

# **Emerging Risks Survey**

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## Third Risk Manager Survey of Emerging Risks

Some risks generate a large volume of historical data that remains stable over time. Other risks are evolving in uncertain ways, have been forgotten in their dormancy, or are new. These are called emerging risks. While stable risks can usually be represented by a statistical distribution, often using a normally distributed, bell-shaped curve, emerging risks typically do not have a known distribution and challenge even the best modeler's analytical skills.

In a competitive market, business opportunities often go to those who mistakenly ignore significant risks. Risk managers who recognize a risk before others can encounter several downsides. These managers might be so prescient that, rather than enjoying the benefits of a lucrative investment, their own organizations become insolvent because backers lose faith in their mission or the investment vehicles used may expire worthless. A recent example occurred in the pricing of credit default swaps for collateralized debt obligations. Some investors recognized the risk but their options were too short-lived. Others avoided this asset class and lost sales to others with higher crediting rates. This is a challenge for those whose environmental scanning for emerging risks uncovers those not considered by anyone else.

When working with contingent events where the cash flows occur many years out, clearly there will be future risks that were not considered when the decision was made to accept the risk. For example, consider a product manager in 1990 looking at risks internationally. Should earthquake risk be considered? Yes, it generally is known if earthquakes have previously occurred in a particular location. How about fresh water shortages? Global warming? Pandemics? These questions are tougher. The risk manager must consider risks such as terrorism, climate change, and various fiscal crises across an uncertain political environment. To do this a risk manager must be creative and able to communicate to a skeptical audience. While feature films and documentaries can invoke ancient Mayan calendars and the quatrains of Nostradamus, convincing senior management with them is unlikely to enhance your credibility. Some companies seem to avoid the pitfalls of emerging risks better than others. It is hard to know with certainty whether they are lucky or skilled.

This survey attempts to track the risk manager population's thoughts about emerging risks across time. This is the third survey conducted by the Casualty Actuarial Society, Canadian Institute of Actuaries, and Society of Actuaries' Joint Risk Management Section on this topic. It demonstrates that trends are as important as absolute responses. The trends described herein can aid risk managers as they contemplate individual risks, combinations of risks, and unintended consequences of actions. The survey responses and summarized results also provide a tool for risk managers to network with peers and identify new ways to think about risk. To further clarify the responses, numerous opportunities were provided within the survey to comment beyond the specific questions posed.

Risk managers have recently encountered many risks that the financial markets did not anticipate. Many were financial risks, but other issues include hurricanes, data security and pandemics. There is an upsurge in management's willingness to listen to risk managers. Long-term it is unclear if ERM will consistently become part of the strategic decision making process. Many firms (and individuals) had no game plan in place to address the recent crisis. As Nassim Taleb has stated, a Black Swan is something no one predicted in advance but everyone predicted and understands after the fact. It is this attempt to convert from lagging to actionable leading indicators that we investigate here. In reality, very few were prepared for the extent of the recent impact on a wide range of financial instruments, but those with minimal leverage and long-term asset allocation strategies have had relatively better results than others. Some even profited by identifying emerging risks early, creating for themselves a competitive advantage. Good risk management practice entails preparing a firm to succeed across a variety of potential scenarios with focus on both mitigation and optimization.

### ***Executive Summary***

Once risks become apparent most financial pundits start looking for someone who identified the problems in advance. The financial winners are anointed as geniuses. This is the aura surrounding emerging risks—somehow, someone can make better decisions by being the smartest person in the room. Sun Tzu, who wrote *The Art of War* around 2,500 years ago, provides a deep insight into risk management with this quote:

*"So it is said that if you know your enemies and know yourself, you can win a hundred battles without a single loss. If you only know yourself, but not your opponent, you may win or may lose. If you know neither yourself nor your enemy, you will always endanger yourself."*

He could easily have been referring to various risks that risk managers choose to accept or avoid. Competitors may make different choices. In hindsight, someone will appear to have had a competitive advantage. Going forward, will insurers accept mortality risk prior to a previously unseen infectious disease? Will banks accept credit risk in the calm prior to a blow up in asset prices? Will auto makers reduce quality control to boost margins? Will countries borrow heavily prior to natural catastrophes driven by climate change? Do we worry about Middle East instability and totally miss an ensuing blow up somewhere else? Stability leads to excessive risk taking, and volatility leads to fear. Better decision making comes from recognizing that many risks cycle over time. Models and management actions should remain flexible where possible. A strong risk culture empowers this flexibility.

Since the previous iteration of this survey in November 2008, a number of risks have been realized or highlighted. Recent events are reflected in what behavioral finance calls anchoring, where forecasts are influenced by recent events. The Mumbai terrorism attack coincided with the end of the prior survey, after most respondents had completed it. The Copenhagen Climate Summit in Fall 2009 raised awareness of the many risks implied by human interaction with the environment. In Spring 2009 the World Health Organization (WHO) declared H1N1 to be a pandemic. Other catastrophes were local, including a somewhat normal litany of earthquakes, capsizing boats, airplane crashes,

rain/snow/wind storms, avalanches and fires. The earthquakes in Haiti, Japan, and Chile in early 2010 occurred after the survey closed. Past surveys have led this researcher to look for ways to help those taking the survey to recognize that anchoring occurs. In a rather clumsy attempt to help those filling out the survey recognize that recent events impact their responses to future emerging risks, the current survey started with a question asking respondents to rank the top current risk from the same list of 23 used for emerging risks. This process will likely evolve, and hopefully improve, over time.

As in past reports, the survey results show that current values of the S&P 500, a barrel of oil, and the U.S. dollar relative to the Euro seem to anchor perceptions of risk. The survey results have evolved over time, generally following the current environment. Only economic factors are shown here in Table 1, and the researcher would be interested in suggestions about how to track current exposures of other risks.

	S&P 500	Oil (per barrel)	USD/Euro
Spring 2008	1,385.59	\$ 113.70	\$ 1.56
Fall 2008	968.75	68.10	1.27
Fall 2009	1,106.41	77.04	1.48

Table 1

The initial survey was released to the INARM group (International Network of Actuarial Risk Managers) in April 2008. When this survey was completed, the S&P 500 stood at 1,385.59 (according to Yahoo Finance), the price of a barrel of oil was \$113.70 (Energy Information Administration at <http://tonto.eia.doe.gov/dnav/pet/hist/rwtcd.htm> and one Euro cost \$1.56 ([http://www.federalreserve.gov/releases/h10/Hist/dat00\\_eu.htm](http://www.federalreserve.gov/releases/h10/Hist/dat00_eu.htm)). At that time the top four emerging risks chosen, out of the five each survey respondent could pick, were

1. Oil shock/energy supply interruptions (57% of respondents)
- 2T. Climate change (40%)
- 2T. Blow up in asset prices/excessive indebtedness (40%)
4. U.S. current account deficit/fall in U.S. dollar (38%)

With oil at historic highs it was the predominant emerging risk chosen. The second survey was issued in early November 2008, so rates are compared at the end of October. At that time, using the same sources, the S&P 500 had dropped 30%, the price of a barrel of oil had decreased 40%, and the U.S. dollar had strengthened 23%. The top four emerging risks from this second iteration of the survey were

1. Blow up in asset prices/excessive indebtedness (64%)
2. US current account deficit/fall in US dollar (48%)
3. Oil price shock/energy supply interruptions (39%)
4. Middle East instability (34%)

Systemic risk was perceived to be very high at this time with stock values in free fall. Oil prices had fallen quite a bit, U.S. currency was considered a safe harbor and the U.S.

election cycle had just ended with Barack Obama voted in as the new President. The current survey was issued in early December 2009, so rates are compared with those at November month end. At that time, using the same sources and comparing against the previous survey date, the S&P 500 had increased 14%, the price of a barrel of oil had increased 13%, and the U.S. dollar had weakened 17%. The top four emerging risks from this third iteration of the survey are

1. US current account deficit/fall in US dollar (66%)
2. Blow up in asset prices/excessive indebtedness (49%)
3. Oil price shock/energy supply interruptions (45%)
4. Chinese economic hard landing (33%)

The three surveys have created three distinct top choices for emerging risks, each with over half the respondents choosing it as one of their top five. At the time of this survey fiscal stimulus driven deficits were much larger than previously seen, both in the United States and elsewhere. The perceived systemic risk had receded from the previous fall. A bit surprisingly based on recent events, *Climate change* and *Pandemics* did not spike into the top five responses. It could be that risk managers do not consider these risks as emerging at this point. There is evidence from the survey that these risks are already being monitored by many risk managers. Changes between the most recent surveys were not as material as observed between the first two surveys.

The survey results should become more stable over time. With more data we can review trends and measures like higher/lower than average results and whether some form of mean reversion exists. The only material consistent trend seen is the increase in the *US current account deficit/fall in US dollar*, from 9% to 10% to 14% across the three surveys. It is a bit surprising that other risks have not consistently trended higher (or lower) during this period.

