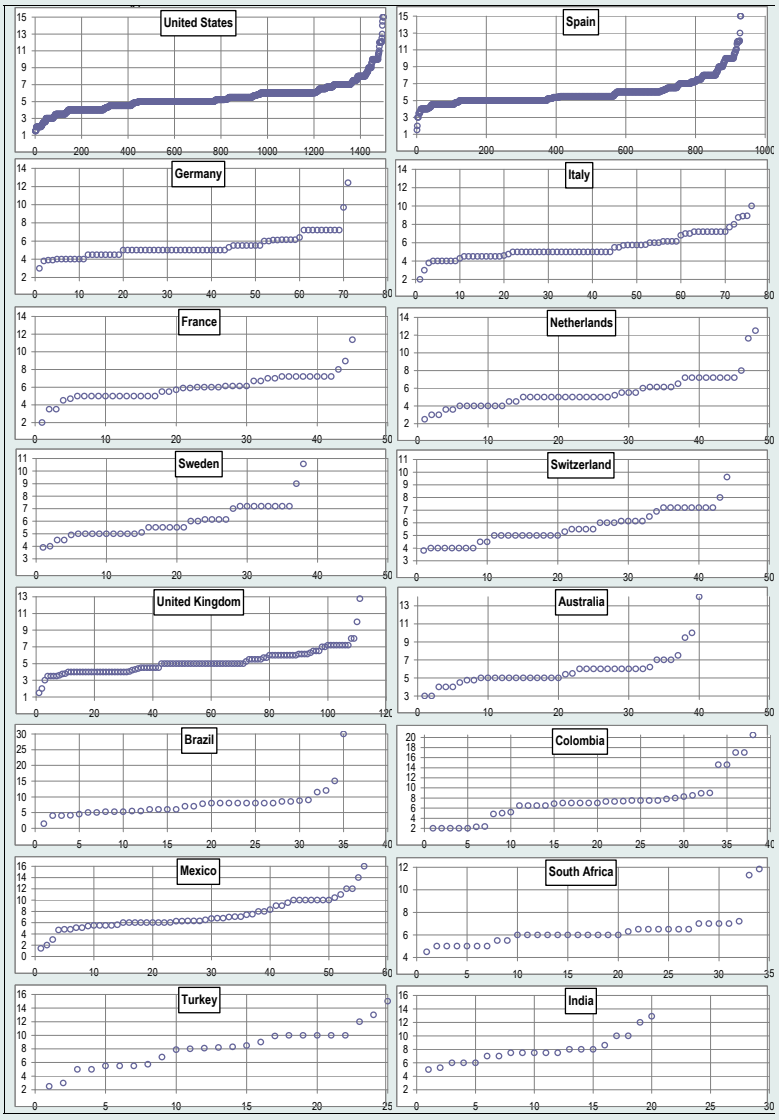


Figure 2. Market Risk Premium used in 2011. Average, median and dispersion of the answers by country
P90%: percentile 90%. P 10%: percentile 10%

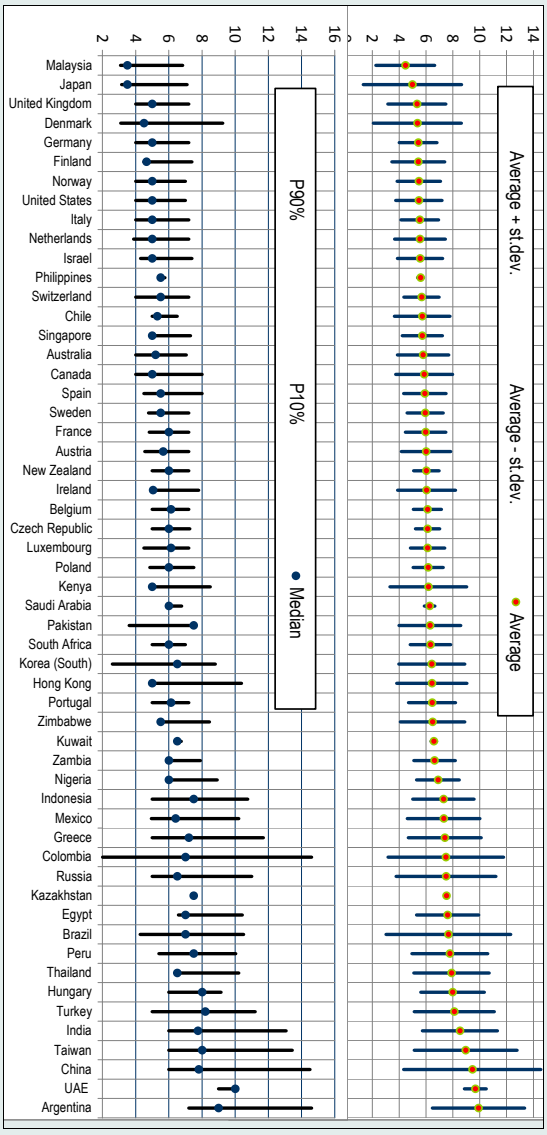


Table 3. Market Risk Premium used for 34 countries in 2011 by professors, analysts and managers of companies

	Average			Median			Number of answers			Standard deviation		
	prof.	anal.	comp.	prof.	anal.	comp.	prof.	anal.	comp.	prof.	anal.	comp.
United States	5.7	5.0	5.5	5.5	5.0	5.2	522	330	651	1.6	1.1	2.0
Spain	5.5	5.6	6.1	5.5	5.0	5.5	92	305	533	1.0	1.3	1.8
United Kingdom	5.6	5.4	4.9	5.0	5.0	5.0	20	68	24	4.0	1.6	1.1
Italy	5.1	5.7	5.7	5.0	5.0	5.0	21	40	15	1.3	1.4	1.4
Germany	4.9	5.7	4.8	5.0	5.0	5.0	8	47	16	0.8	1.6	0.6
Mexico	10.6	6.6	6.8	10.0	6.0	6.3	9	25	22	2.7	1.6	2.9
Netherlands	5.2	5.9	4.6	4.5	5.5	4.0	12	29	7	2.5	1.6	1.7
France	5.1	6.2	5.9	5.5	6.1	5.7	6	26	13	1.7	1.7	1.0
Switzerland	5.2	5.9	5.1	5.0	6.0	5.0	8	29	7	1.0	1.4	0.9
Australia	6.2	5.4	6.5	6.0	5.0	6.0	15	21	4	2.5	1.1	2.5
Colombia	6.7	5.7	10.1	7.4	7.0	8.2	5	19	14	2.6	2.4	5.5
Sweden	6.2	6.0	5.4	6.0	5.8	5.0	5	26	7	1.6	1.4	0.7
Canada	5.9	5.5	6.2	5.3	5.0	5.1	12	12	12	1.8	1.7	2.8
Brazil	6.6	7.3	8.3	6.0	8.0	7.0	5	14	16	1.3	3.3	6.1
Greece	8.9	6.3	9.3	8.6	6.1	9.5	7	21	6	3.9	1.5	3.2
South Africa	5.8	7.0	5.9	5.5	6.5	6.0	3	13	18	1.0	2.1	0.7
Argentina	10.4	8.7	10.8	9.5	8.3	9.0	10	12	11	4.1	1.7	4.1
Portugal	8.0	6.0	7.2	6.9	6.1	6.5	6	24	3	3.2	1.0	1.2
Austria	4.8	6.3	5.3	4.8	6.1	5.5	2	23	7	0.4	2.0	0.9
Belgium	5.6	6.1	6.1	5.6	6.1	6.0	2	22	7	0.9	1.0	1.2
Chile	6.1	5.2	6.5	6.0	5.3	5.5	5	17	9	0.2	0.4	3.8
China	8.9	7.9	10.9	9.0	6.5	8.0	8	10	13	3.6	2.5	7.0
Norway	5.0	5.9	5.2	5.0	5.8	5.0	2	13	15	0.0	2.3	0.8
India	7.3	8.0	10.1	7.0	7.5	9.0	9	9	10	1.5	2.3	3.5
Poland	6.2	6.1	6.2	5.5	6.0	6.1	3	13	12	1.5	1.3	0.9
Turkey	11.3	7.8	7.5	12.0	8.4	8.1	3	12	10	2.1	2.3	3.5
Czech Republic	5.8	6.2	6.1	5.8	6.5	5.8	2	10	7	0.3	0.9	1.1
Peru	6.5	7.5	8.4	6.5	7.5	7.2	2	9	8	2.1	0.7	4.3
Finland	6.0	4.8	6.1	6.0	4.5	5.0	3	9	6	1.0	1.4	2.9
New Zealand	6.0	5.6	6.6	5.5	5.0	6.7	3	8	6	1.3	0.9	0.7
Taiwan	11.3	7.1	8.4	9.3	6.0	8.0	6	6	5	5.1	2.6	1.8
Japan	3.0	6.0	4.6	3.0	3.5	5.0	3	7	4	1.0	5.0	0.8
Korea (South)	4.0	7.2	8.5	3.5	6.5	8.5	4	7	2	2.4	1.7	0.7
Egypt	10.0	7.5	5.5	10.0	7.0	5.5	2	8	2	4.2	1.3	2.8

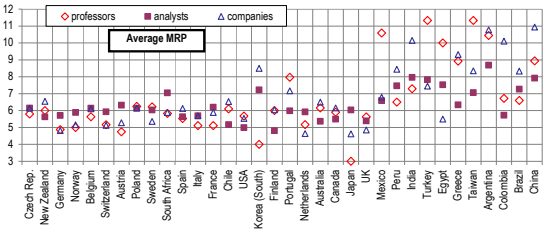


Table 4. References used to justify the Market Risk Premium

References	Professors	Analysts	Companies	Total
Ibbotson/Morningstar	53	31	172	256
Damodaran	72	34	114	220
Internal (own) estimate	15	84	67	166
Analysts/Inv. Banks	16	25	80	121
Experience, subjective, own judgement	57	23	28	108
Bloomberg	7	44	47	98
Historic data	45	15	33	93
Fernandez	26	6	31	63
Duff&Phelps	2	0	34	36
Surveys, conversations,...	12	3	18	33
DMS	13	3	15	31
Grabowski/Pratt's and Grabowski	1	5	24	30
Brealy & Myers	14	4	8	26
Mckinsey, Copeland	5	4	15	24
Internet	2	2	16	20
CFA books	2	9	6	17
Reuters	0	6	10	16
Ross/Westerfield	13	0	1	14
Fama and French	10	0	3	13
Siegel	5	0	5	10
Others*	142	47	135	324
I do not justify the number/do not answer	173	151	185	509
SUM	685	496	1.047	2.228

*Among them: CDS, Internet, Reuters, Siegel, Bodie, Kane, Marcus, Implied MRP, Economic Press, Datastream, Malkiel, Sharpe, Brigham, Consensus, IMF, RWJ, Shapiro, Kaplan, Shiller, Welch.

CONTINUED ON **PAGE 12**

Market Risk Premium... | from Page 11

Table 5. Comparison of previous surveys

	Surveys of Ivo Welch					Fernandez et al (2009, 2010)			
	Oct 97– Feb 98*	Jan-May 99+	Sep 2001**	Dec. 2007#	January 2009++	US	Europe	US	Europe
Number of answers	226	112	510	360	143	487	224	462	194
Average	7.2	6.8	4.7	5.96	6.2	6.3	5.3	6.0	5.3
Std. Deviation	2.0	2.0	2.2	1.7	1.7	2.2	1.5	1.7	1.7
Max	15	15	20	20		19.0	10.0	12.0	12.0
Q3	8.4	8	6	7.0	7	7.2	6.0	7.0	6.0
Median	7	7	4.5	6.0	6	6.0	5.0	6.0	5.0
Q1	6	5	3	5.0	5	5.0	4.1	5.0	5.3
Min	1.5	1.5	0	2		0.8	1.0	2.0	2.0

*30-Year Forecast. Welch (2000) First survey
+30-Year Forecast. Welch (2000) Second survey
**30 year Equity Premium Forecast (Geometric). "The Equity Premium Consensus Forecast Revisited" (2001)
#30-Year Geo Eq Prem Used in class. Welch, I. (2008), "The Consensus Estimate for the Equity Premium by Academic Financial Economists in December 2007". http://ssrn.com/abstract=1084918
++In your classes, what is the main number you are recommending for long-term CAPM purposes? "Short Academic Equity Premium Survey for January 2009". http://welch.econ.brown.edu/academics/equpdate-results2009.html

MRP would be over the next 30 years. He obtained 226 replies, ranging from 1% to 15%, with an average arithmetic EEP of 7% above T-Bonds[5]. Welch (2001) presented the results of a survey of 510 finance and economics professors performed in August 2001 and the consensus for the 30-year arithmetic EEP was 5.5%, much lower than just three years earlier. In an update published in 2008 Welch reports that the MRP "used in class" in December 2007 by about 400 finance professors was on average 5.89%, and 90% of the professors used equity premiums between 4% and 8.5%.

Johnson et al (2007) report the results of a survey of 116 finance professors in North America done in March 2007: 90% of the professors believed the Expected MRP during the next 30 years to range from 3% to 7%.

Graham and Harvey (2007) indicate that U.S. CFOs reduced their average EEP from 4.65% in September 2000 to 2.93% by September 2006 (st. dev. of the 465 responses = 2.47%). In the 2008 survey, they report an average EEP of 3.80%, ranging from 3.1% to 11.5% at the tenth percentile at each end of the spectrum. They show that average EEP changes through time. Goldman Sachs (O'Neill, Wilson and Masih 2002) conducted a survey of its global clients in July 2002 and the average long-run EEP was 3.9%, with most responses between 3.5% and 4.5%.

Ilmanen (2003) argues that surveys tend to be optimistic: "survey-based expected returns may tell us more about hoped-for returns than about required returns." Damodaran (2008) points out that "the risk premiums

Table 6. Estimates of the EEP (Expected Equity Premium) according to other surveys

Authors	Conclusion about EEP	Respondents
Pensions and Investments (1998)	3%	Institutional investors
Graham and Harvey (2007)	Sep. 2000. Mean: 4.65%. Std. Dev. = 2.7%	CFOs
Graham and Harvey (2007)	Sep. 2006. Mean: 2.93%. Std. Dev. = 2.47%	CFOs
Welch update	December 2007. Mean: 5.69%. Range 2% to 12%	Finance professors
O'Neill, Wilson and Masih (2002)	3.9%	Global clients Goldman

in academic surveys indicate how far removed most academics are from the real world of valuation and corporate finance and how much of their own thinking is framed by the historical risk premiums... The risk premiums that are presented in classroom settings are not only much higher than the risk premiums in practice but also contradict other academic research."

The magazine *Pensions and Investments* (12/1/1998) carried out a survey among professionals working for institutional investors: the average EEP was 3%. Shiller[6] publishes and updates an index of investor sentiment since the crash of 1987. While neither survey provides a direct measure of the equity risk premium, they yield a broad measure of where investors or professors expect stock prices to go in the near future. The 2004 survey of the Securities Industry Association (SIA) found that the median EEP of 1500 U.S. investors was about 8.3%. Merrill Lynch surveys more than 300 institutional investors globally in July 2008: the average EEP was 3.5%.

A main difference of this survey with previous ones is that this survey asks about the Required MRP, while most surveys are interested in the Expected MRP. Exhibits 2 and 3 contain comments from 168 respondents.

5. MRP OR EP (EQUITY PREMIUM): 4 DIFFERENT CONCEPTS

As Fernandez (2007, 2009b) claims, the term "equity premium" is used to designate four different concepts:

1. Historical equity premium (HEP): historical differential return of the stock market over treasuries.
2. Expected equity premium (EEP): expected differential return of the stock market over treasuries.
3. Required equity premium (REP): incremental return of a diversified portfolio (the market) over the risk-free rate required by an investor. It is used for calculating the required return to equity.
4. Implied equity premium (IEP): the required equity premium that arises from assuming that the market price is correct.