Respondents were asked about the top current risk. The results, not surprisingly, showed 5 of the top 6 current risks from the Economic category. Of non-Economic risks, only *Climate change* made the top current risks list with a tie for third place.

1. 30% Blow up in asset prices/excessive indebtedness
2. 17% US current account deficit/fall in US dollar
- 3T. 7% Climate change
- 3T. 7% Fiscal crises caused by demographic shift
5. 6% Chinese economic hard landing
6. 5% Oil price shock/energy supply interruptions

Tabulating by categories, the Economic category led with 64%, with Geopolitical at 16% and Environmental at 10%. An interesting category comparison is between the top current risk and the top emerging risk.

- Economic 64% current 63% emerging
- Environmental 10% current 12% emerging
- Geopolitical 16% current 14% emerging
- Societal 3% current 2% emerging
- Technological 3% current 6% emerging

Only the technological risks are materially higher for emerging than current risks. What is interesting is the consistency in these results. The past two years have been dominated by economic risks. Will the emerging risk percentages remain stable in a period where another type of risk dominates, or will it change as the top current risk changes? That is unknown at this point, but the apparent anchoring implied by these results is intriguing at the very least.

Looking at an average of the single top emerging risk chosen over time, the following risks have been the most selected:

1. US current account deficit/fall in US dollar (11%)
2. Oil price shock/energy supply interruptions (10%)
3. Blow up in asset prices/excessive indebtedness (10%)
4. Chinese economic hard landing (7%)

Several questions about combinations of emerging risks led to a concentration in the same categories, with half the choices made in just 10 risk combinations and driven by Economic risks.

Political instability could be the result of many of the listed emerging risks. Not surprisingly, when asked to list up to three emerging risks related to political instability, the Geopolitical category was dominant with 58%. Economic was second with 33% and the others lagged. The leading combination of a selection of three risks, with eight responses (the next highest was four), was the risk combination *International terrorism, Failed and failing states, and Middle East instability*.

Enterprise risk management (ERM) views all risks as they are managed across an entity. Emerging risks are a subset of ERM, dealing with risks not currently being fully considered in this process. An approach used to manage risks and make better (and earlier) decisions factors in leading indicators. As companies implement an ERM process, many are creating metrics around both lagging and leading indicators. These are designed to help make better decisions. A lagging indicator could be the number of auto policies in force or premium collected. A leading indicator provides information earlier in the process. Examples would include insurance applications much higher/lower than expected or a spike in the credit default spread for a counterparty risk such as a reinsurer. Nearly half the respondents reported having at least some leading indicators around

emerging risks. In addition to economic indicators like currency and GDP, some reported using agent surveys, housing prices, World Health Organization (WHO) pandemic reports, temperature changes, and population growth. Some even reported having criteria that leads to action steps, although few details were provided. For those emerging risks that develop into current risks, it becomes costly to hedge them as the market gains familiarity. At one time it was inexpensive to hedge variable annuity guarantees. Then it wasn't. Leading indicators are an important part of future ERM research.

The survey asked about changes for ERM-focused activities that occurred in 2009. Not surprisingly, given the recent financial turmoil and the background of participants as risk managers, 66% saw activities for their organization or clients increase. Yet, only 36% saw staffing levels increase for these activities. For 2010, nearly half expect to see increased funding, which might reflect the timing of the financial issues late in 2008 after budgets had been set.

## **Background**

This research project was funded by the Joint Risk Management Section of the Society of Actuaries, Canadian Institute of Actuaries, and Casualty Actuarial Society. A survey was developed and made available through an email link to members of the Joint Risk Management Section, along with others (especially the INARM list serve). A total of 176 responses were received. This represents greater than 5% of completed surveys relative to the number distributed (over 2,500 to JRMS). Similar surveys were distributed in April 2008 and November 2008. Articles describing the earlier research can be found on pages 18-21 of the International News August 2008 issue <http://soa.org/library/newsletters/international-section-news/2008/august/isn-2008-iss45.pdf> and pages 17-20 of the Joint Risk Management Section March 2009 newsletter <http://soa.org/library/newsletters/risk-management-newsletter/2009/march/jrm-2009-iss15.pdf>. The research report associated with the Fall 2008 survey can be found at <http://soa.org/research/risk-management/research-2009-emerging-risks-survey.aspx>.

Rather than developing a unique set of emerging risks to consider, a set developed by the World Economic Forum was chosen as reasonable. The World Economic Forum reports, starting in 2007, can be found at [www.weforum.org](http://www.weforum.org). The 23 risks developed by the World Economic Forum are described in detail in Appendix I. Each risk has been categorized as Economic (5 risks), Environmental (5), Geopolitical (7), Societal (4) or Technological (2). These emerging risks were held constant for all three survey iterations to allow comparisons and develop trends. The new survey added questions designed to provide input to several current topics and leading indicators.

Research reports do not create themselves in isolation, and the researcher thanks Beverly Barney, Dave Ingram, Barbara Scott and Steve Siegel for their help designing and implementing the questionnaire, along with gleaned information from the results. Of course all errors and omissions remain the responsibility of the researcher.



## **Researcher**

The lead researcher for this project is Max J. Rudolph, FSA CERA CFA MAAA. Additional related articles and presentations can be found at his web site. His contact information is

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## **Results**

The survey contained sections covering Emerging Risks, Leading Indicators, Modeling and Metrics, Accounting, Current Topics, and Demographics. Highlights of each section are presented here. A total of 174 surveys were completed (electronically), but some respondents (about 15%) did not answer all the questions. Partially completed surveys are included and percentages adjusted for the number completing each question.

### **Default Question**

In previous surveys, it was observed that responses were anchored in the present. For example, when a recent terrorist attack occurred, then International terrorism responses increased dramatically. When oil prices spiked, Oil price shock was more often selected as an emerging risk. The reality was that these risks were not emerging any more often after they happened; however, it confirmed expectations from the concepts of behavioral finance about how perceptions change. It might be that emerging risk surveys should be considered contrarian in nature, or only valuable when taken as averages over several years. In this survey a benchmarking question was asked about the top current risk. It was thought that a respondent would answer the current risk question, and then when answering the emerging risk questions would recognize the difference. In behavioral finance it is thought that recognizing our shortcomings will help us to overcome them. In future surveys anchoring will continue to be addressed but the methods used will evolve and improve.

For the five broad categories, responses were impacted by several events occurring in Fall 2009. The global financial crisis and the UN Climate Change Conference in Copenhagen were the major news events. Somewhat surprisingly given the H1N1 pandemic that hit earlier in the year, only 3% of respondents listed pandemics as the top current risk.

- Economic 112 responses      64%
- Geopolitical 28 responses    16%
- Environmental 17 responses   10%
- Societal 5 responses         3%
- Technological 5 responses    3%
- Other 7 responses             4%

More than half of the “other” responses were also tied to economic risks. The leading individual risks selected were

- 30% Blow up in asset prices/excessive indebtedness
- 17% US current account deficit/fall in US dollar
- 7% Fiscal crises caused by demographic shift
- 7% Climate change
- 6% Chinese economic hard landing

Of the economic risks, the only one outside the top five responses was *Oil price shock/energy supply interruptions*. This was considered by many to be the top risk early in 2008 when the first emerging risks survey was completed. Less than two years later it is not even in the top five of current risks (6<sup>th</sup> overall).

### **Section 1: Emerging Risks**

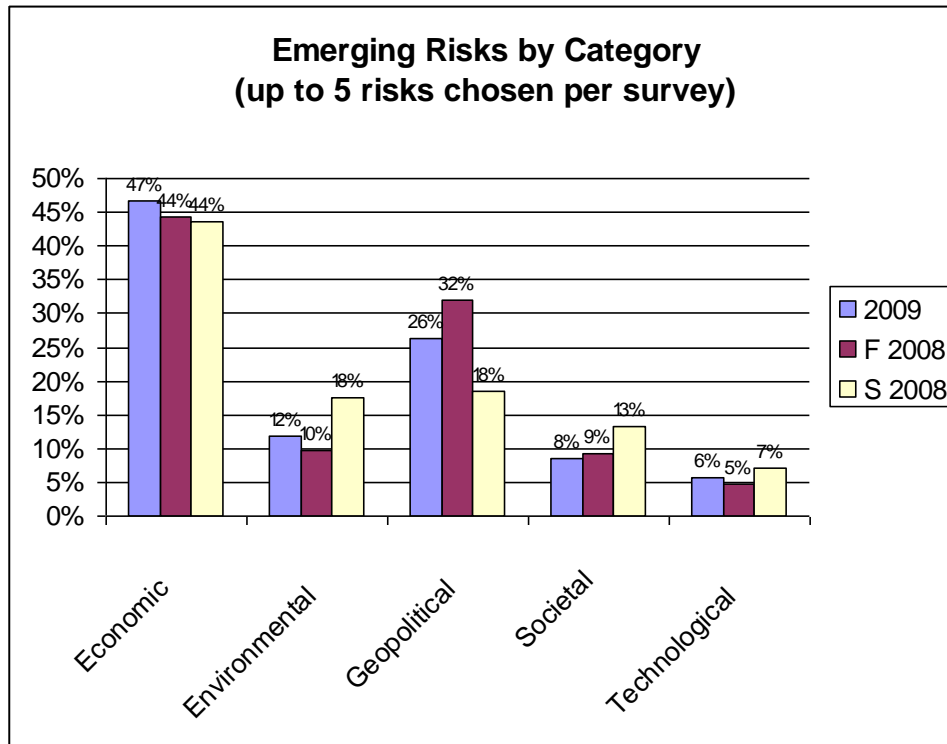
After the attempt to help respondents understand their tendency to anchor through the benchmarking question, 168 survey respondents chose up to five emerging risks that “you feel will have the greatest impact over the next few years.” This wording is intentionally ambiguous so that respondents can define greatest impact in their own way. The World Economic Forum had a time horizon of 10 years in mind when it developed these risks, but that is not required here. This is the third time this survey has been completed, and trend data is starting to become valuable. In May 2008 the market was a bit rocky, but the real concern was the price of oil. In late 2008 stock markets had fallen precipitously and the price of oil had dropped from record highs as the global financial crisis was strongest. The US Presidential election cycle had just completed. This survey was completed in December 2009 when the global financial crisis and systemic risk was beyond its worst but still making headlines and unemployment rates remained high. A large climate conference had just been held in Copenhagen and the H1N1 pandemic had spread in the spring. The large deficits incurred by fiscal stimulus packages appear to have impacted risk concerns as well.

Not all respondents chose to list five risks. While 82% of those who filled out at least one risk did list the maximum allowed, and the average was 4.72, some also entered fewer than five risks.

Given the economic stresses worldwide and the group being surveyed (actuaries and other risk managers), it is not surprising that the Economic category received the most responses, followed by Geopolitical. The others trailed far behind. It will be interesting to trend over time to see if this is a leading, lagging or contrarian indicator. Are risk professionals able to step outside their current surroundings to predict emerging risks or do they get locked into today’s major issues and ignore risks about to explode into consciousness after years of calm? Many would argue this is what happened with the recent financial problems, where it was too easy to take risk. Managers were lulled into a false sense of security by more complex models supposedly reducing volatility risk and government intervention intended to smooth the bumps in the financial road.

A total of 793 responses included 8 (5%) in the Other category. The results distributed by category are:

1. 370 responses 47% Economic
2. 161 responses 26% Geopolitical
3. 94 responses 12% Environmental
4. 67 responses 8% Societal
5. 46 responses 6% Technological



Geopolitical dropped quite a bit, mainly due to reductions in *Failed and failing states*, *Retrenchment from globalization* and *Middle East Instability*. In addition to Economic categories described below, material increases went to various *Natural catastrophes* and *Breakdown of critical information infrastructure (CII)*.

The top four specific responses to Question 1, *What are the emerging risks that you feel will have the greatest impact over the next few years?*, were each from the Economic category. Percentages in this survey are based on the number of respondents who answered the specific survey question. This allows consistent comparison with previous and subsequent survey iterations. . For example, 168 respondents answered Question 1 and 82 included *Blow up in asset prices/excessive indebtedness* as one of their (up to 5) responses. Thus 49% ( $82/168 = 0.49$ ) chose this emerging risk.

1. 66% (48% in previous survey) US current account deficit/fall in US dollar
2. 49% (64%) Blow up in asset prices/excessive indebtedness
3. 45% (39%) Oil price shock/energy supply interruptions
4. 33% (27%) Chinese economic hard landing

In earlier surveys, conducted in May 2008 and November 2008, *Oil price shock/energy supply interruptions* (57%) and *Blow up in asset prices/excessive indebtedness* were the top responses, respectively. *Climate change* continues to be the top response from categories other than Economic (27% in this survey, 25% in fall 2008). The top responses from non-Economic categories were

1. 30% (29%) International terrorism (5<sup>th</sup> overall)
2. 28% (34%) Middle East instability
3. 27% (25%) Climate change
4. 25% (22%) Pandemics
5. 21% (16%) Breakdown of critical information infrastructure (CII)

Other risks which increased materially from Fall 2008 to Fall 2009 included Environmental risks related to natural catastrophes.

- 8% from 3% Natural catastrophe: Tropical storms
- 7% from 4% Natural catastrophe: Earthquakes
- 5% from 1% Natural catastrophe: Inland flooding

Natural catastrophes in 2009 did not dominate the news as the Indian Ocean tsunami did in 2004 or the Haitian earthquake early in 2010. In Fall 2008, the survey was impacted by the Mumbai terrorist attack. This makes it hard to explain this result. Three respondents listed all three, while 2 others listed 2 of the 3. No evidence was found of someone entering the same results multiple times as other questions had varying responses.

The Geopolitical group had decreases in *Failed and failing states* (26% to 18%) and *Retrenchment from globalization* (25% to 18%). Both seem to reflect the evolving environment from late 2008 to late 2009. A year ago the economy was in free fall worldwide, and an era of protectionism was predicted. At the same time, the public was distracted from a discussion about governments about to fail. As this report is being written, Greece and others have moved to the forefront, and a double dip recession could lead to lower oil prices and risks in states that rely on that revenue.

Other responses to question 1, in addition to the 23 choices provided, included pricing of generic drugs, digital crime, growing income disparity, and regulatory risk. It is interesting that someone would consider regulatory risk as emerging since regulation seems to cycle with a short setback to the economy. When the economy is in a down cycle it is not long thereafter that regulations tighten up, then they seem to loosen following calm economic periods.

Complete results for all survey questions can be found in Appendix II. Appendix III details the survey results from Fall 2008.

Another interesting result is the trend of Societal risks. The number of responses in this category has decreased in each survey to date, from 13% to 9% to 8%. This could be due to risk managers moving these risks from the emerging category to current risks as these

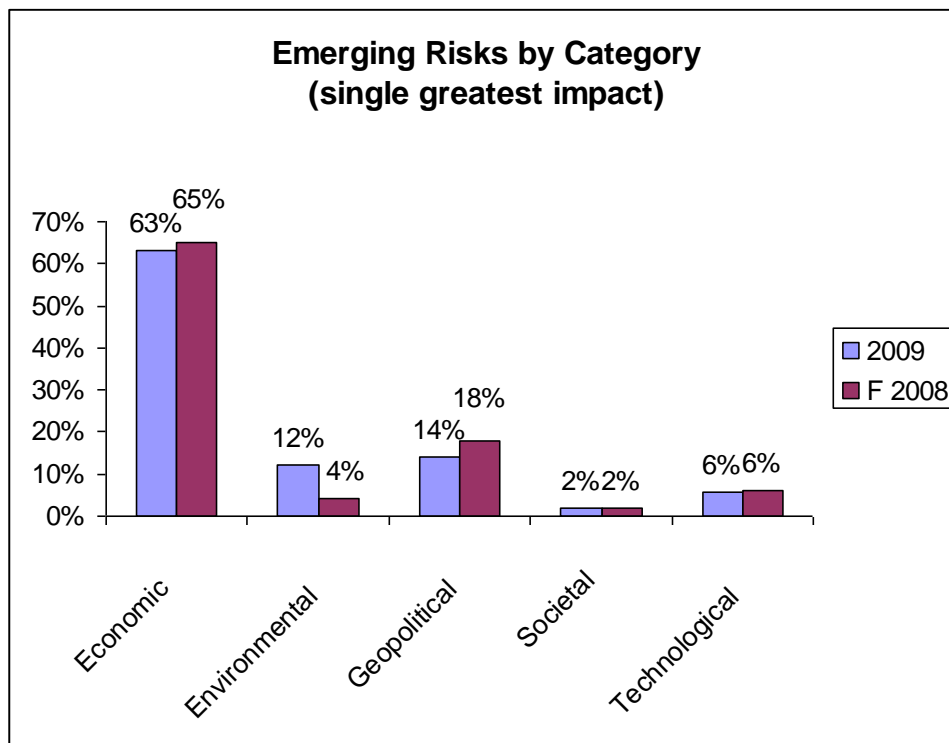
risks have become more visible. They also might feel that they are able to manage these risks in the normal course of their risk management process since they successfully made it through the recent H1N1 pandemic.

One method to analyze this data over time is to highlight those risks reported in the current survey above their long-term averages. Interestingly, only three of the 23 risks meet these criteria. They are: *US current account deficit/fall in US dollar, International terrorism, and Middle East instability.*

In Question 2, respondents were asked to state which single emerging risk they expected to have the greatest impact. Not surprisingly, the Economic category dominated this question, with Geopolitical risks again ranked second.