The four concepts (HEP, REP, EEP and IEP) designate different realities. The HEP is easy to calculate and is equal for all investors, provided they use the same time frame, the same market index, the same risk-free instrument and the same average (arithmetic or geometric). But the EEP, the REP and the IEP may be different for different investors and are not observable.

The HEP is the historical average differential return of the market portfolio over the risk-free debt. The most widely cited sources are Ibbotson Associates and Dimson et al. (2007).

Numerous papers and books assert or imply that there is a "market" EEP. However, it is obvious that investors and professors do not share "homogeneous expectations" and have different assessments of the EEP. As Brealey et al. (2005, page 154) affirm, "Do not trust anyone who claims to know what returns investors expect."

The REP is the answer to the following question: What incremental return do I require for investing in a diversified portfolio of shares over the risk-free rate? It is a crucial parameter because the REP is the key to determining the company's required return to equity and the WACC. Different companies may use, and in fact do use, different REPs.

The IEP is the implicit REP used in the valuation of a stock (or market index) that matches the current market price. The most widely used model to calculate the IEP is the dividend discount model: the current price per share (P0) is the present value of expected dividends discounted at the required rate of return (Ke). If d1 is the dividend per share expected to be received at time 1, and g the expected long term growth rate in dividends per share, P0 = d1 / (Ke - g), which implies: IEP = d1/ P0 + g - RF (1)

The estimates of the IEP depend on the particular assumption made for the expected growth (g). Even if market prices are correct for all investors, there is not an IEP common for all investors: there are many pairs

CONTINUED ON **PAGE 14**

Market Risk Premium... | from Page 13

(IEP, g) that accomplish equation (1). Even if equation (1) holds for every investor, there are many required returns (as many as expected growths, g) in the market. Many papers in the financial literature report different estimates of the IEP with great dispersion, as for example, Claus and Thomas (2001, IEP = 3%), Harris and Marston (2001, IEP = 7.14%) and Ritter and Warr (2002, IEP = 12% in 1980 and -2% in 1999). There is no a common IEP for all investors.

For a particular investor, the EEP is not necessary equal to the REP (unless he considers that the market price is equal to the value of the shares). Obviously, an investor will hold a diversified portfolio of shares if his EEP is higher (or equal) than his REP and will not hold it otherwise.

We can find out the REP and the EEP of an investor by asking him, although for many investors the REP is not an explicit parameter but, rather, it is implicit in the price they are prepared to pay for the shares. However, it is not possible to determine the REP for the market as a whole, because it does not exist: even if we knew the REPs of all the investors in the market, it would be meaningless to talk of a REP for the market as a whole. There is a distribution of REPs and we can only say that some percentage of investors have REPs contained in a range. The average of that distribution cannot be interpreted as the REP of the market nor as the REP of a representative investor.

Much confusion arises from not distinguishing among the four concepts that the phrase equity premium designates: Historical equity premium, Expected equity premium, Required equity premium and Implied equity premium. 129 of the books reviewed by Fernandez (2009b) identify Expected and Required equity premium and 82 books identify Expected and Historical equity premium.

Finance textbooks should clarify the MRP by incorporating distinguishing definitions of the four different concepts and conveying a clearer message about their sensible magnitudes.

6. CONCLUSION

Most surveys have been interested in the Expected MRP, but this survey asks about the Required MRP.

We provide the statistics of the Equity Premium or Market Risk Premium (MRP) used in 2011 for 56 countries. We got answers for 85 countries, but we only report the results for 56 countries with more than six answers.

Most previous surveys have been interested in the Expected MRP, but this survey asks about the Required MRP. The paper also contains the references used to justify the MRP, comments from 12 persons that do not use MRP, and comments from 33 that do use MRP. Fernandez et al. (2011a) has additional comments (58 do not use MRP, and 110 use it). The comments illustrate the various interpretations of the required MRP and its usefulness.

This survey links with the Equity Premium Puzzle: Fernandez et al (2009), argue that the equity premium puzzle may be explained by the fact that many market participants (equity investors, investment banks, analysts, companies…) do not use standard theory (such as a standard representative consumer asset pricing model…) for determining their Required Equity Premium, but rather, they use historical data and advice from textbooks and finance professors. Consequently, ex-ante equity premia have been high, market prices have been consistently undervalued, and the ex-post risk premia has been also high. Many investors use historical data and textbook prescriptions to estimate the required and the expected equity premium, the undervaluation and the high ex-post risk premium are self fulfilling prophecies.

EXHIBIT 1

MAIL SENT ON MARCH AND APRIL 2011

We are doing a survey about the Market Risk Premium (MRP) that companies, analysts and professors use to calculate the required return to equity in different countries.

We will be very grateful to you if you kindly reply to the following 3 questions.

Of course, no companies, individuals or universities will be identified, and only aggregate data will be made public.

Best regards and thanks,
Pablo Fernandez

"At this very moment we are finalizing the construction of a share index that covers the period 1940 to 2010."

Professor of Finance. IESE Business School. Spain
http://www.iese.edu *http://ssrn.com/author=12696*
3 questions:
1. The Market Risk Premium that I am using in 2011 for my country _____ is: _____%
2. The Market Risk Premium that I am using in 2011 for United States is: _____%
3. Books or articles that I use to support this number:

Comments

EXHIBIT 2
COMMENTS OF RESPONDENTS THAT DID NOT PROVIDE THE MRP USED IN 2011

1. 95% of valuations are executed on multiple basis, i.e. we don't properly calculate a wacc per investment case nor market risk premium
2. We focus on emerging markets. We don't use a formulaic approach to specific country risk and return requirements, and believe that it doesn't adequately account for relative risk or reward. Rather, we look at each country and determine whether there is a compelling real estate opportunity from a perspective of fundamental demand (like Brazil) and which meets our overall return requirements (approximately 20%).
3. Analyst. Europe. Changes every week
4. Germany. We do not apply this methodology in venture capital.
5. In Canada we don't use MRP. The majority of our appraisals are on an orderly liquidation basis. For the few fair market value appraisals, we use remaining useful life formulas.
6. I am fundamentally critical as regards the concept of a risk premium, it mainly serves as a tool to rationalize/ legitimate claims on income in the struggle between creditors and debitors.
7. European Fund. We only invest in European non-listed, private companies. Our required return is not depended on MRPs, we try to get the maximum out of it for our shareholders. A reference for us is the return you get on a savings account of a bank. For the moment this is about 2.5%. So if we get on top of an extra 10 to 15% per year, you are doing fine.
8. We usually calculate cost of equity in US$ and then translate it through PPP to R$.
9. The survey comes to me during the period of Japanese 9.0 earthquake, which I believe have strong impact in Taiwan. Unfortunately up to now no precise estimates for the damage can be obtained.
10. I have to confess that what I have doing in finance area is for my own pleasure. In other words I have made some theoretical research but almost never did not try to calculate 'numbers'. On the other hand my understanding of the problem related to the questions below is a little bit different than benchmark. In particular each 'The MRP ' implies risk characteristics that cover the set of scenarios for which say 'payer' pays more than implied by scenarios. Actually I think that relevant general information can be drawn from CDS and Interest Rate Parity. The MRP are excessively simplified.
11. I believe that the long run risk dynamics of corporations versus sovereigns has altered to the extent that risk has diminished for the former and increased for the latter. South African cost of capital has also been shifting in the past few years with the cost of debt particularly declining. I think slightly higher Price Earnings ratios will be typical in South Africa going forward than the long run market average of around 14x.In Private Equity EBITDA multiples of 7x are common today whereas a few years back 3 to 5x was the norm for deals.
12. No previous study is known of a comprehensive study of the portuguese domestic market. We (3 professors) are developing a 3-year project that aims to estimate our domestic ERP along with an understanding of the reasons that influenced that premium. At this very moment we are finalizing the construction of a share index that covers the period 1940 to 2010.

EXHIBIT 3
COMMENTS OF RESPONDENTS THAT DID PROVIDE THE MRP USED IN 2011

1. Your survey assumes that folks are using the segmented markets approach. I use an International CAPM approach and the MRP on the world market index, which I assume to be 5% from the perspective US dollars. We base also on information provided by surveys (e.g. from KPMG, Roland Berger, and other, or finance articles).
2. In estimating a cost of equity for a company with operations outside of US, we typically consider a country risk premium reflects subject country credit risk from the International Cost of Capital Report 2010, Ibbotson Associates, Inc.

CONTINUED ON **PAGE 16**

Market Risk Premium... | from Page 15

3. Stock market in Egypt has been closed for almost a month now, but just before that my planned MRP based on estimations for Egypt was 3.5%. I'll probably not lower it too much after the revolution since I expect a lot of domestic investment and rebuilding efforts.
4. In Japan, a big seismic hazard is received, and the real estate dealings market is being confused in Japan now. Therefore, I cannot appropriately answer your question now.
5. Professor, UK. I think you're potentially asking the wrong question in that I think we should measure (E(rm) directly rather than the MRP. That seems particularly important in the context of current markets.
6. Professor, Finland. Predicting the market premium by using the survey method for asking the personally subjective opinion on the future market outlooks is not the scientific way.
7. I am working with/using a Long-term risk-free rate of 3%, and a premium of 9%. But note that this is to illustrate cases in teaching and/or Exam assignments! In Sweden the inflation is around 2%. The central banks target is 2%.
8. I use CAPM Model. The Iranian stock Market has showed 46% gain in 2010 and it seems continuing for 2011.
9. For the Euro zone, I use a country risk premium and the german bund rate as a risk free rate in euros.
10. Indonesia. We export mainly to US, Europe, and Japan. The crisis on US affect our export, meanwhile our commodities hardly survive the competition with China commodities. But we still have prospect. We are optimist that our economic growth will increase from 5.7% in 2010 to more than 6.5% at the end of 2011.
11. The Malaysian government securities yield is 2,77% whereas historical market FBMKLIC return (market index) is 4,24% from Jan 1980 to the end of 2009.
12. I dont believe in fixed ERP its a random variable and partially predictable. You can use 10% for my country Cda and US 8%.
13. Pakistan is an emerging market, Its interest rate statistics hardly show any correlation with developing world especially western Europe and United States, Despite higher interest rates, it has witnessed inflation in double digits and depreciation in its currency, Therefore, most monetary economics fails to explain the case of Pakistan and in fact for all emerging economies, The country has a very large undocumented sector, very limited tax base and its policies - for the most part - lately are not set independent of international political pressures.
14. In the case of Japan, true premium should be higher, but risk premium computed by stock return - JGB yield is small. Also this number can change due to the real impact of the current Tsunami and Nuclear problems.
15. The U.S. is higher than Germany and before the earthquake, Japan, but still quite low. The biggest risk is inflation which I normally account for separately – not as part of the country risk premium. In the long run, it is at least 1-3% as a component of the discount rate. Brueggeman and Fisher, Real Estate Finance, has some discussion of principals but no estimates of country risk premium.
16. I anticipate China stock market to increase by around 10% within 2011 while its one-year deposit interest rate stands at 3.5%. It results in a 6.5% of MRP for China. I also project the US stock market to increase by around 5% while the risk free rate of US remains close to zero within 2011.
17. Calculating a MRP for Iran is not straightforward because of unforecastable economic situation. The best thing I can do is narrowing the range of possible rates. The reason for considering 18% as MRP for Iran is that the annual interest rate of bank investments and participation bonds are approximately 14% to 16% (average 15%) announced by the central bank these years. Besides, historical return earned by the market, proxied by the Tehran Stock Exchange (TSE) Index, comes more than 30%. Using a CAPM, these two rates with a market beta of one come to 15% (at least) as MRP. Unlike the other countries that are regaining from the economical crises, here it seems that it takes more time for Iran to revive from recession; that is a personal judgment and should push the premium down. Furthermore, Iranian government is now fulfilling and experiencing a new economical plan which involves cutting subsides and paying peoples directly any savings thereof. This might push the premium up as people expecting more inflation. In my opinion, this MRP goes above 15%. That is why I choose 18%.
18. For international markets from a US perspective we calculate the Cost of Capital per Country Credit

Rating model based upon the International Cost of Capital Report issued by Morninstar.

19. We use the policy potential index from this report to adjust project valuations for country risk. We find this is more useful and more comprehensive for the mines operated by our companies than a credit rating.
20. Please note that while my WACC's in general are high (11-13%) my growth rates are a bit higher also, anywhere from ½ to ¾ the overall long-run growth rate for the Chinese economy of 7-8%.
21. The equity risk premium we use here is 5.0%, historically we have used Ibbotson as a source for ERP minus the Ibbotson and Chen study adjustment, more recently we have joined KPMG ELLP and a 5.0% ERP is the generally applied level for Equity Risk Premium. We do not calculate a specific MRP for Russia based on historical returns on the equity market as Gazprom and the oil majors dominate the index so the applicability of any number is only really applicable to the natural resources sector rather than the broader market. The risk free rate in rouble terms is also a problem as there are no reliable long-term rouble bonds traded so we tend to us Russian Government USD denominated bonds as a basis for the risk free rate and then add a currency risk premium based on the fisher formula, not a perfect solution but it seems to work. We also use Ibbotson for size premium determination.
22. I use 4% for all countries based on the Credit Suisse Global Investment Returns Sourcebook that provide data for 17 countries beginning in 1900
23. Implied equity risk premium from major stock market indexes
24. Please note that if we calculate the real MRP in Italy for the last ten years, the measure is negative. The value is reasonably considered as right only in force of an accepted practice by the main consulting and auditing firms active in Italy. There is no more rational explanation in doing it!
25. This is based on my VC investors' general requirement. Nowadays, US is no longer safer than some Asian emerging markets. Someday, it may even reverse.
26. Financial analyst for belgian institutions. In general I am using a standard WACC of 7,5% to 8%, which is in fact including an average risk premium of 3% to 4,5%. I am using these figures in good and in bad times, in order to get a standard approach. It is obvious that in bad times, risk premiums are high and thus valuations low and in good times low risk premium result in high valuations. I want to go through this phenomenon by using one standard WACC and risk premium.
27. I would say that I think equities are going to outperform bonds by 3% for both US and the Netherlands.
28. Risk premium for US is measured (for me) in £ i.e. is adjusted for expected depreciation in $
29. I tend to like the Dimson Marsh research. Their Triumph of the Optimists is quite a good read as are some of their articles. I tend to agree that Ibbotson tends to overestimate the MRP.
30. We base our total premium at 12%, counting an estimation of 6% inflation for 2011, according to a survey done on our main market, which is environmental services.
31. Comparison of the interest rate that the market establishes for a standard security in the country to the comparable security in the benchmark country.
32. We use a regression on US Dollar denominated sovereign bonds and our in-house risk rating to determine African countries' MRP.
33. This figure is adjusted regularly based on current market levels and recent market performance. The Margin Lending borrowing rate also helps determine the MRP. Our current variable Margin Lending Rate is 9.75%.

REFERENCES

Brealey, R.A., S.C. Myers and F. Allen (2005), Principles of Corporate Finance, 8th edition, McGraw-Hill/Irwin.

Claus, J.J. and J.K. Thomas (2001), "Equity Premia as Low as Three Percent? Evidence from Analysts' Earnings Forecasts for Domestic and International Stock Markets," Journal of Finance. 55, (5), pp. 1629-66.

Damodaran, A. (2008), "Equity Risk Premiums (ERP): Determinants, Estimation and Implications", Working Paper.

Dimson, E., P. Marsh and M. Staunton (2007), "The Worldwide Equity Premium: A Smaller Puzzle," in Handbook of investments: Equity risk premium, R. Mehra, Elsevier.

Fernandez, P. (2007), "Equity Premium: Historical, Expected, Required and Implied", http://ssrn.com/abstract=933070

Fernandez, P. (2009a), "Market Risk Premium Used in 2008 by Professors: A Survey with 1,400 Answers", http://ssrn.com/abstract=1344209

Fernandez, P. (2009b), "The Equity Premium in 150 Textbooks", http://ssrn.com/abstract=1473225

Fernandez, P., J. Aguirremalloa and H. Liechtenstein (2009),

CONTINUED ON **PAGE 18**

Market Risk Premium... | from Page 17

"The Equity Premium Puzzle: High Required Premium, Undervaluation and Self Fulfilling Prophecy". IESE Business School WP. http://ssrn.com/abstract=1274816

Fernandez, P. and J. del Campo (2010a), "Market Risk Premium used in 2010 by Analysts and Companies: a survey with 2,400 answers", downloadable in http://ssrn.com/abstract=1609563

Fernandez, P. and J. del Campo (2010b), "Market Risk Premium Used in 2010 by Professors: A Survey with 1,500 Answers", downloadable in http://ssrn.com/abstract=1606563

Fernandez, P., J. Aguirreamalloa and L. Corres (2011a), "US Market Risk Premium Used in 2011 by Professors, Analysts and Companies: A Survey with 5.731 Answers", downloadable in http://ssrn.com/abstract=1805852

Fernandez, P., J. Aguirreamalloa and L. Corres (2011b), "The Equity Premium in Spain: Survey 2011 (in Spanish)", downloadable in http://ssrn.com/abstract=1822422

Graham, J.R. and C.R. Harvey (2007), "The Equity Risk Premium in January 2007: Evidence from the Global CFO Outlook Survey," Icfai Journal of Financial Risk Management, Vol. IV, No. 2, pp. 46-61.

Harris, R.S. and F.C. Marston (2001), "The Market Risk Premium: Expectational Estimates Using Analysts' Forecasts," Journal of Applied Finance, Vol. 11.

Ilmanen, A. (2003), "Expected returns on stocks and bonds", Journal of Portfolio Management 29, pp. 7-27.

Johnson, D. T., T. Kochanek, T and J. Alexander (2007), "The Equity Premium Puzzle: A New Look", Journal of the Academy of Finance, Vol. 5, No. 1, pp. 61-71.

O'Neill, J., D. Wilson and R. Masih (2002), "The Equity Risk Premium from an Economics Perspective", Goldman Sachs, Global Economics Paper No. 84.

Ritter, J.R. and R. Warr (2002), "The Decline of Inflation and the Bull Market of 1982 to 1999," Journal of Financial and Quantitative Analysis, Vol. 37, No. 1, pp. 29-61.

Welch, I. (2000), "Views of Financial Economists on the Equity Premium and on Professional Controversies", Journal of Business, Vol. 73, No. 4, pp. 501-537.

Welch, I. (2001), "The Equity Premium Consensus Forecast Revisited", Cowles Foundation Discussion Paper No. 1325.

Welch, I. (2007), "A Different Way to Estimate the Equity Premium (for CAPM and One-Factor Model Use Only)," SSRN n. 1077876.

ENDNOTES:

[1] We considered 124 of them as outliers because they provided a very small MRP (for example, -23% and 0 for the USA) or a very high MRP (for example, 30% for the USA).

[2] We got 5 answers for Bahrain (6,0), Ecuador (7,7), Lebanon (8,0), Morocco (4,5), Oman (5,0), Qatar (8,0) and Senegal (5,5). The average MRP is in parenthesis. We got 4 answers for Romania (7,2) and Vietnam (8,8). We got 3 answers for Croatia (7,0), Slovakia (5,3) and Slovenia (4,9). We got 2 answers for Bulgaria (8,6), Costa Rica (6,9), Trinidad&Tobago (14,5) and Venezuela (11,0). We got 1 answer for Albania, Bolivia, Cyprus, Ghana, Guatemala, Honduras, Lituania, Malta, Panama, Puerto Rico, Tunisia and Uruguay.

[3] Fernandez, P., J. Aguirreamalloa and L. Corres (2011a), "US Market Risk Premium Used in 2011 by Professors, Analysts and Companies: A Survey...", downloadable in http://ssrn.com/abstract=1805852

[4] Fernandez, P., J. Aguirreamalloa and L. Corres (2011b), "The Equity Premium in Spain: Survey 2011 (in Spanish)", downloadable in http://ssrn.com/abstract=1822422

[5] At that time, the most recent Ibbotson Associates Yearbook reported an arithmetic HEP versus T-bills of 8.9% (1926–1997).

[6] See http://icf.som.yale.edu/Confidence.Index

CALLING ALL ACTUARIES!

Are you comfortable being in the **limelight**?
Do you have a **thought-provoking perspective** to share?

The SOA's communications staff is **seeking subject matter experts** to raise the profession's visibility in print and electronic media on a **number of different topics**, including:

- Health
- Retirement
- Enterprise Risk Management
- Finance
- Investments
- Supply chain management
- Energy

Tell us about your expertise in one or more of the areas listed above and we'll add you to our growing roster of subject matter experts.

As experts, you may be called upon to share your knowledge with the business media as part of our targeted campaign to bring attention to the thought-leadership of the actuarial profession.

Examples of potential opportunities range from shaping future story ideas to conducting broadcast, radio or phone interviews with the media, and authoring relevant content for the SOA blog, as appropriate.

Interested? Contact Kim McKeown, public relations program manager, at 847.706.3528 or ***kmckeown@soa.org***. Or, visit *soa.org/PRvolunteers*.

Be ready to share a brief bio or résumé.

Actuaries
Risk is Opportunity.®

Report on the CAS COTOR Risk Premium Project Update

By Martin Eling and Hato Schmeiser

THE RISK PREMIUM PROJECT (RPP) REPRESENTS AN EXTENSIVE ANALYSIS OF THE THEORY AND EMPIRICS OF RISK ASSESSMENT IN PROPERTY-CASUALTY INSURANCE. The project was initiated by the Committee on Theory of Risk (COTOR) of the Casualty Actuarial Society (CAS) and began in 2000 with RPP I, a review of the actuarial and finance research done to that date. Given the vast development of research both in finance and actuarial science, the aim of RPP II was to extend the findings from RPP I with research done in the last decade. Furthermore, challenges for future research shall be identified. The research on RPP II was undertaken from June to November 2010 and CAS members were involved in the process via an online questionnaire. The following article provides some background on the Risk Premium Project and highlights some key results. We also list some references to further information, especially a database available at *http://www.casact.org/rpp2/*.

Martin Eling, is professor for insurance management and director of the Institute of Insurance Economics at the University of St. Gallen.

Hato Schmeiser, holds the chair for Risk Management and Insurance and is managing director of the Institute of Insurance Economics at the University of St. Gallen.

The findings from this research are also of interest for members of the Society of Actuaries and the Canadian Institute of Actuaries. A number of new research topics are addressed that are of relevance both in the life and the non-life sector. Among these topics are operational risk, new emerging risks, insurance pricing, new risk measures, capital allocation, risk control and alternative risk transfer, among others. This article also represents an update article of an older article published in this newsletter (see Cummins, Derrig, and Phillips, 2007).

BACKGROUND AND DEVELOPMENT OF THE RISK PREMIUM PROJECT

The RPP was initiated in 1999 with a call for research by COTOR. During that time the appropriate procedure to account for risk in discounted loss reserves has been subject of much research and discussion in the actuarial profession. COTOR's intention was to develop a document integrating the various approaches presented in literature in order to provide guidance, e.g., for actuaries and regulators. Furthermore, COTOR wanted to advance the state of the art in risk assessment by identifying and working on open empirical research questions on the discounting of loss reserves.

A first document summarizing the state of research on risk adjustments for discounting liabilities in property-liability insurance was published in 2000 (see Cummins et al., 2000; the RPP I report). This report widened the original focus on risk adjustments for discounting liabilities to other advances in risk assessment and capital allocation techniques. Based upon the presented findings, two empirical research papers were sponsored by COTOR: Cummins and Phillips (2005) analyze the costs of equity capital for insurers by line of insurance and Cummins, Lin, and Phillips (2009) regress insurance price variables on capital allocations by line, measures of insurer insolvency risk, and other risk and control variables.

The results of these two empirical studies and other recent articles (see, e.g., Cummins, Derrig, and Phillips, 2007) made it clear that literature on risk assessment for property-casualty insurance is evolving rapidly. In fact, the modeling and management of risk has seen significant new developments over the last ten years, with a substantial number of academic research papers published on topics such as risk mitigation, risk and solvency measurement, capital allocation, risk management tools, or valuation techniques. Noteworthy is as well the development of behavioral insurance, new valuation techniques (e.g., market consistent embedded value), new regulatory models (e.g., Solvency II, Swiss Solvency Test), and analysis of emerging risks, especially in the field of operational risks. Furthermore, enterprise risk management, an integrated and holistic

"The goals of the Risk Premium Project Update (RPP II) is thus to revise the findings of the first Risk Premium Project."

view on risk and risk management, has become an accepted and widespread concept in the profession.

AIMS OF THE RPP UPDATE

All these developments motivated COTOR in 2010 to renew its call for research. The goals of the Risk Premium Project Update (RPP II) is thus to revise the findings of the first Risk Premium Project. Specifically, three goals were defined by COTOR:

An update of the bibliography from Phase I of RPP I with additional papers and research done since 2000, incorporating literature from reinsurance, risk management, and catastrophe sources.

A revision of the key conclusions included in Phase II of RPP I in light of additional literature and results of the two empirical studies funded by COTOR (Cummins and Phillips, 2005; Cummins, Lin, and Phillips, 2009). The recommendation of additional empirical studies to enhance the understanding of the current theories and to quantify particular aspects, update, and provide alternatives to recent models.

For RPP II it was important to recognize that the literature has seen an impressive increase in the number of topics, papers, and journals. In addition, strategies for literature search as well as means of communication among researchers have completely changed over the last decade. The search and evaluation strategy used for RPP II incorporates these changes. For example, an online questionnaire to collect feedback on recent developments from interested colleagues in academia and practice was included.

KEY RESULTS

The RPP II literature review covers 961 references. The opinions of 51 colleagues from academia and practice were incorporated into the review. As a brief summary of the main results, we find that actuarial and financial views of how to price risk are still converging, but additional factors have incorporated into the discussion such as new risk measures, new valuation techniques, behavioral aspects, or emerging risks. In the aftermath of the financial crisis, systemic risk, liquidity risks, and implications from the crisis are discussed. Throughout RPP II five conclusions from RPP I are revised and five new conclusions are added. Furthermore, five areas for future research are identified.

REVISION OF KEY CONCLUSIONS FROM RPP I

1. Financial vs. actuarial approaches: There is an ongoing consolidation between financial and actuarial literature with regard to pricing of insurance contracts. Both fields acknowledge the role of systematic and non-systematic risk in the pricing of insurance contracts.
2. Fair value of the insurance premium: Theoretical models and empirical tests have confirmed that given the real-world market imperfections, the price of insurance should be a function of the (1) expected cash flow with adjustments for systematic risk, (2) production costs (i.e. expenses), (3) default risk, and (4) frictional capital costs. By-line adjustments should be integrated depending on the cash flow pattern of the liabilities.
3. General finance: The single beta CAPM cannot adequately price financial contracts. Asset pricing models were systematically expanded to account for new aspects (e.g., liquidity risk or behavioral aspects). Empirical validation is ongoing. All these aspects are of high relevance for the insurance industry, but have not yet been investigated in an insurance context.
4. Capital allocation: Capital allocation is still controversial in the literature. More than 20 new approaches have been proposed in the recent literature and critically reviewed in light of economic and mathematical principles. Some authors consider the Myers and Read (2001) model as a benchmark, while others believe that it is inaccurate. Capital allocation remains a topic of active discussion in academia and practice.
5. Risk transfer: Numerous papers have theoretically and empirically confirmed the assertion that default risk is recognized in pricing risk transfer to the policyholder.

CONTINUED ON **PAGE 22**

Report on the CAS COTOR.. | from Page 21

EXTENSION OF KEY CONCLUSIONS FROM RPP I

6. Use of market consistent valuation techniques: Practitioners are increasingly using market consistent valuation techniques, for example in the context of regulation (Solvency II, Swiss Solvency Test) and public disclosure (IFRS, MCEV). The new valuation techniques reflect the theoretical conclusions on the price of insurance (see, e.g., conclusion 2).
7. Increasing importance of enterprise risk management involving classical techniques as well as new product categories: Market consistent valuation reveals the volatility of the insurer's business model and calls for holistic risk management. In this context we see an increasing role of both classical risk management techniques (e.g., risk mitigation) as well as new means (e.g., reinsurance and alternative risk transfer) to manage risk in a world of market-consistent values.
8. New risk measures and new risk categories: The last decade has seen the success story of quantile-based risk measures (value at risk, expected shortfall) and generalizations of these (spectral, distortion). New risk categories (operational risk, systemic risk) have been introduced in academic literature and their limitations are discussed.
9. Emergence of behavioral insurance: First steps have been taken towards behavioral insurance, a new area of literature that may bridge the gap between theoretical models and real world outcomes. Many researchers have discussed default risk and complement findings of theoretical models.
10. Reinsurance and alternative risk transfer: The convergence of (re-) insurance and capital markets through alternative risk transfer (ART) has been one of the most important economic developments of the past decade. The market for ART is, however, still below the expected capacity and has suffered several setbacks. Recent literature has analyzed the reasons for market failures (e.g., diversification trap) and alternative product innovations (e.g. hybrid cat bonds) to increase volume of the ART market.

FIVE AREAS FOR FUTURE RESEARCH

1. Pricing and cost of capital: Classical CAPM is insufficient to estimate costs of capital; Fama/French, and Rubinstein-Leland are better models for this purpose. However, more research has been done on financial economics in recent years, with unclear implications for pricing of insurance. Are there other factors that we need to take into consideration, such as liquidity risk, credit risk, operational risk, or behavioral aspects such as time varying risk aversion? A systematic analysis of asset pricing theories in an insurance context could thus constitute a major empirical research agenda.
2. Capital Allocation: Dozens of capital allocation approaches are discussed in literature and adding another one will be of very limited value. It might be more helpful to empirically validate the usefulness of different capital allocation approaches. Some authors see the Myers and Read (2001) approach as a best practice; others think that this model is inaccurate. Which model is the best one?
3. ERM, modeling of risk, and dependencies: Several empirical questions surrounding ERM need to be answered. First, the value added by ERM is an empirical but still unanswered question. Second, there are many models for the depiction of dependencies, but no empirical evidence for their validity. Third, the robustness of risk measures should be tackled empirically. Finally, the consistency in risk management must be addressed.
4. Financial crisis and systemic risk: The recent financial crisis has raised important questions. Do regulations accelerate a crisis? What is the role of insurers in the highly connected financial services industry? Is an insurance run possible or not?
5. Analysis of new insurance markets and products: In theory the market for ART products should have a huge potential, but in reality the market is rather small. How can we eliminate the market failure in ART? What is the capacity of the ART market? Finally, emerging insurance markets are future growth markets, but we still do not know enough about insurance business in these markets.

A searchable website with all review results is provided at *www.casact.org/rpp2*. The webpage is structured along four categories (About RPP II; Questionnaire; RPP II Results; RPP II Database) and contains most of the results presented in this document. The central element is the searchable RPP II database with 961 references and all future research topics that might encourage future research on risk assessment for property-casualty insurers. The selection of thematic categories and literature is subjective, but by incorporating the opinions of interested colleagues from academia and practice, we hope to make the survey as objective as possible.

For further details we also refer to the RPP II report, a 58 page pdf-document with detailed analysis of the conclusions and future research areas outlined above (also available at *www.casact.org/rpp2*). We hope that the results encourage future research on the theory and empirics of property-casualty insurance. We also hope that it will serve as an interesting reference for members of the Society of Actuaries and the Canadian Institute of Actuaries, e.g., with respect to new topics such as operational risk, new emerging risks, or alternative risk transfer. ■

REFERENCES

Cummins, J.D., and Phillips, R.D., 2005, Estimating the cost of capital for property-liability insurers, Journal of Risk and Insurance, 72(3), 441-478.