1. 63% (65%) Economic
2. 14% (18%) Geopolitical
3. 12% (4%) Environmental
4. 6% (6%) Technological
5. 2% (2%) Societal

Four of the five categories within Environmental increased relative to prior surveys and this trend will be monitored to see if it continues or if it drops as memories of the Copenhagen conference on climate change fade.



Four of the top five specific responses came from the Economic category, with Climate change (Environmental) tied for third. Nearly half of the results are explained by the top

two responses, with the rest distributed across the remaining 21 emerging risks on our list. These results are not unexpected given anchoring to the current environment.

1. 26% (18%) US current account deficit/fall in US dollar
2. 22% (25%) Blow up in asset prices/excessive indebtedness
- 3T. 6% (3%) Climate change
- 3T. 6% (12%) Oil price shock/energy supply interruptions
5. 5% (7%) Fiscal crises caused by demographic shift

Survey responses relative to the prior survey continue to show the effects of anchoring in the results, even for the top emerging risks. Respondents show more concern for currency risk and climate change this year and less for a *Blow up in asset prices/excessive indebtedness* and *Oil price shock/energy supply interruptions*. *Climate change* replaced *Breakdown of critical information infrastructure (CII)* as the only new entrant to the top 5.

The world exists in a dynamic environment. Whether it is the interaction between budget deficits, oil prices and currency exchange rates, or climate change and the loss of freshwater services, it is clear that no one can fully understand all of the interactions between risks and how it will all play out. An example of such interaction might be China's economy. If its economic growth slows, what impact will that have on climate change, currency imbalances and spreads on U.S. Treasuries? The expert risk manager won't have the absolute "right" answer to this, but will oversee a process that considers flexibility in responding to new issues rather than inflexibly following a set of rules to measure and manage risk.

In Question 3, combinations of risks were considered. It is interesting to review this from differing perspectives. Even though the question is about combinations of risks, it is helpful to look first at the risks in isolation. As was seen in earlier questions, Economic (53%) and Geopolitical (25%) are the most frequent responses when identified in isolation, but there was some movement away from Geopolitical and Societal to Environmental and Economic relative to the previous survey. Economic risks received over half of the mentions. With the H1N1 pandemic occurring during 2009 it is very interesting that Societal risks, including pandemic and other diseases, decreased in responses. These will be interesting trends to monitor over longer periods of time.

1. 53% (49%) Economic
2. 25% (32%) Geopolitical
3. 13% (9%) Environmental
4. 5% (8%) Societal
5. 3% (2%) Technological

Individual risks were led by the same major categories. A three way tie for 5<sup>th</sup> place reflects the changes from the prior survey as Geopolitical risks were lower and *Climate change* higher. The *Chinese economic hard landing* moved into the top 5 from a 6<sup>th</sup> place tie last year.

- |     |           |  |
|-----|-----------|--|
| 1.  | 18% (12)  | US current account deficit/fall in US dollar   |
| 2.  | 13% (12%) | Oil price shock/energy supply interruptions    |
| 3.  | 11% (14%) | Blow up in asset prices/excessive indebtedness |
| 4.  | 8% (6%)   | Chinese economic hard landing                  |
| 5T. | 6% (8%)   | International terrorism                        |
| 5T. | 6% (8%)   | Middle East instability                        |
| 5T. | 6% (4%)   | Climate change                                 |

Many emerging risk combinations could lead to a variety of unintended consequences and should be considered as strategic plans are implemented. Risk combinations can happen simultaneously or sequentially. For example, many other risks might lead to Geopolitical risks like *Loss of freshwater services*, leading to *Interstate and civil wars*. Concurrent emerging risks could exacerbate a scenario such as a *Pandemic* occurring simultaneously with a *Natural catastrophe* such as tropical storms or an earthquake.

Each respondent could choose up to three combinations of two risks. In total there were 408 combinations suggested. Respondents were not asked to list them in priority order. Appendix II includes a grid showing all combinations. While the top three were various combinations of the most frequently listed individual risks, the fourth leading response included *Oil price shock/energy supply interruptions* teamed with *Middle East instability*. With more responses in this survey, it is interesting that the results were more concentrated in the top four combinations than was seen previously. There were also more risk combinations chosen (101 versus 75 in the previous survey, out of a set of 253 possible combinations). The major category combinations were

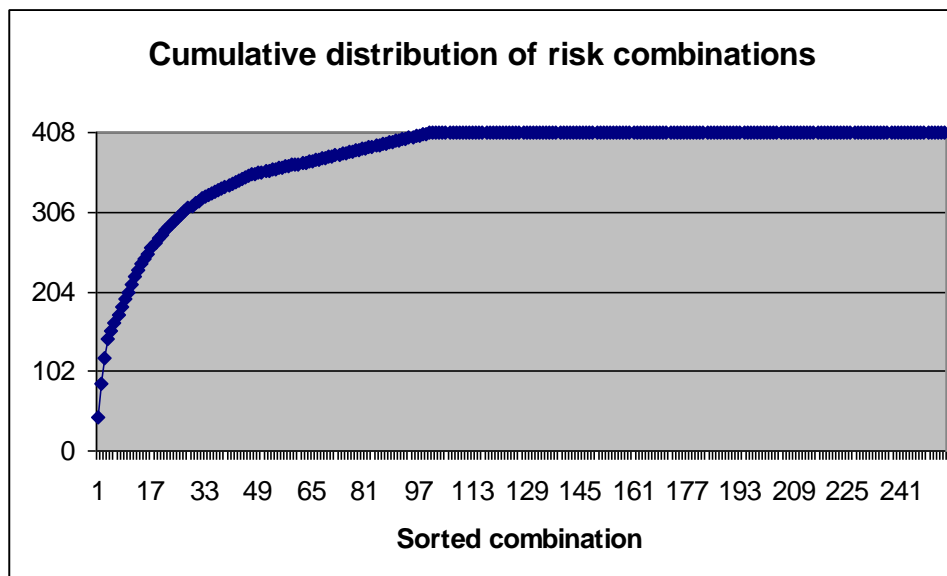
- 42% (34%) Economic – Economic
- 16% (22%) Economic – Geopolitical
- 14% (16%) Geopolitical – Geopolitical
- 9% (7%) Environmental – Environmental
- 3% (2%) Economic – Environmental
- 3% (2%) Economic – Societal
- 3% (5%) Environmental – Societal
- 2% (1%) Geopolitical – Technological
- 2% (2%) Environmental – Geopolitical
- 2% (4%) Geopolitical – Societal
- 1% (2%) Societal – Societal
- 1% (1%) Economic – Technological
- 1% (<1%) Technological – Technological
- <1% (0%) Environmental – Technological
- <1% (1%) Societal - Technological

Leading combinations were

1. 44 responses
  - US current account deficit/fall in US dollar
  - Blow up in asset prices/excessive indebtedness
2. 43 responses
  - US current account deficit/fall in US dollar
  - Chinese economic hard landing
3. 32 responses
  - Oil price shock/energy supply interruptions
  - US current account deficit/fall in US dollar
4. 24 responses
  - Oil price shock/energy supply interruptions
  - Blow up in asset prices/excessive indebtedness
5. 11 responses
  - Climate change
  - Natural catastrophes: Inland flooding

Many of these combinations are likely to have unintended consequences, and perhaps a question along those lines should be asked in the future. For example, a *Chinese economic hard landing* could lead to currency imbalances, spread widening of low risk assets, and general economic stresses around the world due to the recent role of the Chinese government as the buyer of US Treasury bonds.

A total of 57 combinations included two risks from the Geopolitical category. The two most frequent combinations, with 10 responses each, combined *Proliferation of weapons of mass destruction (WMD)* with *International terrorism* and *Middle East instability*. These are major risks for the casualty industry, as terror groups and rogue states each pose a risk to developed nations.