Cummins, J.D., Derrig, R.A., and Phillips, R.D., 2007, A report on the CAS COTOR risk premium project, Society of Actuaries, Risk Management Section, 11, 11-16.

Cummins, J.D., Lin, Y., and Phillips, R.D., 2009, Capital Allocation and the pricing of financially intermediated risks: An empirical investigation, Working Paper, Georgia State University, Atlanta, GA.

Cummins, J.D., Phillips, R.D., Butsic, R.P., and Derrig, R.A., 2000, The risk premium project (RPP) phase I and II report, Casualty Actuarial Society Forum, Fall 2000, 165-230.

Myers, S.C., and Read, J.A., 2001, Capital Allocation for Insurance Companies, Journal of Risk and Insurance, 68, 545-580.

Spending Retirement on Planet Vulcan: The Impact of Longevity Risk Aversion on Optimal Withdrawal Rates

By Moshe A. Milevsky and Huaxiong Huang

RECOMMENDATIONS FROM THE MEDIA AND FINANCIAL PLANNERS REGARDING RETIREMENT SPENDING RATES DEVIATE CONSIDERABLY FROM UTILITY MAXIMIZATION MODELS. This study argues that wealth managers should advocate dynamic spending in proportion to survival probabilities, adjusted up for exogenous pension income and down for longevity risk aversion.

Moshe A. Milevsky, PhD, is an associate professor at the Schulich School of Business and executive director of the IFID Centre at York University in Toronto. He can be reached at *milevsky@yorku.ca.*

Huaxiong Huang, PhD, is professor of mathematics at York University in Toronto. He can be reached at *hhuang@yorku.ca*

In our study, we attempted to derive, analyze, and explain the optimal retirement spending policy for a utility-maximizing consumer facing (only) a stochastic lifetime. We deliberately ignored financial market risk by assuming that all investment assets are allocated to risk-free bonds (e.g., Treasury Inflation-Protected Securities [TIPS]). We made this simplifying assumption in order to focus attention on the role of longevity risk aversion in determining optimal consumption and spending rates during a retirement period of stochastic length.

By longevity risk aversion, we mean that different people might have different attitudes toward the "fear" of living longer than anticipated and possibly depleting their financial resources. Some might respond to this economic risk by spending less early on in retirement, whereas others might be willing to take their chances and enjoy a higher standard of living while they are still able to do so.

Indeed, the impact of financial risk aversion on optimal asset allocation has been the subject of many studies and is intuitively well understood by practitioners. On the one hand, investors who are particularly concerned about losing money (i.e., risk averse) invest conservatively and thus sacrifice the potential upside, leading to a reduced lifetime standard of living. On the other hand, financially risk-tolerant investors accept more risk in their portfolios in exchange for the potential—never a guarantee—of a higher standard of living in retirement. But the impact of longevity risk aversion on retirement spending behavior has not received as much attention, and most practitioners are unfamiliar with the concept.

Although neither our framework nor our mathematical solution is original—they can be traced back almost 80 years—we believe that the insights from a normative life-cycle model (LCM) are worth emphasizing in the current environment, which has grown jaded by economic models and their prescriptions. Our pedagogical objective was to contrast the optimal (i.e., utility-maximizing) retirement spending policy with popular recommendations offered by the investment media and financial planners.

The main results of our investigation are as follows: Counseling retirees to set initial spending from investable wealth at a constant inflation-adjusted rate (e.g., the widely popular 4 percent rule) is consistent with life-cycle consumption smoothing only under a very limited set of implausible preference parameters—that is, there is no universally optimal or safe retirement spending rate. Rather, the optimal forward-looking behavior in the face of personal longevity risk is to consume in proportion to survival probabilities—adjusted upward for pension income and downward for longevity risk aversion—as opposed to blindly withdrawing constant income for life.

HISTORY OF THE PROBLEM

The first problem I propose to tackle is this: How much of its income should a nation save?

With those words, the 24-year-old Cambridge University economist Frank R. Ramsey began a celebrated paper published two years before his tragic death, in 1930. The so-called Ramsey (1928) model and the resultant Keynes–Ramsey rule, implicitly adopted by thousands of economists in the last 80 years (including Fisher 1930; Modigliani and Brumberg 1954; Phelps 1962; Yaari 1965; Modigliani 1986), form the foundation for life-cycle utility optimization. They are also the workhorse supporting the original asset allocation models of Samuelson (1969) and Merton (1971).

In its basic form, the normative LCM assumes a rational individual who seeks to maximize the discounted additive utility of consumption over his entire life. Despite its macroeconomic origins, the Ramsey model has been extended by scores of economists. Indeed, ask a first-year graduate student in economics how a consumer should be "spending" over some deterministic time horizon *T*, and she will most likely respond with a Ramsey-type model that spreads human capital and financial capital (i.e., total wealth) between time zero and the terminal time, *T*.

The pertinent finance literature has advanced since 1928 and now falls under the rubric "portfolio choice" or extensions of the Merton model. We counted more than 50 scholarly articles on this topic published in the top finance journals over the last decade alone. *Unfortunately, much of the financial planning community has ignored these dynamic optimization models, and nowhere is this ignorance more evident than in the world of "retirement income planning."*

Lamentably, the financial crisis, coupled with general skepticism toward financial models, has moved the practice of personal finance even further away from a dynamic optimization approach. In fact, many popular and widely advocated strategies are at odds with the prescriptions of financial economics. For examples of how economists "think about" problems in personal finance and how their thinking differs from conventional wisdom, see Bodie and Treussard (2007); Kotlikoff (2008); Bodie, McLeavey, and Siegel (2008); Ayres and Nalebuff (2010).

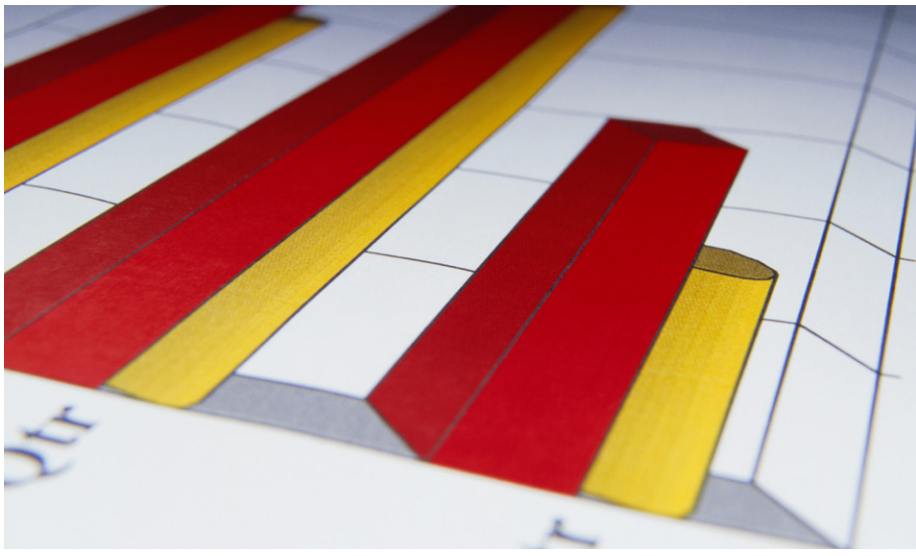
Along the same lines, we attempted to narrow the gap between the advice of the financial planning community regarding retirement spending policies and the "advice" of financial economists who use a rational utility-maximizing model of consumer choice.[1]

In particular, we focused exclusively on the impact of life span uncertainty—longevity risk—on the optimal consumption and retirement spending policy. To isolate the impact of longevity risk on optimal portfolio retirement withdrawal rates, we placed our deliberations on Planet Vulcan, where investment returns are known and unvarying, the inhabitants are rational and utility-maximizing consumption smoothers, and only life spans are random.

LITERATURE ON RETIREMENT SPENDING RATES

Within the community of retirement income planners, a frequently cited study is Bengen (1994), in which he used historical equity and bond returns to search for the highest allowable spending rate that would sustain a portfolio for 30 years of retirement. Using a 50/50 equity/bond mix, Bengen settled on a rate between 4 percent and 5 percent. In fact, this rate has become known as the Bengen or 4 percent rule among retirement income planners and has caught on like wildfire. The rule simply states that for every $100 in the retirement nest egg, the retiree should withdraw $4 adjusted for inflation each year—forever, or at least until the portfolio runs dry or the retiree dies, whichever occurs first.

Indeed, it is hard to overestimate the influence of the Bengen (1994) study and its embedded "rule" on the community of retirement income planners. Other studies in the same vein include Cooley, Hubbard, and Walz (1998), often referred to as the Trinity Study. In the last two decades, these and related studies have been quoted and cited thousands of times in the popular media (e.g., *Money Magazine, USA Today, Wall Street Journal*).[2] The 4 percent spending rule now seems destined for the same immortality enjoyed by other (unduly simplistic) rules of thumb, such as "buy term and invest the difference" and dollar cost averaging. And although numer-



CONTINUED ON **PAGE 26**

Spending Retirement on Planet Vulcan | from Page 25

ous authors have extended, refined, and recalibrated these spending rules, the spirit of each rule remains intact across all versions.[3]

We are not the first to point out that this "start by spending *x* percent" strategy has no basis in economic theory. For example, Sharpe, Scott, and Watson (2007) and Scott, Sharpe, and Watson (2008) raised similar concerns and alluded to the need for a life-cycle approach, but they never actually solved or calibrated such a model. The goal of our study was to illustrate the solution to the lifecycle problem and demonstrate how longevity risk aversion—in contrast to financial risk aversion, so familiar to financial analysts—affects retirement spending rates.

Other researchers have recently teased out the implications of mortality and longevity risk for portfolio choice and asset allocation (see, e.g., Bodie, Detemple, Ortuba, and Walter 2004; Dybvig and Liu 2005; Babbel and Merrill 2006; Chen, Ibbotson, Milevsky, and Zhu 2006; Jiménez-Martín and Sánchez Martín 2007; Lachance, forthcoming 2011). Likewise, Milevsky and Robinson (2005) argued that retirement spending rates should be reduced because the embedded equity risk premium (ERP) assumption is too high. In our study, however, we used an economic LCM approach to retirement income planning.

NUMERICAL EXAMPLES AND CASES

The model we used is fully described in Appendix A so that readers can select their own parameter values and derive optimal values under any assumptions. Using our equations, readers can obtain values quite easily in Microsoft Excel. We selected one (plausible) set to illustrate the main qualitative insights, which are rather insensitive to assumed parameter values.

Note that we use the following terms (somewhat loosely and interchangeably, depending on the context) throughout the article: (1) The consumption rate is an annualized dollar amount that includes withdrawals from the portfolio, as well as pension income, and is scaled to reflect an initial portfolio value of $100. The retirement consumption rate is synonymous with the retirement spending rate. (2) The portfolio withdrawal rate (PWR) is the annualized ratio of the amount withdrawn from the portfolio divided by the value of the portfolio at that time. (3) The initial PWR is the annualized ratio of the initial amount withdrawn from the portfolio divided by the initial value of the portfolio.

Recall that we are spending our retirement on Vulcan, where only life spans are random. Our approach forced us to specify a real (inflation-adjusted) investment return. So, after carefully examining the real yield from U.S. TIPS over the last 10 years on the basis of data from the Fed, we found that the maximum real yield over the period was 3.15 percent for the 10-year bond and 4.24 percent for the 5-year bond. The average yield was 1.95 percent and 1.50 percent, respectively.

The longer-maturity TIPS exhibited higher yields but obviously entailed some duration risk. After much deliberation, we decided to assume a real interest rate of 2.5 percent for most of the numerical examples, even though current (fall 2010) TIPS rates were substantially lower. Readers can code the formulas in Appendix A—with their favorite riskfree-return estimate—to obtain their own rational spending rates. Our values are consistent with the view expressed by Arnott (2004) regarding the future of the lower ERP.

As for longevity risk, we exercised a great deal of modeling caution because it was the impetus for our investigation. We assumed that the retiree's remaining lifetime obeys a (unisex) biological law of mortality under which the hazard rate increases exponentially over time. This notion is known as the Gompertz assumption in the actuarial literature, and we calibrated this model to common pension annuitant mortality tables. (See Appendix A for a full description of the mortality law.)

In most of our numerical examples, therefore, we assumed an 86.6 percent probability that a 65-year-old will survive to the age of 75, a 57.3 percent probability of surviving to 85, a 36.9 percent probability of reaching 90, a 17.6 percent probability of reaching 95, and a 5 percent probability of attaining 100. Again, note that we do not plan for a life expectancy or an ad hoc 30-year retirement. Rather, we account for the entire term structure of mortality.

Our main objective was to focus attention on the impact of risk aversion on the optimal PWR and especially the initial PWR. Therefore, we display results for a range of values—for example, for a retiree with a very low ($\gamma = 1$) and a relatively high ($\gamma = 8$) coefficient of relative risk aversion (CRRA).

To aid a clear understanding of mortality risk aversion, we offer the following analogy to classical asset allocation models. An investor with a CRRA value of ($\gamma = 4$) would invest 40 percent of her assets in an equity portfolio and 60 percent in a bond portfolio, assuming an equity risk premium of 5 percent and volatility of 18 percent. This analogy comes from the famed Merton ratio. Our model does not have a risky asset and does not require an ERP, but the idea is that the CRRA can be mapped onto more easily understood risk attitudes. Along the same lines, the very low risk-aversion value of ($\gamma = 1$), which is often labeled the Bernoulli utility specification, would lead to an equity allocation of 150 percent, and a high risk-aversion value of ($\gamma = 8$) implies an equity allocation of 20 percent (all rounded to the nearest 5 percent).

Finally, to complete the parameter values required for our model, we assume that the subjective discount rate (ρ), which is a proxy for personal impatience, is equal to the risk-free rate (mostly 2.5 percent in our numerical examples). To those familiar with the basic LCM without lifetime uncertainty, this assumption suggests that the optimal consumption rates would be constant over time in the absence of longevity risk considerations. Again, our motivation for all these assumptions is to tease out the impact of pure longevity risk aversion.

In the language of economics, when the subjective discount rate (SDR) in an LCM is set equal to the constant and risk-free interest rate, a rational consumer will spend his total (human plus financial) capital evenly and in equal amounts over time. In other words, in a model with no horizon uncertainty, consumption rates and spending amounts are, in fact, constant, regardless of the consumer's elasticity of intertemporal substitution (EIS).[4]

The question is, what happens when lifetimes are stochastic?

Table 1. Optimal Rate (pre-$100) under Medium Risk Aversion (γ=4)

	Real Interest Rate			
	0.5%	1.5%	2.5%	3.5%
Retire at age 65	$3.330	$3.941	$4.605	$5.318
5 years later	3.286	3.888	4.544	5.247
10 years later	3.212	3.801	4.442	5.130
20 years later	2.898	3.429	4.007	4.627
30 years later	2.156	2.552	2.982	3.444

Notes: The initial portfolio (nest egg) is worth $100 and is invested at the indicated rates. There is a 5 percent probability of survival to age 100. The Gompertz mortality parameters are m = 89.335 and b = 9.5. No pension income is assumed. All consumption spending is from the investment portfolio.

Let us now take a look at some results. We will assume a 65-year-old with a (standardized) $100 nest egg. Initially, we allow for no pension annuity income, and therefore, all consumption must be sourced to the investment portfolio that is earning a deterministic interest rate. On Planet Vulcan, financial wealth must be depleted at the very end of the life cycle (say, age 120) and bequest motives are nonexistent. So, according to Equation A5 (see Appendix A), the optimal consumption rate at retirement age 65 is $4.605 when the risk-aversion parameter is set to ($\gamma = 4$) (see Table 1), and the optimal consumption rate is $4.121 when the risk-aversion parameter is set to ($\gamma = 8$).

Note that these rates—perhaps surprisingly—are within the range of numbers quoted by the popular press for optimal portfolio withdrawal (spending) rates. Thus, at first glance, these numbers seem to suggest that simple 4 percent rules of thumb are consistent with an LCM. Unfortunately, the euphoria is short-lived. The numbers (may) coincide only in the first year of withdrawals (at age 65) and for a limited range of risk-aversion coefficients (most importantly, no pension income). As retirees age, they rationally consume less each year—in proportion to their survival probability adjusted for risk aversion. For example, at our baseline intermediate level of risk aversion ($\gamma = 4$), the optimal consumption rate drops from $4.605 at age 65 to $4.544 at age 70,

CONTINUED ON PAGE 28

Spending Retirement on Planet Vulcan | from Page 27

and then to $4.442 at age 75, $3.591 at 90, and $2.177 at 100, assuming the retiree is still alive. All these values are derived from Equation A5.

Note how a lower real interest rate (e.g., 0.5 percent in Table 1) leads to a reduced optimal retirement consumption/spending rate. Indeed, in the yield curve and TIPS environment of fall 2010, our model offered an important message for Baby Boomers: Your parents' retirement plans might not be sustainable anymore.

The first insight in our model is that a fully rational plan is for retirees to spend less as they progress through retirement. Life-cycle optimizers (i.e., "consumption smoothers" on Vulcan) spend more at earlier ages and reduce spending as they age, even if their SDR is equal to the real interest rate in the economy.

Intuitively, they deal with longevity risk by setting aside a financial reserve and by planning to reduce consumption (if that risk materializes) in proportion to their survival probability adjusted for risk aversion—all without any pension annuity income.

As Irving Fisher (1930) observed in The Theory of Interest,

> *The shortness of life thus tends powerfully to increase the degree of impatience or rate of time preference beyond what it would otherwise be. . . . Everyone at some time in his life doubtless changes his degree of impatience for income. . . . When he gets a little older . . . he expects to die and he thinks: instead of piling up for the remote future, why shouldn't I enjoy myself during the few years that remain?* (pp. 85, 90)

Table 2. Initial PWR at age 65 with Pension Income, as a Function of Risk Aversion

Pension Income	$\gamma = 1$	$\gamma = 2$	$\gamma = 4$	$\gamma = 8$
$\pi_0 = \$0$	6.330%	5.301%	4.605%	4.121%
$\pi_0 = \$1$	6.798	5.653	4.873	4.324
$\pi_0 = \$2$	7.162	5.924	5.078	4.480
$\pi_0 = \$5$	8.015	6.553	5.551	4.839

Notes: The mortality assumption is that there is a 5 percent probability of survival to age 100. The Gompertz mortality parameters are $m = 89.335$ and $b = 9.5$. The interest rate is 2.5 percent.

Including Pension Annuities.
Let us now use the same model to examine what happens when the retiree has access to a defined benefit (DB) pension income annuity, which provides a guaranteed lifetime cash flow. In the United States, the maximum benefit from Social Security, which is the ultimate real pension annuity, is approximately $25,000 per annuitant. Let us examine the behavior of a retiree with 100, 50, and 20 times this amount in her nest egg—that is, $2,500,000, $1,250,000, and $500,000 in investable retirement assets.

Alternatively, one can interpret Table 2 as displaying the optimal policy for four different retirees with varying degrees of longevity risk aversion, each with $1,000,000 in investable retirement assets. The first retiree has no pension (π_0 = $0), the second has an annual pension of $10,000 ($\pi_0$ = $1), the third has an annual pension of $20,000 ($\pi_0$ = $2), and the fourth has a pension of $50,000 ($\pi_0$ = $5).

Table 2 shows the net initial PWR (i.e., the optimal amount withdrawn from the investment portfolio) as a function of the risk-aversion values and pre-existing pension income. Thus, for example, when the (γ = 4) retiree (medium risk aversion) has $1,000,000 in investable assets and is entitled to a real lifetime pension of $50,000—which, in our language, is a scaled nest egg of $100 and a pension ($\pi_0$= $5)—the optimal total consumption rate is $10.551 in the first year. Of that amount, $5.00 obviously comes from the pension and $5.551 is withdrawn from the portfolio. The net initial PWR is thus 5.551 percent.

In contrast, if the retiree has the same $1,000,000 in assets but is entitled to only $10,000 in lifetime pension income, the optimal total consumption rate is $5.873 per $100 of assets at age 65, of which $1.00 comes from the pension and $4.873 is withdrawn from the portfolio. Hence, the initial PWR is 4.873 percent. All these numbers are derived directly from Equation A5.

The main point of our study can be summarized in one sentence: The optimal portfolio withdrawal rate depends on longevity risk aversion and the level of pre-existing pension income. The larger the amount of the pre-existing pension income, the greater the optimal consumption rate and the greater the PWR.

The pension acts primarily as a buffer and allows the retiree to consume more from discretionary wealth. Even at high levels of longevity risk aversion, the risk of living a long life does not "worry" retirees too much because they have pension income to fall back on should that chance (i.e., a long life) materialize. We believe that this insight is absent from most of the popular media discussion (and practitioner implementation) of optimal spending rates. If a potential client has substantial income from a DB pension or Social Security, she can afford to withdraw more—percentagewise—than her neighbor, who is relying entirely on his investment portfolio to finance his retirement income needs.

Table 2 confirms a number of other important results. Note that the optimal PWR—for a range of risk-aversion and pension income levels—is between 8 percent and 4 percent, but only when the inflation-adjusted interest rate is assumed to be a rather generous 2.5 percent. Adding another 100 bps to the investment return assumption raises the initial PWR by 60–80 bps. Reducing interest assumptions, however, will have the opposite effect. Readers can input their own assumptions into Equation A5 to obtain suitable consumption/spending rates.

Table 3. Impact of Pensionization on Retirement Consumption Rates

Percent: Initial Portfolio and Pension	Lower Longevity Risk Aversion $\gamma = 2.0$		Medium Longevity Risk Aversion $\gamma = 4.0$		Higher Longevity Risk Aversion $\gamma = 8.0$	
	Consume at Age 65	Consume at Age 80	Consume at Age 65	Consume at Age 80	Consume at Age 65	Consume at Age 80
0%: F_0=\$100, π_0=\$0.000	\$5.3014	\$4.5696	\$4.6051	\$4.2755	\$4.1187	\$3.9684
20%: F_0=\$80, π_0=\$1.2661	\$5.9193	\$5.1021	\$5.2637	\$4.8869	\$4.8013	\$4.6263
40%: F_0=\$60, π_0=\$2.5321	\$6.3760	\$5.4958	\$5.7963	\$5.3815	\$5.3858	\$5.1893
60%: F_0=\$40, π_0=\$3.7982	\$6.7040	\$5.7784	\$6.2292	\$5.7833	\$5.8921	\$5.6774
80%: F_0=\$20, π_0=\$5.0643	\$6.8631	\$5.9156	\$6.5328	\$6.0651	\$6.2983	\$6.0687
100%: F_0=\$0, π_0=\$6.3303	\$6.3303	\$6.3303	\$6.3303	\$6.3303	\$6.3303	\$6.3303

***Notes**: Assumes a subjective discount rate (ρ) equal to the interest rate (r) of 2.5%, and annuity factor of \$15.7971 at age 65, under Gompertz mortality with parameters (m=89.335, b=9.5), truncated at age 122. All numbers rounded to four decimals.*

The impact of longevity risk aversion can be described in another way. If the remaining future lifetime has a modal value of (m = 89.335) and a dispersion (volatility) value of (b = 9.5), then a consumer averse to longevity risk behaves (consumes) as if the modal value were [$m^* = m + b\ln(\gamma)$] but with the same dispersion parameter, b.

Longevity risk aversion manifests itself by (essentially) assuming that retirees will live longer than the biological/medical estimate. Only extremely risk-tolerant retirees (γ = 1) behave as if their modal life spans were the true (biological) modal value. Note that this behavior is not risk neutrality, which would ignore longevity risk altogether.

In the asset allocation literature, the closest analogy to these risk-adjusted mortality rates is the concept of risk-adjusted investment returns. A risk-averse investor observes a 10 percent expected portfolio return and adjusts it downward on the basis of the volatility of the return and her risk aversion. If the (subjectively) adjusted investment return is less than the risk-free rate, the investor shuns the risky asset. Of course, this analogy is not quite correct because retirees cannot shun longevity risk, but the spirit is the same. The longevity probability they see is not the longevity probability they feel.

Again, an important take-away is the impact of pension annuities on retirement consumption. Although the point of our study was not to advocate for pension annuities or examine the market for longevity protection—already well achieved in a recent book by Sheshinski (2008), as well as the excellent collection of studies by Brown, Mitchell, Poterba, and Warshawsky (2001)—we present yet another way to use Equations A5 and A6.

Table 3 reports the optimal consumption rate at various ages, assuming that a fixed percentage of the retirement nest egg is used to purchase a pension annuity ("pensionized"). The cost of each lifetime dollar of income

CONTINUED ON **PAGE 30**

Spending Retirement on Planet Vulcan | from Page 29

Figure 1. Optimal Consumption: $5 Pension Income with Investment Rate = 2.5%

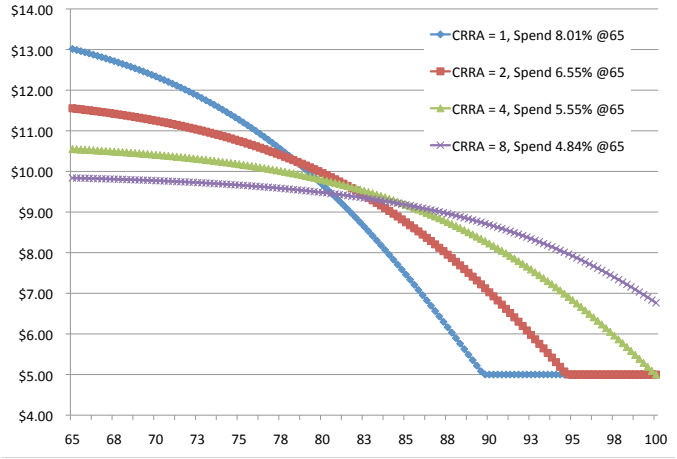
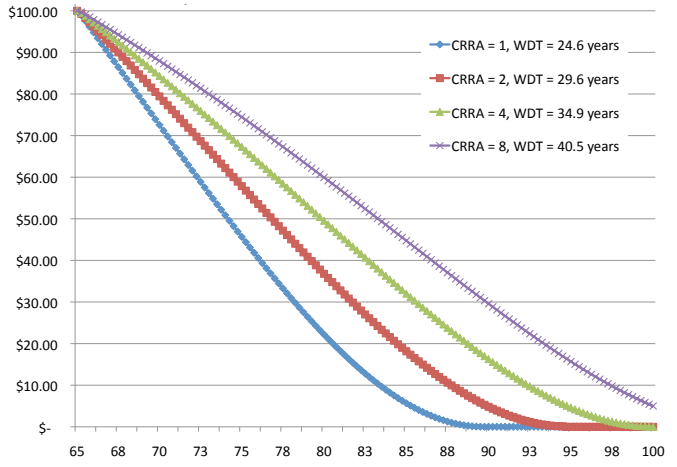


Figure 2. Financial Capital: $5 Pension Income with Investment Rate = 2.5%



is displayed in Equation A2, which is the expression for the pension annuity factor. So, if 30 percent of $100 is pensionized, the corresponding value of F_0 is $70 and the resulting pension annuity income is $\$30 / a_{65}^{55}(0.025,\ 89.335,\ 9.5) = \$1.899$.

We note that the pricing of pension (income) annuities by private sector insurance companies usually involves mortality rates that differ from population rates owing to anti-selection concerns. This factor could be easily incorporated by using different mortality parameters, but we will keep things simple to illustrate the impact of lifetime income on optimal total spending rates.

Results are reported for a retirement age of 65 and planned consumption 15 years later (assuming the retiree is still alive), at age 80. We illustrate with a variety of scenarios in which 0 percent, 20 percent 40 percent, 60 percent, or 100 percent of initial wealth is pensionized—that is, a nonreversible pension annuity (priced by Equation A2) is purchased on the basis of the going market rate.[5]

Table 3 shows total dollar consumption rates, including the corresponding pension annuity income. These rates are not (only) the PWRs that are reported in percentages in Table 2. For example, if the retiree with medium risk aversion allocates $20 (from the $100 available) to purchase a pension annuity that pays $1.261 for life, optimal consumption will be $1.261 + $3.997 = $5.258 at age 65. Note that the $3.997 withdrawn from the remaining portfolio of $80 is equivalent to an initial PWR of 4.996 percent.

In contrast, the retiree with a high degree of longevity risk aversion ($\gamma = 8$) will receive the same $1.261 from the $20 that has been pensionized but will optimally spend only $3.535 from the portfolio (a withdrawal rate of 4.419 percent), for a total consumption rate of $4.801 at age 65.

If the entire nest egg is pensionized at 65, leading to $6.3303 of lifetime income, the consumption rate is constant for life—and independent of risk aversion—because there is no financial capital from which to draw down any income. This example is yet another way to illustrate the benefit of converting financial wealth into a pension income flow. The $6.3303 of annual consumption is the largest of all the consumption plans. Thus, most financial economists are strong advocates of pensionizing (or at least annuitizing) a portion of one's retirement nest egg.

Visualizing the Results. Figure 1 depicts the optimal consumption path from retirement to the maximum length of life as a function of the retiree's level of longevity risk aversion (γ in our model). This figure provides yet another perspective on the rational approach and attitude toward longevity risk management. It uses Equation A5 to trace the entire consumption path, from retirement at age 65 to age 100.

"Using our methodology, one can examine the optimal reaction to financial shocks over the retirement horizon."

Note that the optimal consumption rate declines with age and in relation to the retiree's attitude toward longevity risk as measured by the CRRA.

Figure 1 plots four cases that correspond to various levels of the CRRA. Note that the consumption rate eventually hits $5, which is the pension income flow. For example, the consumer with a CRRA of 2 (i.e., very low aversion to longevity risk) will start retirement by withdrawing 6.55 percent from his nest egg plus his pension income of $5. The withdrawals from the portfolio will continue until the retiree rationally exhausts his wealth at age 95. From the wealth depletion time (WDT) onward, he consumes only his pension.[6]

Figure 2 shows the corresponding trajectory for financial capital. At all levels of longevity risk aversion, the curve begins at $100 and then declines. The rate of decline is higher and faster for lower levels of longevity risk aversion because the retiree is "unafraid" of living to an advanced age. She will deplete her wealth after 24.6 years (at age 90), after which she will live on her pension ($5).

In contrast, the retiree with a longevity risk aversion of CRRA = 8 does not (plan to) deplete wealth until age 105 and draws down wealth at a much slower rate. When there is no pension annuity income at all, the WDT is exactly at the end of the terminal horizon, which is the last possible age on the mortality table. In other words, wealth is never completely exhausted. This result can also be seen from Equation A8, in which the only way to obtain zero (on the right-hand side) is for the survival probability to be zero, which can happen only when τ equals the maximum length of life.

Reacting to Financial Shocks. Using our methodology, one can examine the optimal reaction to financial shocks over the retirement horizon. Take someone who experiences a 30 percent loss in his investment portfolio and wants to rationally reduce spending to account for the depleted nest egg. The rule of thumb suggesting that retirees spend 4–5 percent says nothing about how to update the rule in response to a shock to wealth.

The rational reaction to a financial shock at time s, which results in a new (reduced) portfolio value, would be to follow these steps:

1. Using Equation A8, recalibrate the model from time zero but with the shocked level of wealth and compute the new WDT.
2. Use Equation A7 to compute the new level of initial consumption, which will be different from the old consumption level because of the financial shock.
3. Continue retirement consumption from time s onward on the basis of Equation A5.