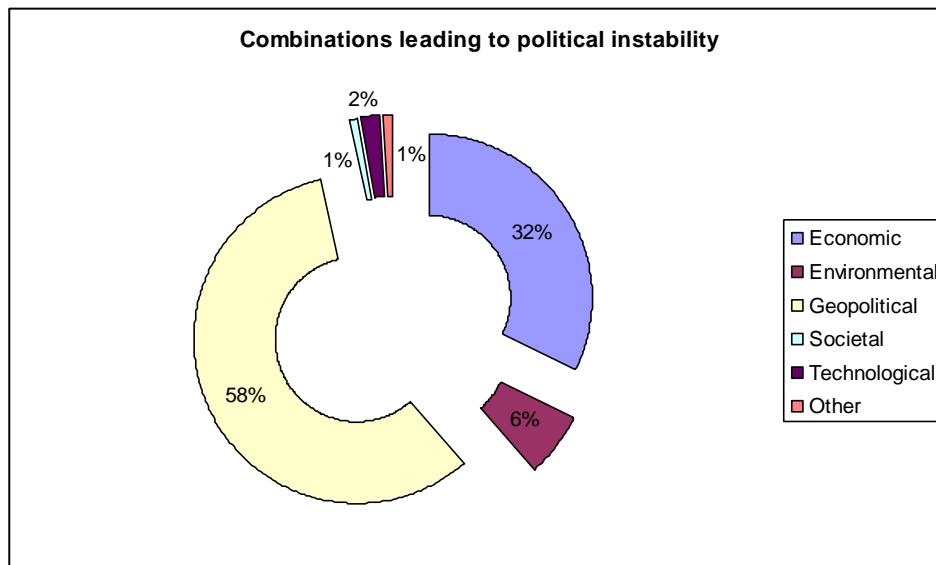


There are 253 possible risk combinations. The top 10 responses accounted for over half of the total 408 choices. By quartile, with data listed cumulatively, results were

- First quartile (most frequent) 3 combinations
- Second quartile (median) 10 combinations
- Third quartile 27 combinations
- Fourth quartile 101 combinations
- Remaining 152 risk combinations were not selected

Question 4 changes with each survey, looking at risk combinations surrounding a topical issue. A year ago the question referred to regional food shortages. This year political instability was the issue chosen. Respondents were allowed to include up to three risks, and 415 responses (2.8 per) were received. Results varied from earlier questions, as might be expected, with Geopolitical risks accounting for over half the responses.

1. 58% Geopolitical
2. 32% Economic
3. 6% Environmental
4. 2% Technological
5. 1% Societal



The top three specific responses were from the Geopolitical category, with *Middle East instability*, *Failed and failing states*, and *International terrorism* the top choices.

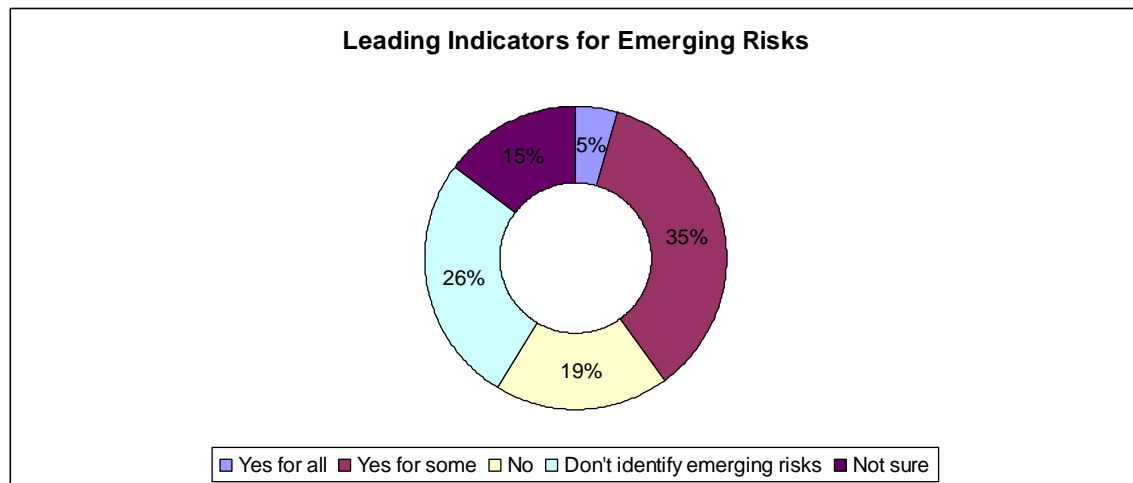
1. 40% Middle East instability
2. 32% Failed and failing states
3. 31% International terrorism
4. 30% Oil price shock/energy supply interruptions
5. 23% US current account deficit/fall in US dollar

Some of the results were surprising. *Chinese economic hard landing* finished only 7<sup>th</sup> and no Environmental category risk finished in the top 5 (*Loss of freshwater services* was 10<sup>th</sup>).

## Section 2: Leading Indicators

This section was added to the 2009 survey to reflect advanced practices in emerging risks and the need for tools that drive better decision making. Key risk indicators (KRIs) are metrics that provide information about a specific risk. Trending GDP or CPI can provide macroeconomic KRIs, as can revenue and liabilities for a firm. These are examples of lagging indicators that measure results after an event. Leading indicators, in contrast, provide information where events can still be adjusted. The survey did not ask about lagging indicators but, instead, about the use of leading indicators that would provide a firm with actionable information about a risk.

The first question stated: “Once an emerging risk is identified, do you select leading indicators to measure changing likelihoods?” 5% of the respondents noted that they had leading indicators for all identified emerging risks, which is astounding based on the difficulties encountered in quantifying many emerging risks. 26% did not formally identify emerging risks and 15% were not sure, so there is much work to be done in this area going forward.

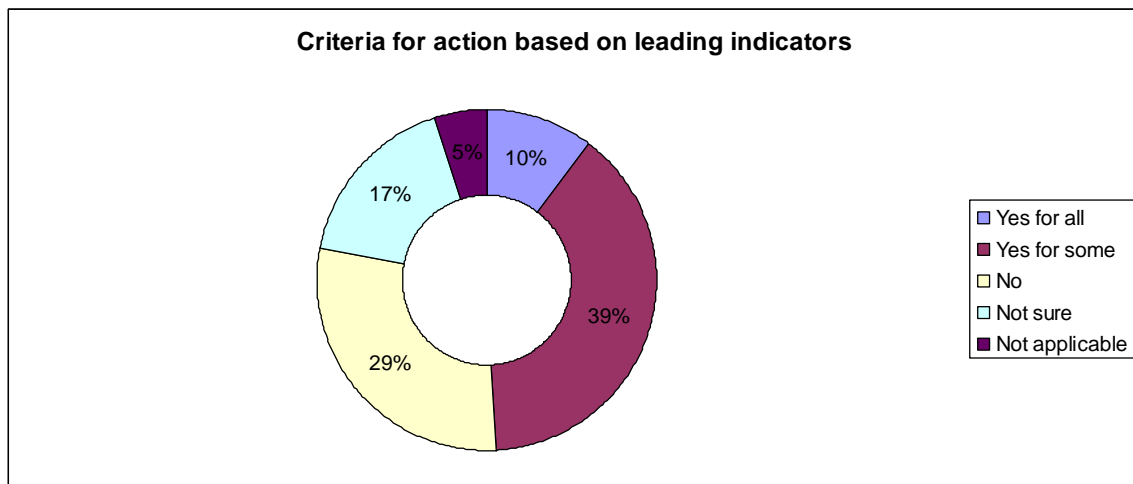


It is likely that these results are representative of best practice practitioners. Even so, only 40% self reported selecting leading indicators for at least some emerging risks. And for those forward thinking companies, a follow-up question might ask if decisions are being made based on this information or does the information remain buried in the risk management department. While this area is further along than anticipated, there is much room for improvement. Risk managers will need to advance from using lagging indicators driven by financial reporting to leading indicators driving decision making to move risk management practices forward.

When asked for examples, respondents provided many excellent ones (found in their entirety in Appendix II). Many of the indicators followed economic variables such as

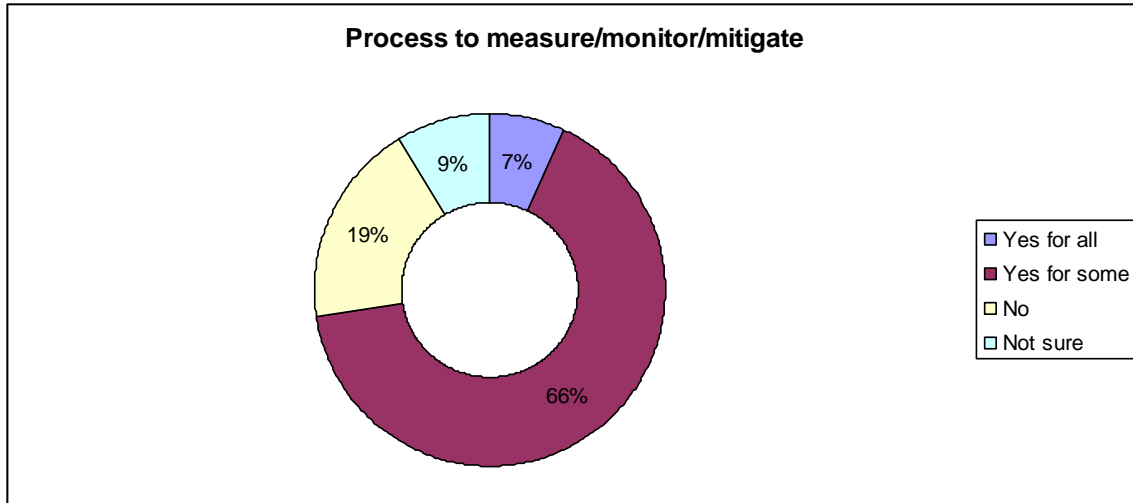
GDP, currency relationships, employment, and CPI for specific countries. Some appeared to be recent additions based on the current environment such as home price depreciation, international tensions, and WHO pandemic fatality rates. Others have developed metrics surrounding mentions in the media and specifically in blogs. One respondent shared a number of techniques they use, covering topics as diverse as a hard economic landing in China, potential reentry into recession, budget deficits, and triggers for international terrorism. This response seemed to consider unintended consequences of current actions. It is important that practitioners consider what could happen and not state that a specific risk will come to pass. Preparing for the fall of a specific country might be prudent but unless imminent can lead to unintended consequences if the warning is followed blindly.