To understand how this approach would work in practice, let us begin with a (CRRA = 4) retiree who has $100 in investable assets and is entitled to $2 of lifetime pension income. With a real interest rate of $r = 2.5$ percent, the optimal policy is to consume a total of $7.078 at age 65 ($2 from the pension and $5.078 from the portfolio) and adjust withdrawals downward over time in proportion to the survival probability to the power of the risk-aversion coefficient. The WDT is at age 105.

Under this dynamic policy, the expectation is that at age 70, the financial capital trajectory will be $86.668 and total consumption will be $6.984 if the retiree follows the optimal consumption path for the next five years.

Now let us assume that the retiree survives the next five years and experiences a financial shock that reduces the portfolio value from the expected $86.668 to $60 at age 70, which is 31 percent less than planned. In this case, the optimal plan is to reduce consumption to $5.583, which is obtained by solving the problem from the beginning but with a starting age of 70. This result is a reduction of approximately 20 percent compared with the original plan.

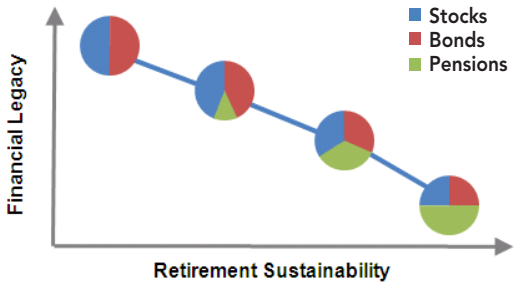
Of course, this scenario is a bit of an apples-to-oranges comparison because (1) a shock is not allowed in our model and (2) the time zero consumption plan is based on a conditional probability of survival that could change on the basis of realized health status. The problem of stochastic versus hazard rates obviously takes us far beyond the simple agenda of our study.

In sum, a rational response to an x percent drop in one's retirement portfolio is not to reduce consumption and spending by the same x percent. Consumption smooth-

CONTINUED ON PAGE 32

Spending Retirement on Planet Vulcan | from Page 31

Figure 3. Economic Tradeoffs at Retirement:



ing in the LCM is about amortizing unexpected losses and gains over the remaining lifetime horizon, adjusted for survival probabilities.

SUMMARY

To a financial economist, the optimal retirement consumption rate, asset allocation (investments), and product allocation (insurance) are a complicated function of mortality expectations, economic forecasts, and the trade-off between the preference for retirement sustainability and the desire to leave a financial legacy (bequest motive). Although it is not an easy problem to solve even under some very simplifying assumptions, the qualitative trade-off can be illustrated (see Figure 3).

Retirees can afford to spend more if they are willing to leave a smaller financial legacy and risk early depletion times. They should spend less if they desire a larger legacy and greater sustainability. Optimization of investments and insurance products occurs on this retirement income frontier. Ergo, a simple rule that advises all retirees to spend *x* percent of their nest egg adjusted up or down in some *ad hoc* manner is akin to the broken clock that tells time correctly only twice a day.

We are not the first authors—and will certainly not be the last—to criticize the "spend *x* percent" approach to retirement income planning. For example, as noted by Scott, Sharpe, and Watson (2008),

> *The 4 percent rule and its variants finance a constant, non-volatile spending plan using a risky, volatile investment strategy. Two of the rule's inefficiencies—the price paid for funding its unspent surpluses and the overpayments for its spending distribution—apply to all retirees, independent of their preferences. (p. 18)*

Although we obviously concur, the focus of our study was to illustrate what exactly a life-cycle model says about optimal consumption rates. Our intention was to contrast *ad hoc* recommendations with "advice" that a financial economist might give to a utility-maximizing consumer and see whether the two approaches have any *overlap* and how much they differ. In particular, we shined a light on aversion to longevity risk—uncertainty about the human life span—and examined how this aversion affects optimal spending rates.[7]

Computationally, we solved an analytic LCM that was calibrated to actuarial mortality rates (see Appendix A). Our model can easily be used by anyone with access to an Excel spreadsheet. Our main insights are as follows:

1. The optimal initial PWR, which the "planning literature" says should be an exogenous percentage of (only) one's retirement nest egg, critically depends on both the consumer's risk aversion—where risk concerns longevity and not just financial markets—and any preexisting pension annuity income. For example, if the portfolio's assumed annual real investment return is 2.5 percent, the optimal initial PWR can be as low as 3 percent for highly risk-averse retirees and as high as 7 percent for those who are less risk averse. The same approach applies to any pension annuity income. The greater the amount of pre-existing pension income, the larger the initial PWR, all else being equal. Of course, if one assumes a healthier retiree and/or lower inflation-adjusted returns, the optimal initial PWR is lower.
2. The optimal consumption rate (c_t^*)—which is the total amount of money consumed by the retiree in any given year, including all pension income—is a declining function of age. In other words, retirees (on Vulcan) should consume less at older ages. The consumption rate for discretionary wealth is proportional to the survival probability ($_tp_x$) and is a func-

"You might live a very long time, so you better make sure to own a lot of stocks and equity."

tion of risk aversion, even when the subjective rate of time preferences (ρ) is equal to the interest rate. The rational consumer—planning at age 65—is willing to sacrifice some income at 100 in exchange the age of 100 the same preference weight as the age of 80 can be explained within an LCM only if the SDR (ρ_t) is a time-dependent function that exactly offsets the declining survival probability. That people might have such preferences is highly unrealistic.

3. The interaction between (longevity) risk aversion and survival probability is quite important. In particular, risk aversion tends to increase the effective probability of survival. So, imagine two retirees with the same amount of initial retirement wealth and pension income (and the same SDR) but with different levels of risk aversion (γ). The retiree with greater risk aversion behaves as if her modal value of life were higher. Specifically, she behaves as if it were increased by an amount proportional to $\ln(\gamma)$ and spends less in anticipation of a longer life. Observers will never know whether such retirees are averse to longevity risk or simply believe they are much healthier than the population.
4. The optimal trajectory of financial capital also declines with age. Moreover, for retirees with pre-existing pension income, spending down wealth by some advanced age, and thereafter living exclusively on pension income, is rational. The WDT can be at age 90—or even 80 if the pension income is sufficiently large. Greater (longevity) risk aversion, which is associated with lower consumption, induces greater financial capital at all ages. Planning to deplete wealth by some advanced age is neither wrong nor irrational.[8]
5. The rational reaction to portfolio shocks (i.e., losses) is nonlinear and dependent on when the shock occurs and the amount of pre-existing pension income. One does not reduce portfolio withdrawals by the exact amount of a financial shock unless the risk aversion is ($\gamma = 1$), known as the Bernoulli utility. For example, if the portfolio suffers an unexpected loss of 30 percent, the retiree might reduce consumption by only 30 percentage points.
6. Converting some of the initial nest egg into a stream of lifetime income increases consumption at all ages regardless of the cost of the pension annuity. Even when interest rates are low and the cost of $1 of lifetime income is (relatively) high, the net effect is that pensionization increases consumption. Note that we are careful to distinguish between real-world pension annuities—in which the buyer hands over a nonrefundable sum in exchange for a constant real stream—and tontine annuities, which are the foundation of most economic models but are completely unavailable in the marketplace.

7. Although not pursued in the numerical examples, one result that follows from our analysis is counterintuitive and perhaps even controversial: Borrowing against pension income might be optimal at advanced ages. For retirees with relatively large pre-existing (DB) pension income, preconsuming and enjoying their pensions while they are still able to do so might make sense. The lower the longevity risk aversion, the more optimal this path becomes.

The "cost" of our deriving a simple analytic expression—described by Equations A1–A8—is that we had to assume a deterministic investment return. Although we assumed a safe and conservative return for most of

CONTINUED ON PAGE 34

Spending Retirement on Planet Vulcan | from Page 33

our numerical examples, we essentially ignored the last 50 years of portfolio modeling theory. Recall, however, that our goal was to shed light on the oft-quoted rules of thumb and how they relate to longevity risk, as opposed to developing a full-scale dynamic optimization model.

CONCLUSION: BACK TO PLANET EARTH

How might a full stochastic model—with possible shocks to health and their related expenses— change optimal consumption policies? Assuming agreement on a reasonable model and parameters for long-term portfolio returns, the risk-averse retiree would be exposed to the risk of a negative (early) shock and would plan for this risk by consuming less. With a full menu of investment assets and products available, however, the retiree would be free to optimize around pension annuities and other downside-protected products, in addition to long-term-care insurance and other retirement products. In other words, even the formulation of the problem itself becomes much more complex.

More importantly, the optimal allocation depends on the retiree's preference for personal consumption versus bequest, as illustrated in Figure 3. A product and asset allocation suitable for a consumer with no bequest or legacy motives— those in the lower left-hand corner of the figure—is quite different from the optimal portfolio for someone with strong legacy preferences. In our study, we assumed that the retiree's objective is to maximize utility of lifetime consumption without any consideration for the value of bequest or legacy.

Although some have argued that a behavioral explanation is needed to rationalize the desire for a constant consumption pattern in retirement, we note that very high longevity risk aversion leads to relatively constant spending rates and might "explain" these fixed rules. In other words, we do not need a behavioral model to justify constant 4 percent spending. Extreme risk aversion does that for us.

That said, we believe that another important take-away from our study is that offering the following advice to retirees is internally inconsistent: "You might live a very long time, so you better make sure to own a lot of stocks and equity." The first part of the sentence implies longevity risk aversion, while the second part is suitable only for risk-tolerant retirees. Risk is risk.

To make this sort of statement more precise, we are working on a follow-up study in which we derive the optimal portfolio withdrawal rate for both pension and tontine annuities in a robust capital market environment *à la* Richard (1975) and Merton (1971) but with a model that breaks the reciprocal link between the elasticity of intertemporal substitution and general risk aversion. Another fruitful line of research would be to explore the optimal time to retire in the context of a mortalityonly LCM, which would take us far beyond the current literature.[9]

One thing seems clear: Longevity risk aversion and pension annuities remain very important factors to consider when giving advice regarding optimal portfolio withdrawal rates. That is the main message of our study, a message that does not change here on Planet Earth.

We thank Zvi Bodie, Larry Kotlikoff, Peng Chen, François Gaddene, Mike Zwecher, David Macchia, Barry Nalebuff, Glenn Harrison, Sherman Hanna, and Bill Bengen—as well as participants at the 2010 Retirement Income Industry Association conference in Chicago, seminar participants at Georgia State University, and participants at the QMF2010 conference in Sydney—for helpful comments. We also offer a special acknowledgment to our colleagues at York University—Pauline Shum, Tom Salisbury, Nabil Tahani, Chris Robinson, and David Promislow—for helpful discussions during the many years of this research program. Finally, we thank Alexandra Macqueen and Faisal Habib at the QWeMA Group (Toronto) for assistance with editing and analytics.

APPENDIX A. LIFE-CYCLE MODEL IN RETIREMENT

The value function in the LCM during retirement years when labor income is zero, assuming no bequest motive, can be written as follows:

$$\max_c V(c) = \int_0^D e^{-\rho t} \left({}_t p_x\right) u(c_t) dt, \qquad \text{(A1)}$$

where

- x = the age of the retiree when the consumption/spending plan is formulated (e.g., 60 or 65)
- D = the maximum possible life span years in retirement (the upper bound of the utility integration, which is currently 122 on the basis of the world's longest-lived person, Jeanne Calment, who died in France in 1997)
- ρ = the SDR, or personal time preference (which ranges in value from 0 percent to as high as 20 percent in some empirical studies)
- tPx = the conditional probability of survival from retirement age x to age $x + t$, which is based on an actuarial mortality table

We parameterize (tPx) on the basis of the Gompertz law of mortality, under which the biological hazard rate is $\lambda_t = (1/b)e^{(x-m+t)/b}$, which grows exponentially with age—m denotes the modal value of life (e.g., 80 years), and b denotes the dispersion coefficient (e.g., 10 years) of the future lifetime random variable. Both numbers are calibrated to U.S. mortality tables to fit advanced-age survival rates.

In our study, we assumed that the utility function of consumption exhibits constant elasticity of intertemporal substitution, which is synonymous with (and the reciprocal of) constant relative risk aversion (RRA) under conditions of perfect certainty and time-separable utility. The exact specification is $u(c) = c^{1-\gamma}/(1-\gamma)$, where γ is the coefficient of relative (longevity) risk aversion, which can take on values from Bernoulli ($\gamma = 1$) up to infinity.

The actuarial present value function, denoted by $a_x^T(v,m,b)$ depends implicitly on the survival probability curve (tpx) via the parameters (m,b). It is defined and computed by using the following:

$$a_x^T(v,m,b) = \int_0^T e^{-vs}\,({}_s p_x)\,ds, \tag{A2}$$

which is the retirement age "price"—under a real, constant discount rate v—of a life-contingent pension annuity that pays a real $1 a year until death or time T, whichever comes first. Although we do not include a mortality risk premium from the perspective of the insurance company in this valuation model, one could include it by tilting the survival rate toward a longer life.

A closed-form representation of Equation A2 is possible in terms of the incomplete gamma function $\Gamma(A,B)$, which is available analytically:

$$a_x^T(v,m,b) = \frac{b\Gamma\left[-vb, \exp\left(\frac{x-m}{b}\right)\right]}{\exp\left[(m-x)v - \exp\left(\frac{x-m}{b}\right)\right]} - \frac{b\Gamma\left[-vb, \exp\left(\frac{x-m+T}{b}\right)\right]}{\exp\left[(m-x)v - \exp\left(\frac{x-m}{b}\right)\right]}. \tag{A2a}$$

See Milevsky (2006, p. 61) for instructions on how to code the gamma function in Microsoft Excel.

The wealth trajectory (financial capital during retirement) is denoted by F_t, and the dynamic constraint in our model—linked to the objective function in Equation A1—can now be expressed as follows:

$$\dot{F}_t = v(t,F_t)F_t - c_t + \pi_0, \tag{A3}$$

where the dot is shorthand notation for a derivative of wealth (financial capital) with respect to time, π_0 denotes the income (in real dollars) from any preexisting pension annuities, and the function multiplying wealth itself is defined by

$$v(t,F_t) = \begin{cases} r, & F_t \geq 0 \\ R + \lambda_t, & F_t < 0 \end{cases}, \tag{A3a}$$

where $R \geq r$. The discontinuous function $v(t,F_t)$ denotes the interest rate on financial capital and allows F_t to be negative. For credit cards and other unsecured lines of credit, $v(t,F_t) = R + \lambda_t$. The borrower pays R plus the insurance (to protect the lender in the event of the borrower's death).

Note that we do not assume a complete liquidity constraint that prohibits borrowing in the sense of Deaton (1991), Leung (1994), or Bütler (2001). We do not allow stochastic returns. Equations A1, A2, and A3 are

CONTINUED ON PAGE 36

Spending Retirement on Planet Vulcan | from Page 35

essentially the Yaari (1965) setup, under which pension annuities, but not tontine annuities, are available.

The initial condition is $F_0 = W$, where W denotes the investable assets at retirement. The terminal condition is $F_\tau = 0$, where τ denotes the wealth depletion time, at which point only the pension annuity income is consumed. Leung (1994, 2007) explored the existence of a WDT in a series of theoretical papers. In theory, the WDT can be at the final horizon time ($\tau = D$) if the pension income is minimal (or zero) and/or the borrowing rate is relatively low. To be very precise, it is possible for $F_t < 0$ for some time $t < D$. We are not talking about the zero values of the function. Rather, the definition of our WDT is $F_t = 0$; $\forall t > \tau$ permanently. One can show that when $R > \rho$, borrowing is not optimal and $\tau < D$ under certain conditions. For our numerical results, we assume a high-enough value of R.

The Euler–Lagrange theorem from the calculus of variations leads to the following. The optimal trajectory, F_t, in the region over which it is positive, assuming that $v(t,F_t) = r$, can be expressed as the solution to the following second-order nonhomogeneous differential equation:

$$\ddot{F}_t - (k_t + r)\dot{F}_t + rk_tF_t = -\pi_0 k_t, \tag{A4}$$

where the double dots denote the second derivative with respect to time and the time-dependent function $k_t = (r - \rho - \lambda_t)/\gamma$ is introduced to simplify notation. The real interest rate, r, is a positive constant and a pivotal input to the model. We reiterate that Equation A4 is valid only until the wealth depletion time, τ. But one can always force a wealth depletion time $\tau < D$ by assuming a minimal pension annuity, as well as a large-enough (arbitrary) interest rate $v(t,F_t)$ on borrowing when $F_t < 0$. For a more detailed discussion, including the impact of a stochastic mortality rate, see Huang, Milevsky, and Salisbury (2010).

The solution to the differential Equation A4 is obtained in two stages. First, the optimal consumption rate while $F_t > 0$ can be shown to satisfy the equation

$$c_t^* = c_0^* e^{kt} \left({}_t p_x\right)^{1/\gamma}, \tag{A5}$$

where $k = (r - \rho)/\gamma$ and the unknown initial consumption rate, c_0^*, can be solved for. The optimal consumption rate declines when the SDR, ρ, is equal to the interest rate, r, and hence, $k = 0$. This outcome is a very important implication (and observable result) from the LCM. Planning to even if ($\rho = r$).

Note also that consumption as defined earlier includes the pension annuity income, π_0. Therefore, the portfolio withdrawal rate (PWR), which is the main item of interest in our study, is $(c_t^* - \pi_0)/F_t$, and the initial PWR (i.e., the retirement spending rate) is $(c_0^* - \pi_0)/F_0$. The optimal financial capital trajectory (also defined as only until time $t < \tau$), which is the solution to Equation A4, can be expressed as a function of c_0^* as follows:

$$F_t = \left(W + \frac{\pi_0}{r}\right)e^{rt} - a_x^t\left(r - k, m^*, b\right)c_0^* e^{rt} - \frac{\pi_0}{r}, \tag{A6}$$

where the modified modal value in the annuity factor is $m^* = m + b\ln(\gamma)$. The actuarial present value term multiplying time zero consumption values a life-contingent pension annuity under a shifted modal value of $m + b\ln(\gamma)$ and a shifted valuation rate of $r - (r - \rho)/\gamma$ instead of r. Plugging Equation A6 into the differential Equation A4, however, confirms that the solution is correct and valid over the domain $t \in (0,\tau)$.

In other words, the value function in Equation A1—and thus life-cycle utility—is maximized when the consumption rate and the wealth trajectory satisfy Equations A5 and A6, respectively. Of course, these two equations are functions of two unknowns—c_0^* and τ—and we must now solve for them, which we will do sequentially.

First, from Equation A6 and the definition of the WDT ($F_\tau = 0$), we can solve for the initial consumption rate:

$$c_0^* = \frac{\left(W + \pi_0/r\right)e^{r\tau} - \pi_0/r}{a_x^\tau\left(r - k, m^*, b\right)e^{r\tau}}. \tag{A7}$$

Note that when $\gamma = 1$, $\pi_0 = 0$, and $\rho = r$, Equation A7 collapses to W / a_x^{τ}.

Finally, the WDT, τ, is obtained by substituting Equation A7 into Equation A5 and searching the resulting nonlinear equation over the range $(0,D)$ for the value of τ that solves $c_t^* - \pi_0 = 0$. In other words, if a WDT exists, then for consumption to remain smooth at that point—which is part of the foundation of life-cycle theory—it must converge to π_0.

Mathematically, the WDT, τ, satisfies the equation

$$\frac{\left(W + \pi_0 / r\right)e^{r\tau} - \pi_0 / r}{a_x^{\tau}\left(r - k, m^*, b\right)e^{r\tau}} e^{k\tau}\left({}_{\tau}p_x\right)^{1/\gamma} = \pi_0. \qquad \text{(A8)}$$

Put another way,

$$\tau = f\left(\gamma, \pi_0 \,|\, W, \rho, r, x, m, b\right). \qquad \text{(A8a)}$$

The optimal consumption policy (described by Equation A5) and the optimal trajectory of wealth (described by Equation A6) are now available explicitly. Practically speaking, the WDT ($\tau \leq D$) is extracted from Equation A8, and the initial consumption rate is then obtained from Equation A7. Everything else follows. These expressions can be coded in Excel in a few minutes.

NOTES

1. Thus, our use of "Planet Vulcan" in the title of our study, inspired by Thaler and Sunstein (2008), who distinguished "humans" from perfectly rational "econs," much like the Star Trek character Spock, who is from Vulcan.
2. See, for example, Walter Updegrave, "Retirement: The 4 Percent Solution," Money Magazine (16 August 2007): http:/ /money.cnn.com/2007/08/13/pf/expert/expert.moneymag/ index.htm.
3. In fact, to some extent, Milevsky and Robinson (2005) encouraged this approach by deriving and publishing an analytic expression for the lifetime ruin probability that assumes a constant consumption spending rate.
4. For detailed information on possible parameter estimates for the EIS and how they affect consumption under deterministic life-cycle models in which the SDR is not equal to the interest rate, see Hanna, Fan, and Chang (1995) and Andersen, Harrison, Lau, and Rutstrom (2008).
5. This annuity is quite different from the Yaari (1965) tontine annuity, in which mortality credits are paid out instantaneously by adding the mortality hazard rate, λ_t, to the investment return, r. Thus, we use the term pensionization to distinguish it from economists' use of the term annuitization. The latter assumes a pool in which survivors inherit the assets of the deceased, whereas the former requires an insurance company or pension fund to guarantee the lifetime payments. See Huang, Milevsky, and Salisbury (2010) for a discussion of the distinction between the two and their impact on optimal retirement planning in a stochastic versus deterministic mortality model.
6. The consumption function is concave until the WDT, at which point it is nondifferentiable and set equal to the pension annuity income.
7. A (tongue-in-cheek) rule of thumb that could be substituted for the static 4 percent algorithm is to counsel retirees to pick any initial spending rate between 2 percent and 5 percent but to reduce the actual spending amount each year by the proportion of their friends and acquaintances who have died. This approach would roughly approximate the optimal decline based on anticipated survival rates.
8. Thus, one could say that there are bag ladies on Vulcan. 9. See Stock and Wise (1990) for an example of this burgeoning literature.

REFERENCES

Andersen, S., G.W. Harrison, M.I. Lau, and E.E. Rutstrom. 2008. "Eliciting Risk and Time Preferences." Econometrica, vol. 76, no. 3 (May):583–618.

Arnott, R.D. 2004. "Sustainable Spending in a Lower-Return World." Financial Analysts Journal, vol. 60, no. 5 (September/ October):6–9.

Ayres, I., and B. Nalebuff. 2010. Lifecycle Investing: A New, Safe, and Audacious Way to Improve the Performance of Your Retirement Portfolio. New York: Basic Books.

Babbel, D.F., and C.B. Merrill. 2006. "Rational Decumulation." Working paper, Wharton Financial Institutions Center.

Bengen, W.P. 1994. "Determining Withdrawal Rates Using Historical Data." Journal of Financial Planning, vol. 7, no. 4 (October):171–181.

CONTINUED ON **PAGE 38**

Bodie, Z., and J. Treussard. 2007. "Making Investment Choices as Simple as Possible, but Not Simpler." Financial Analysts Journal, vol. 63, no. 3 (May/June):42–47.

Bodie, Z., D. McLeavey, and L.B. Siegel, eds. 2008. The Future of Life-Cycle Saving and Investing. 2nd ed. Charlottesville, VA: Research Foundation of CFA Institute.

Bodie, Z., J.B. Detemple, S. Ortuba, and S. Walter. 2004. "Optimal Consumption-Portfolio Choice and Retirement Planning." Journal of Economic Dynamics & Control, vol. 28, no. 6 (March):1115–1148

Brown, J.R., O.S. Mitchell, J.M. Poterba, and M.J. Warshawsky. 2001. The Role of Annuity Markets in Financing Retirement. Cambridge, MA: MIT Press.

Bütler, M. 2001. "Neoclassical Life-Cycle Consumption: A Textbook Example." Economic Theory, vol. 17, no. 1 (January): 209–221.

Chen, P., R.G. Ibbotson, M.A. Milevsky, and K.X. Zhu. 2006. "Human Capital, Asset Allocation, and Life Insurance." Financial Analysts Journal, vol. 62, no. 1 (January/February):97–109.

Cooley, P.L., C.M. Hubbard, and D.T. Walz. 1998. "Retirement Savings: Choosing a Withdrawal Rate That Is Sustainable." AAII Journal, vol. 20, no. 2 (February):16–21.

Deaton, A. 1991. "Saving and Liquidity Constraints." Econometrica, vol. 59, no. 5 (September):1221–1248.

Dybvig, Philip H., and Hong Liu. 2005. "Lifetime Consumption and Investment: Retirement and Constrained Borrowing." Working paper, Washington University in St. Louis (September).

Fisher, I. 1930. The Theory of Interest: As Determined by

Impatience to Spend Income and Opportunity to Invest It. New York: Macmillan.

Hanna, S., J.X. Fan, and Y.R. Chang. 1995. "Optimal Life Cycle Savings." Financial Counseling and Planning, vol. 6:1–14.

Huang, H., M.A. Milevsky, and T.S. Salisbury. 2010. "Calibrating Yaari in the 21st Century." Working paper, IFID Centre at York University.

Jiménez-Martín, S., and A.R. Sánchez Martín. 2007. "An Evaluation of the Life Cycle Effects of Minimum Pensions on Retirement Behavior." Journal of Applied Econometrics, vol. 22, no. 5 (August):923–950.

Kotlikoff, L. 2008. "Economics' Approach to Financial Planning." Working paper (www.esplanner.com/learn/ economics-approach-financial-planning).

Lachance, M. Forthcoming 2011. "Optimal Onset and Exhaustion of Retirement Savings in a Life-Cycle Model." Journal of Pension Economics and Finance.

Leung, S.F. 1994. "Uncertain Lifetime, the Theory of the Consumer, and the Life Cycle Hypothesis." Econometrica, vol. 62, no. 5 (September):1233–1239. ———. 2007. "The Existence, Uniqueness, and Optimality of the Terminal Wealth Depletion Time in Life-Cycle Models of Saving under Uncertain Lifetime and Borrowing Constraint." Journal of Economic Theory, vol. 134, no. 1 (May):470–493.

Merton, R.C. 1971. "Optimum Consumption and Portfolio Rules in a Continuous-Time Model." Journal of Economic Theory, vol. 3, no. 4 (December):373–413.

Milevsky, M.A. 2006. The Calculus of Retirement Income: Financial Models for Pensions and Insurance. Cambridge, U.K.: Cambridge University Press.

Milevsky, M.A., and C. Robinson. 2005. "A Sustainable Spending Rate without Simulation." Financial Analysts Journal, vol. 61, no. 6 (November/December):89–100.

Modigliani, F. 1986. "Life Cycle, Individual Thrift, and the Wealth of Nations." American Economic Review, vol. 76, no. 3 (June):297–313.

Modigliani, F., and R. Brumberg. 1954. "Utility Analysis and the Consumption Function: An Interpretation of Cross-Section Data." In Post Keynesian Economics. Edited by K.K. Kurihara. New Brunswick, NJ: Rutgers University Press.

Phelps, E.S. 1962. "The Accumulation of Risky Capital: A Sequential Utility Analysis." Econometrica, vol. 30, no. 4 (October): 729–743.

Ramsey, F.P. 1928. "A Mathematical Theory of Saving." Economic Journal, vol. 38, no. 152 (December):543–559.

Richard, S.F. 1975. "Optimal Consumption, Portfolio and Life Insurance Rules for an Uncertain Lived Individual in a Continuous Time Model." Journal of Financial Economics, vol. 2, no. 2 (June):187–203.

Samuelson, P.A. 1969. "Lifetime Portfolio Selection by Dynamic Stochastic Programming." Review of Economics and Statistics, vol. 51, no. 3 (August):239–246.

Scott, J.S., W.F. Sharpe, and J.G. Watson. 2008. "The 4% Rule— At What Price?" Working paper (April): www.stanford.edu/ ~wfsharpe/retecon/4percent.pdf.

Sharpe, W.F., J.S. Scott, and J.G. Watson. 2007. "Efficient Retirement Financial Strategies." Pension Research Council Working Paper (July).

Sheshinski, E. 2008. The Economic Theory of Annuities. Princeton, NJ: Princeton University Press.

Stock, J.H., and D.A. Wise. 1990. "Pensions, the Option Value of Work, and Retirement." Econometrica, vol. 58, no. 5 (September): 1151–1180.

Thaler, R.H., and C.R. Sunstein. 2008. Nudge: Improving Decisions about Health, Wealth, and Happiness. New Haven, CT: Yale University Press.

Yaari, M.E. 1965. "Uncertain Lifetime, Life Insurance, and the Theory of the Consumer." Review of Economic Studies, vol. 32, no. 2 (April):137–150.

Changing Seasons of Risk Attitudes

By David Ingram and Dr. Michael Thompson

Editor's Note: This article originally appeared in the February/March 2011 issue of The Actuary.

RISK ATTITUDES ARE AN EXTREMELY IMPORTANT DRIVER FOR FINANCIAL DECISION MAKING. The authors talk about how and why those risk attitudes keep changing with experiences and especially with surprises.

On July 21, 2010, Ben Bernanke, the chairman of the Federal Reserve, said that he thought that the economy was "unusually uncertain." Business leaders are reporting that there is relatively little investment going on by U.S. businesses. Companies are paying down debt and building up cash. Things are just too unsettled, too unpredictable for them to feel comfortable making commitments.

Just three years ago, Charles Prince made the now famous statement to a Hong Kong reporter regarding Citigroup's participation in the U.S. subprime mortgage market, "As long as the music is playing, you've got to get up and dance, [and] we're still dancing." That statement represented almost the exact opposite approach to business, a compulsion to participate in the market.

In between, U.S. businesses did a remarkably quick adjustment to a shrinking level of economic activity. Payrolls were trimmed, jobs were shed, benefits curtailed and businesses returned quickly to profitability in a no-growth economy.

If you look carefully enough, you will also find firms who avoided participating in either the high growth of the boom, the cuts of the bust or the paralysis of the uncertain environment. These firms seem to just keep steering their company carefully between the rocks, avoiding both shipwrecking rocks, fast currents and eddies.

But you can feel the sea change in the prevailing opinion of the economy. In a free market economy, this prevailing opinion is formed, not by edict but as individual managers and separate firms each reach the conclusion that some prior way of thinking is no longer working for them. They also notice that other managers and other firms with different attitudes are doing better (or less worse). These individuals and these firms all had firm opinions of how the world worked and therefore how best to run their firms that were formed based upon hard earned experience and careful perceptions.

Even in the best of times or the worst of times or even in "unusually uncertain" times, that prevailing opinion is never unanimous. In all times, these opinions about the environment and especially about risk in the environment tend to fall into four categories or risk attitudes.

They are:

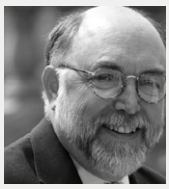
- Pragmatists who believe that the world is uncertain and unpredictable,
- Conservators whose world belief is of peril and high risk,
- Maximizers who see the world as low risk and fundamentally self correcting, and finally,
- Managers whose world is risky, but not too risky for firms that are guided properly.

(See "Full Spectrum of Risk Attitude" in the August/September 2010 issue of The Actuary.)