The survey asked whether these leading indicators included criteria that would lead to an action to mitigate or accept the risk. There were 59 responses of the 62 who stated that they use leading indicators for emerging risks. Of those, about half (49%) stated that criteria exist for at least some of their emerging risks.



When asked for examples, several respondents provided general statements about education and nearing a tipping point. Specific examples included monitoring capital ratios, inflation thresholds, letters of credit and other range driven metrics. This is a good start, and risk managers should monitor what their peers are doing to share best practices.

58 surveys answered about measuring, monitoring, and mitigating an emerging risk once it has been identified, with 73% responding that they did for some or all of their identified emerging risks.



Examples provided did not generally get very specific, focusing instead on the risk rather than the resulting action. Topics included currency risk, interest rate risk, pandemics, scientific and legal developments. Some respondents stated they were encouraging alternative product designs and discouraging concentration of risks. It is often hard to enact a previously developed plan in its entirety as there are many moving parts. For example, an insurer might be concerned about interest rate risk and want to hedge the risk when rates are expected to be low, but the price at that time might be too expensive to implement the hedge as planned.

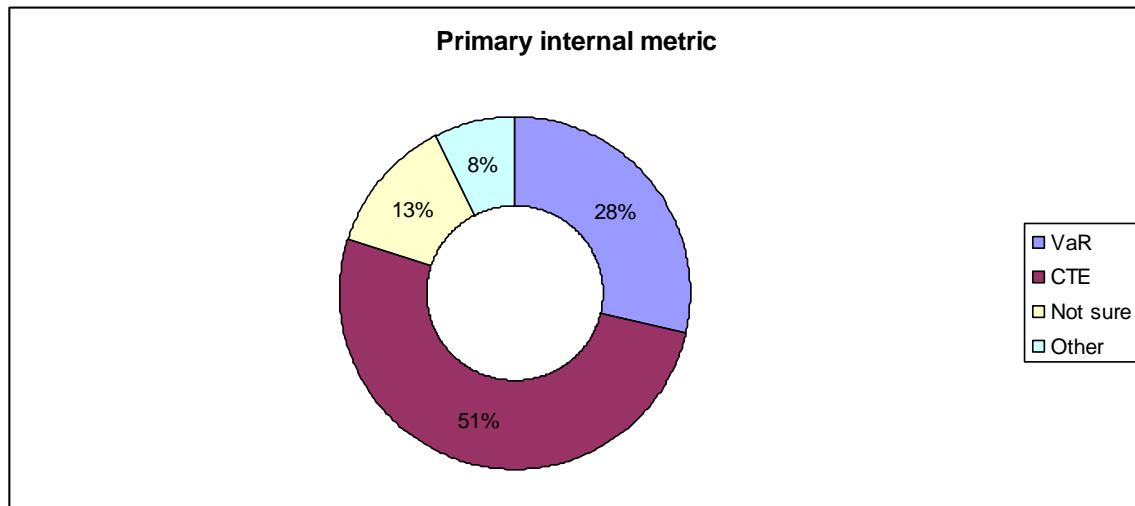
### ***Section 3: Modeling and Metrics***

During the Global Financial Crisis which still permeates throughout the economy, models have taken a beating. From “all models are wrong but some are useful” to the material shortcomings of the Value at Risk metric, little has gone right for modelers in the past few years. In some cases they were held out as unchallengeable. In others they were manipulated to recreate the desired answer (often the current market value) no matter what the actual risk accepted was.

Risk modeling has evolved as computers have become more powerful. Initially mainframe computers were used, and now a combination of mainframe and personal computers (and cloud computing) allow small as well as large firms to generate statistics that measure their risks. Bankers have focused on Value at Risk (VaR), which works great if the group being graded is ignorant of the tool being used but is easily manipulated otherwise. Banks generally use VaR while insurers use Conditional Tail Expectation (CTE). From a distribution of sorted results a specific level of conservatism is chosen, say 95%, to calculate either metric. The single scenario driving that sorted result is chosen and used to determine capital requirements for VaR. What can end up happening is firms load up on the 94<sup>th</sup> percentile risk. In a severe case, 94% of the results are very close to the 95<sup>th</sup> percentile result that was chosen. Many think CTE, also called Tail-VaR, is a better metric because it bases the required capital on an average of tail scenarios. So 95CTE would look at the worst 5% of results. CTE is also a coherent measure, meaning it

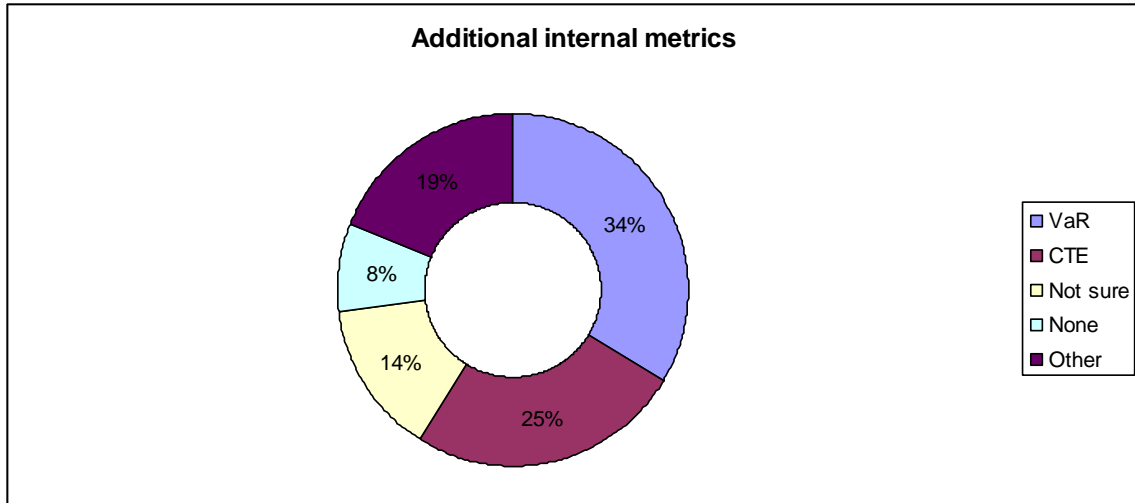
can be combined mathematically with other distributions of results and still provide credible results.

The results in this section are interesting, as the base choices for preferred internal use of CTE and VaR maintained a stable distribution from the prior survey with CTE close to 50%. The “Not sure” responses increased from prior surveys. This could reflect modelers becoming less sure of their models and metrics or becoming more familiar with the metric they had not previously used.

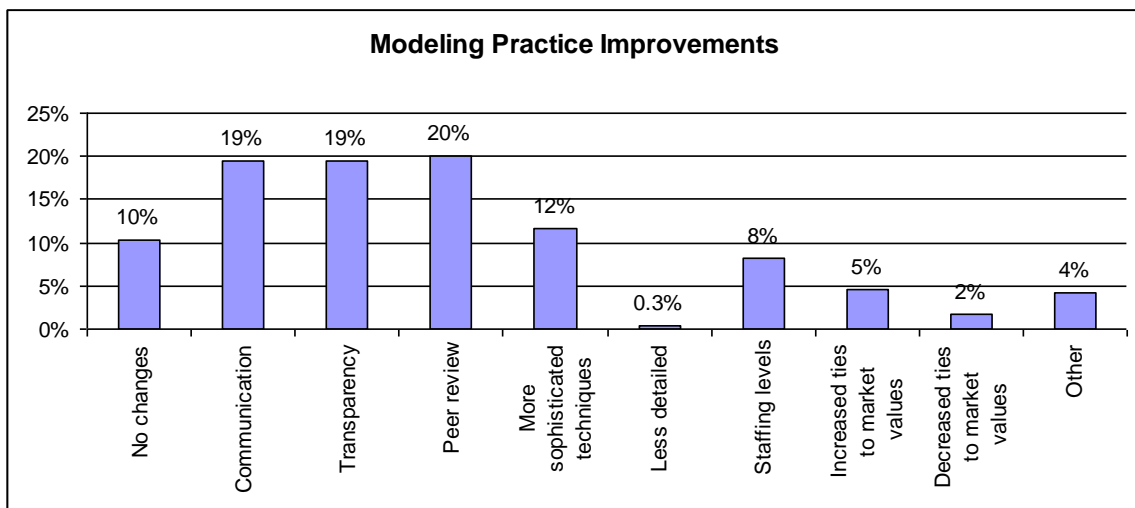


There were 11 specific answers beyond these two metrics. They included Conditional expected shortfall minus expected value and GAAP earnings volatility.