Changes come to these risk attitudes via the process of surprise. Surprise is the persistent, and very likely growing, mismatch between what we expect to happen based upon our chosen strategy and what actually happens. Surprise is the difference between Knightian risk and uncertainty.1 If there is no uncertainty, there should never need to be a surprise. But there clearly is uncertainty because over and over again, we are surprised.

When we all have the exact same expectations, then we are all surprised at the same time. But at any point in time, there are firms and individual managers with totally different risk attitudes. So there is a varied and varying set of surprises that are actually happening at all times. In market terms, we might expect a moderate market with fluctuations that follow past experiences, an uncertain market with unpredictable volatility, a market boom when everything seems to be going up or a recession when everything seems to be going down. Different business strategies are usually

CONTINUED ON **PAGE 40**



David Ingram, FSA, CERA, FRM, PRM, is senior vice president for Willis Re Inc. He can be contacted at *dave.ingram@willis.com.*

Michael Thompson, a research scholar with the Risk and Vulnerability Program at the International Institute for Applied Systems Analysis (IIASA) in Laxenburg, Austria. He can be contacted at *thompson@iiasa.ac.at.*

Changing Seasons of Risk Attitudes | from Page 39

chosen because of an expectation of a market in one or the other of those states. This means that surprises, when they come, can come in a total of 12 different ways. (See Figure 1)

Along the matrix's top-left to bottom-right diagonal, where the world is indeed the way it is stipulated to be, there are no penalties and therefore no surprises, but there are in each of the remaining 12 boxes. To deduce what each of these surprises will be, we need to contrast the strategy that is sensible to each firm with the responses the resulting tactics will provoke in each of the actual worlds.

- In the uncertain market there is no discoverable pattern to the responses: the world is an enormous slot machine. This is the world of financial uncertainty, when business activity and markets might turn abruptly. The model of the world has unknown drift and unknown volatility. Maximizers, Conservators and Managers are all surprised by the lack of predictability of the uncertain market. Each had their own different idea of what they were predicting and they are all disappointed.
- In a bust there is a discoverable order: the world is a vast negative-sum game. This is the world of the financial market bust. The world model has negative drift and low volatility. Of course, Maximizers and Managers are surprised. The Maximizers thought that persistent losses would just not happen and Managers are surprised by the magnitude of the losses. The Pragmatists were surprised when "correlations all go to one" and their preferred strategy of diversification fails to protect them.
- In a boom the reverse is the case—the world is a huge positive-sum game. This is the world when the financial bubbles form. The model for this world has high positive drift and low volatility. Managers and Conservators see the large gains of the Maximizers in the boom and are surprised that they can get away with that. Pragmatists see their own larger than expected gains and are surprised.
- In a moderate market there are two games going on—a positive-sum one and a negative-sum one. But, unlike the uncertain market, there is a discoverable order: it is possible to differentiate between those situations in which one game is operating and those in which the other holds sway. This is the "normal" world of the risk management models, with moderate drift and moderate volatility, perhaps at the levels of long-term averages. The Maximizers will be surprised that they underperform their outsized expectations, while Conservators see the Managers' careful taking of risks, which they had shunned, succeeding. Pragmatists are puzzled and surprised by the success of the orderly Managers as well.

The process of changing risk attitudes for business takes two routes. First, individual managers will be surprised just as is described earlier. The process of noticing again and again that their expectations are not being met by the world will wear away at their convictions about how the world works. Some managers will notice immediately and adapt quickly; others will keep expecting that they will wake up tomorrow and the world will again work the way they expect it to work, persisting in their unrequited beliefs even with repeated evidence to the contrary. As these individuals

ACTUAL WORLD

EXPECTED WORLD	UNCERTAIN	BUST	BOOM	MODERATE
UNCERTAIN (Pragmatist)	NO SURPRISES	Expected windfalls don't happen—only losses	Unexpected runs of good luck	Unexpected runs of good and bad luck
BUST (Conservator)	Caution does not work	NO SURPRISES	Others prosper (especially Maximizers)	Others prosper (especially Managers)
BOOM (Maximizer)	Skill is not rewarded	Total collapse	NO SURPRISES	Partial collapse
MODERATE (Manager)	Unpredictability	Total collapse (when only partial was expected)	Competition	NO SURPRISES

"The process of changing risk attitudes for business takes two routes."

shift their risk attitudes, they will shift their approach to their business and especially to the risks of their business. If they are very perceptive and highly adaptable, they will change to a belief that aligns with the current environment and the process will begin again. They will help to lead their firms to the best result they can achieve in that environment. If they are less adaptable and less perceptive, they might well shift to a different risk attitude that does not align with the environment. Their firms might then lurch along from one type of suboptimal performance to another.

The second way that firms adapt is by changing leaders. This happens when the firm has been spectacularly surprised. Firms that were led by Maximizers like Mr. Prince at Citigroup are more likely to create large crashes for their firms when the environment shifts and the firm persists with its "all ahead full" approach to business. Firms led by leaders with a Manager strategy are also subject to potential collapses. We saw that in the past two years when the firms who used their excellent risk models to help them to take the maximum amount of risk that was tolerable as shown by those models and subsequently choked on the outsized losses. Conservators and Pragmatists are much less likely to suffer collapse because their strategies tend to be much less aggressive. Their surprises are more often disappointments because their firms miss the opportunities that the Maximizers are jumping on and the Managers are taking up in moderation.

In the firms where the board reacts to a collapse or even to a disappointment by changing leaders, then the new leader faces the problem of shifting the prevailing risk attitude of the firm. The new leader will be looking around for managers within the firm who share his or her attitude. Through a series of persuasions, orders, reorganizations, promotions, retirements and layoffs, the new leader will eventually get the firm's risk attitude to be what he or she and the board want.

Meanwhile, the success of the firms with an approach that aligns with the environment will cause them to grow and the firms with a misaligned approach will shrink relative to each other. That process will additionally create a shift of the emphasis of the market to different risk attitudes. The risk attitude that aligns well will eventually control more of the market's resources.

Back in the risk department, there is a model, and a group of modelers. They will be seeing and experiencing the changing environment. Emerging experience will fit one and only one of these four situations. (See figure 2)

Figure 2

	Drift	Volatility
Moderate	Moderate	Moderate
Boom	High	Low
Bust	Negative	Low
Uncertain	Unknown/ Unpredictable	Unknown/ Unpredictable

The modelers will also experience the changing winds of corporate risk attitude described above. Most often the risk models will fit into the moderate mold. These modelers will find that their work will be seen to have high value by management sometimes and completely ignored in other times. However, there may be folks within the modeling group who think that the model is too conservative and see that it will keep the firm from growing at the time when business is very advantageous. There may be others who think that the moderate assumptions understate the risks and lead the firm to excessive risk taking at just the wrong time. And when the discussion in the modeling group turns to correlation calculations, the fourth group will identify themselves by their skepticism about the reliability of any tail diversification effects.

The same surprise process that causes changes in firm risk attitude will have a profound impact on the risk modelers. That impact may mean that management looks at different outputs from the models at different points in time. Or it might mean that the firms ignore the models and the modelers some of the time. And some firms will simply stop funding risk modeling and disband the entire group.

To avoid this cycle of irrelevancy and defunding, risk modelers need to be aware of this process of changing environments and changing risk attitudes, and perhaps to be more adaptable to the different environments and to the different needs for risk information from managers with different risk strategies.

CONTINUED ON **PAGE 42**

Changing Seasons of Risk Attitudes | from Page 39

And to expect surprises.

For more on Surprise see Thompson, M. (2008). Organising and Disorganising, Triarchy Press. ■

ENDNOTES:

[1] Frank Knight famously separated the definitions of Risk (as purely statistical variations with known frequency distributions) and Uncertainty (variations with unknown distribution of frequency and severity) in his 1921 book Risk, Uncertainty, and Profit.

Risk—The Concept of Dr. Michael Thompson's "Di-vidual"

By Robert Wolf

ULTIMATELY, ONE CAN ARGUE that many of the risks that we face in society today manifest themselves through the decisions, behaviors and biases of people, and not necessarily through any exogenous and uncontrollable event. The collaboration of an actuary, Dave Ingram, FSA, CERA, MAAA, and anthropologist, Dr. Michael Thompson, continues to strengthen this notion and is prompting some tremendously interesting, evolutionary and thought-provoking articles (such as the one in this issue of *The Actuary*) around the cultural view of risk and how it relates to risk management and decision making.

I personally had the pleasure of meeting Dr. Thompson for the first time at the 2010 ERM Symposium in Chicago last April where I had recruited both he and Dave Ingram to speak on the human element of risk management. I learned that he not only is an eloquent speaker, and a tremendous individual, but he also is an avid mountain climber as 35 years ago he successfully climbed Mount Everest in the Himalayas. One would think this would give a great perspective of risk and reward—definitely a human element perspective.

As humans, we tend to not search for disconfirming evidence to our own beliefs. As decision makers, we all deviate from rationality based on our own biases, and we are clearly influenced by the format of how we receive information. Dr. Thompson goes further, saying, "At the heart of what I have to say is a very bold assertion. The world of human activity can be divided into four divergent views of risk, four resulting [types]of risk taking strategists, and four different environments that impact the views of risk and are themselves impacted by the [types] of risk taking strategists. These four divergent views came from the eminent British anthropologist Mary Douglas in her work on plural rationalities."

Dr. Thompson is one of Mary Douglas' students. The main premise of plural rationalities concerns how we, as individuals, behave in groups. We as humans do not follow alone the risk-averse individual in classical economics, nor the emotional human via behavioral finance. Dr. Thompson states, "Groups form because people share the same concept of risk. In anthropology, the key term is 'social solidarity,' defined by the great French Sociologist Emiel Durkheim as, 'The different ways we bind ourselves to one another as a way of organizing and in so doing determine our relationship with nature.'" Dr. Thompson further states, "Cultural theory, in essence, maps all that in a four-fold typology of forms of social solidarity. These four specific models of nature, per se, are intended to sustain and justify the four fundamental arrangements for the promotion of social transactions."

When asked how he differs from the points of view of behavioral economists, Dr. Thompson says, "Behavioral economists assume that we individuals get it wrong in a systematic way. I argue that these forms of social solidarities should be the true units of analysis, and not that of the individual. Indeed, if you take this approach, it makes more sense to speak not of the individual, but of the 'di-vidual.' If you think about it, we all move in and out of those different solidarities in different parts of our daily lives. These views contrast the more familiar theories that take the 'individual' as the unit of analysis, such as the case in classical economics, and behavioral finance. "

From these views one can truly substantiate why we as individuals sometimes say one thing, and do the other. Dr. Thompson and Dave Ingram's work continues to evolve in integrating the anthropological viewpoints and the financial problems that actuaries and risk managers face with the four seasons of risk, the types of risk management tools, and the ultimate solution of rational adaptability and what Dr. Thompson calls clumsy solutions. Their contribution via the voice and the pen, I envision will continue to evolve how we will think in risk management terms. I thank Mike and Dave for being our catalysts in bringing about, perhaps, a new way of thinking. I'm looking forward to their next chapter.

Robert Wolf, ASA, CERA, FCAS, MAAA, is staff fellow, Risk Management for the Society of Actuaries. He can be contacted at rwolf@soa.org.

Book Review: *Mastering Operational Risk By Tony Blunden and John Thirwell*

Review by Pierre Tournier

WHEN I PICKED UP MY COPY of *Mastering Operational Risk* I had a mixed feeling. First, it looks imposing (344 pages) and second, it's part of a series of financial "how-to" books. As soon as I started reading though, it was obviously worth my time. Although it's long, each section feels concise and I wouldn't want less detail.

Pierre Tournier, FSA, CERA, is an assistant actuary in the Profitability Management area at Allianz Life Insurance Company in Minneapolis. He can be reached at *pierrectournier@hotmail.com*.

Mastering Operational Risk is a high level review covering the theory, culture, and practice or the risk management process. Although the sample reports are based on the banking industry, the material is relevant in other industries. The authors keep a practical feel by spending significant time on some of the nuts and bolts of risk management, particularly around effective reporting technique. The target audience is someone looking to understand the big picture of their company's operational risk framework or who is moving into a risk management role.

The authors begin by describing a risk management framework that also sets the structure of the book. The framework includes: Governance, Indicators, Assessments, Events, Modeling, and Reporting. Each part of the framework is sequentially presented in relation to this framework. Continually tying the different parts of operational risk management process back to the framework is a useful way of putting context to each section and reminding the reader of the overarching purpose. For me, this was the most interesting and relevant part of the book.

The second part of this book deals with specific risks (people, reputation, continuity) and specific risk management tools (insurance, audit.) Throughout this section, the emphasis is on proactive operational risk management rather than describing a management framework. The section header "The outsourcing project – getting it right at the start" is representative of this part. The boundary between careful business practice and risk management is blurry at times, but this seems consistent with the idea that effective operational risk management includes a risk culture.

A weakness of this book is the use of acronyms and terms that are not defined until later sections. Early on, for example, the authors mention the "three lines of defense" philosophy which isn't described until the last few chapters. Also, the two parts of the book don't feel cohesive. The first part is relevant to the corporate world and provides significant detail. The second part is broader and more general.

The authors did give me some things to consider; quite a few of the suggestions were different from my own experience. In the proposed framework risk ownership, monitoring duties, and management is pushed down to the business level. Risk Management takes an assurance, support, and coordination role rather than being directly involved in daily monitoring. I partially chose this book because it was published post 2008 and was based on a banking model. I expected a more centralized structure then what was proposed.

A significant strength of *Mastering Operational Risk* is how risk culture is treated. In addition to being directly addressed, risk culture is continuously referenced as a key part of the risk management process. The value of upper and middle management buy-in is frequently stressed as is pairing risk management with the proper message. Risk management awareness and education are also well covered themes.

In all, *Mastering Operational Risk* does a good job of being both a conceptual and hands on introduction to operational risk. This book takes a "big picture" approach, mostly describing a structure and management philosophy for each step of operational risk management. At the same time, entire sections are devoted topics like to effective report generation and practical scenario analysis. I liked having the "big picture" issues along side day to day challenges to maintain my perspective.

ReFocus2012

SEE THE FUTURE FIRST

March 4–7, 2012, Four Seasons
Las Vegas, NV

A Global Gathering for Senior Life Insurance and Reinsurance Executives

An Industry at a Critical Crossroads

SOCIETY OF ACTUARIES
A.S.A. 1889
A.I.A. 1909
1949

ACLI
Financial Security...for Life.

ENTERPRISE RISK MANAGEMENT

ERM

Symposium

Where Cutting Edge Theory Meets State of the Art Practice

More than 400 senior executives, directors, and risk management experts gathered at the 2011 Enterprise Risk Management Symposium in Chicago to present the latest on ERM thinking and practices. Make sure you don't miss the next opportunity—our 2012 ERM Symposium—to learn from industry leaders about this emerging discipline and expand your ERM skills.

Highlights include:

- Top risk management experts offering their perspectives on key risk issues
- Pre-Symposium seminars on ERM topics
- Networking opportunities to renew and expand your list of ERM contacts
- Call for papers program showcasing new research
- Exhibitors demonstrating their ERM services and knowledge

Visit **www.ermsymposium.org**
to learn more about this global conference.

Presented by the Casualty Actuarial Society, Canadian Institute of Actuaries, Professional Risk Managers' International Association and Society of Actuaries

and with collaboration of the Asociacion Mexicana de Actuarios, Colegio Nacional de Actuarios, and Enterprise Risk Management International Institute.

The 10th Annual Premier Global Event on ERM!

2012 ERM Symposium
April 18–20, 2012

Washington Marriott Wardman Park
Washington, DC

JOINT RISK MANAGEMENT SECTION

Canadian Institute of Actuaries
Casualty Actuarial Society
Society of Actuaries

475 N. Martingale Road, Suite 600
Schaumburg, Illinois 60173
p: 847.706.3500 f: 847.706.3599
w: www.soa.org

Risk management