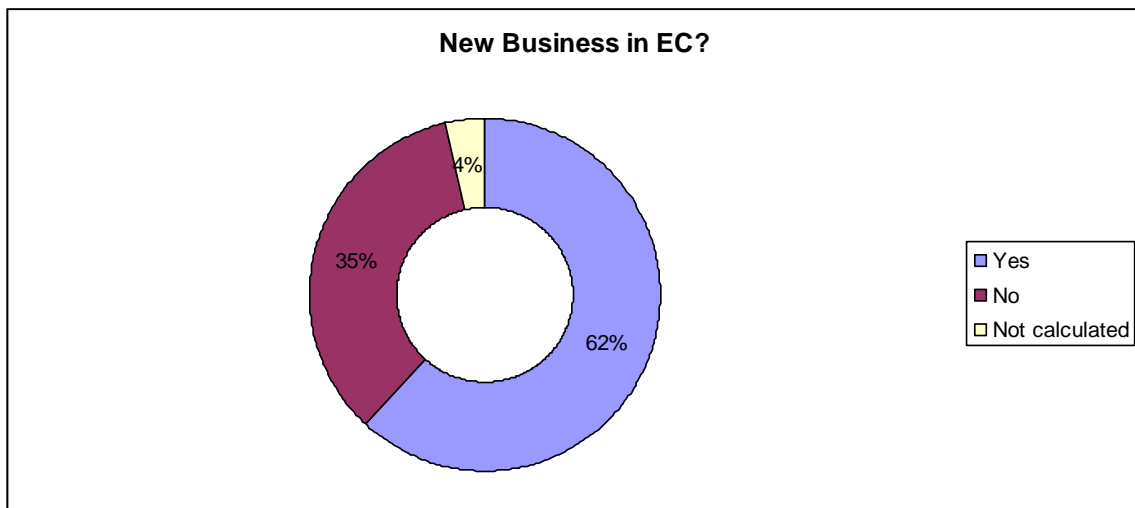
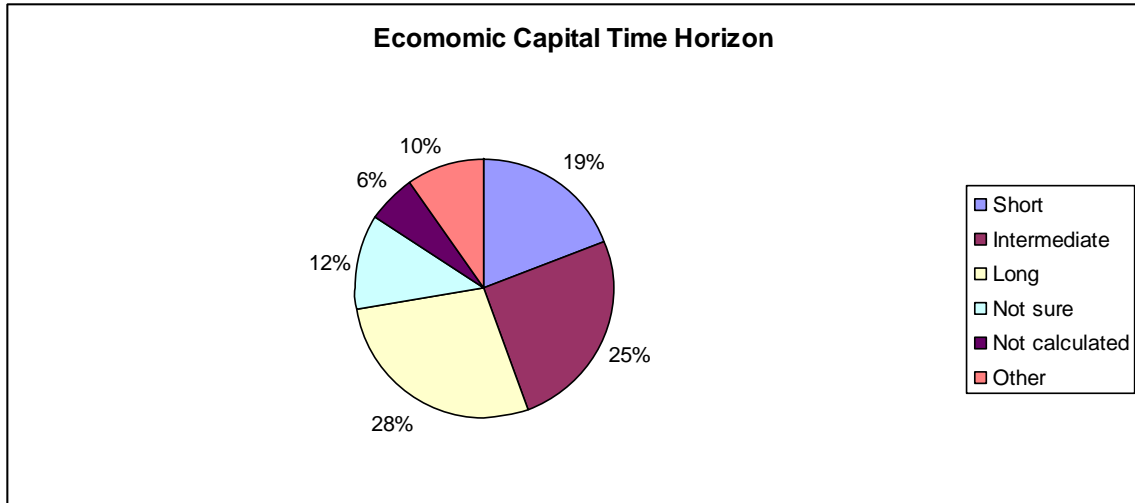
The survey also asked about additional metrics that were used internally. VaR and CTE each had increased percentage responses from the prior survey at the expense of None and Other. Respondents seem to be focusing more on these two metrics relative to other options, and it is interesting to see that fewer are focused on just one metric in this survey. That would be a logical conclusion of the recent environment where overreliance on one tool resulted in problems. There were 31 “Other” responses, with references to more sophisticated tools related to higher order moments and tail results relative to the mean. This is a positive result as risk managers are trying out various statistics using a base distribution of results. Earnings at risk and stress tests are additional tests that companies are using.



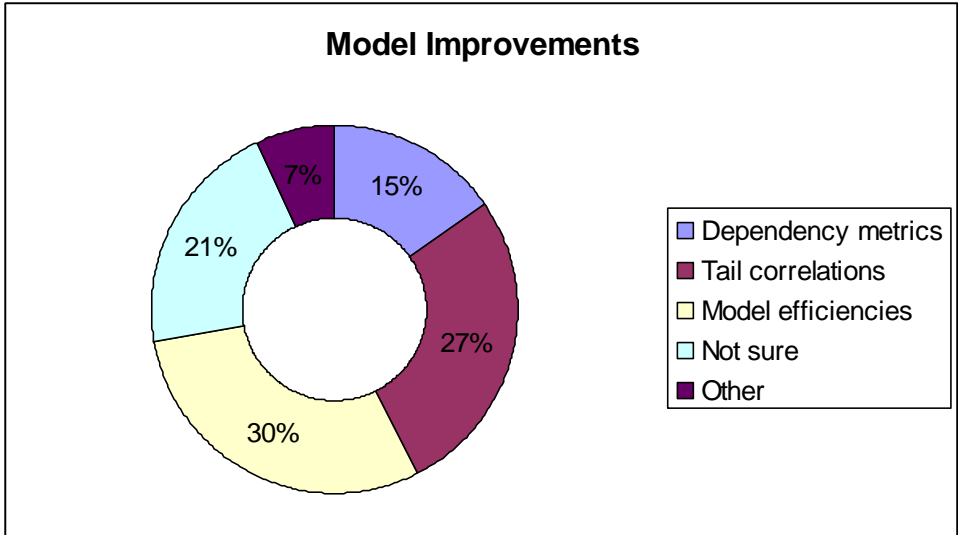
The survey asked how modeling practices had improved over the past year as the volatile era unfolded. Peer review, transparency and communication were listed most frequently. Only 8% saw their staffing levels improve, but that might be due to timing and budget cycles. Some of the additional comments were enlightening, including analysis of extreme risks, independent validation, and behavioral risk. These comments show that risk managers are not content with their models and are looking for ways to help them evolve based on previous shortcomings and best practices of others. It is hoped that this survey will become an avenue for leading practitioners to share top practices with others to help reduce the magnitude of risk surprises.



Responses were all over the map for the question about how long internal economic capital models were run out with similar rates for short (1 year), intermediate (3-5 years), and long (e.g., 30 years) time horizons. Others stated that they model for the entire lifetime of risks or a combination of time horizons. Almost two-thirds included new business in their analysis.



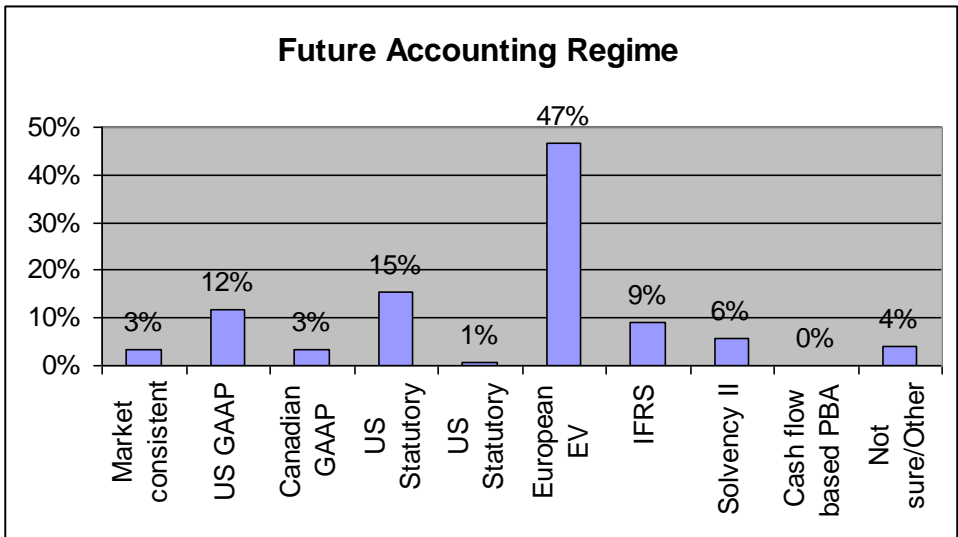
Modeling improvements are important to any evolutionary process. Financial modeling is no exception. Model efficiencies (30%) and tail correlations (27%) were again the leading responses. Interestingly, the “Not sure” response increased from 7% in the prior survey to 21% this time. This could be due to multiple initiatives (the survey asked for a primary source) or distracted modelers focused in on improving the silo risk errors which became apparent during the Global Financial Crisis.



The ten additional comments included using increased computing power to complete additional scenarios, but also discussed better assumptions to reflect management actions specific to a scenario and more sensitivities of key assumptions.

### Section 4: Accounting

There has been much discussion over the past year about current accounting practices. Rather than ask about preferences, this survey asked respondents where the accounting regime in their jurisdiction was expected to end up in 10 years. Almost 50% chose European embedded value, with US statutory and US GAAP distant runners-up. These results might also differ with a different regional mix of respondents.



### Section 5: Current topics

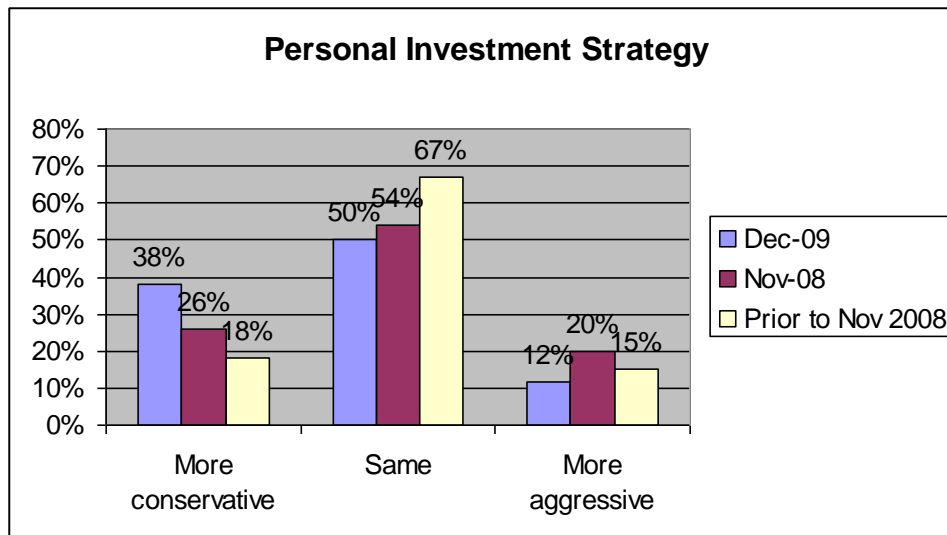
This is the third iteration of the survey, and much has happened since April 2008 and November 2008 when previous iterations were issued. With this in mind, some questions



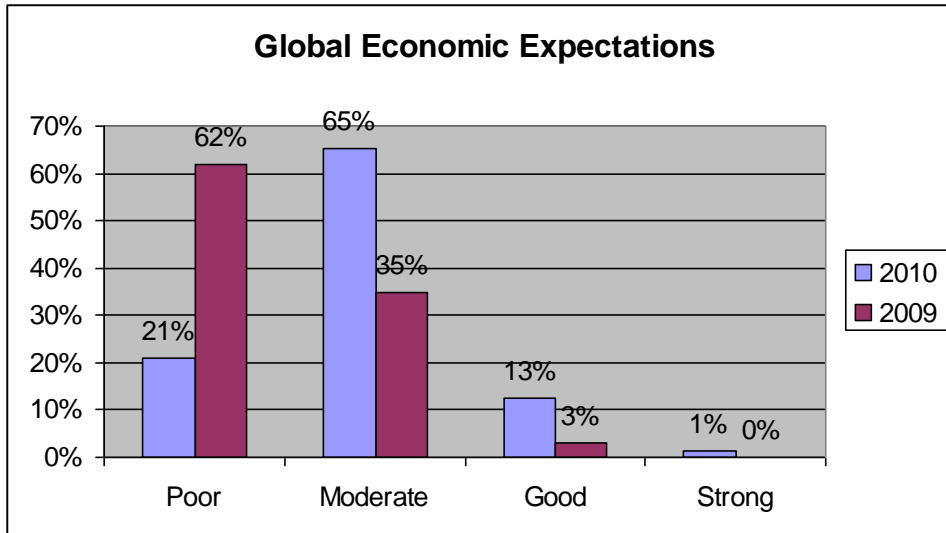
were posed for trending purposes and to determine if the responses can be used as leading indicators and thus predictive.

Respondents were asked if they manage their personal investments. A large majority of the risk managers, 87%, manage some portion of their portfolio with over half managing the entire amount.

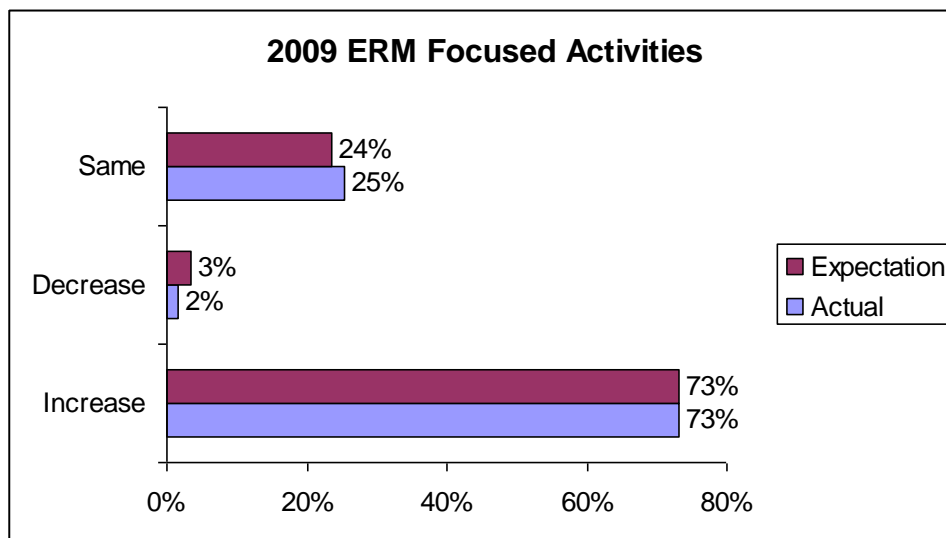
As shown in the figure, there is clearly a trend toward more conservatism in personal investing among the survey respondents over the past several years. The stock market enjoyed a healthy rally between the second survey and this one. Some who were more aggressive a year ago might be scaling back and taking profits, but overall the trend seems clear. Only time will tell if this is good advice or a contrarian indicator.



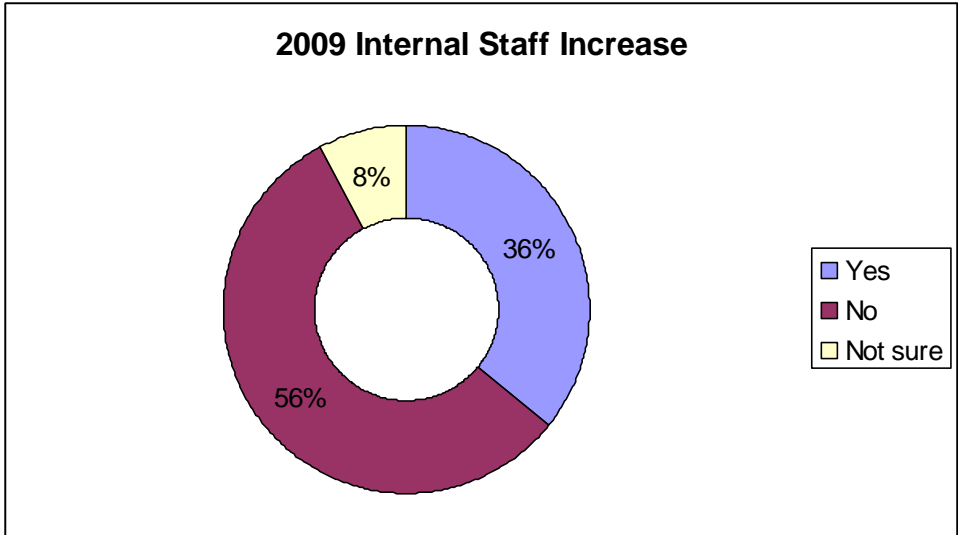
A year ago the survey asked about Global Economic Expectations for 2009. The responses were, not surprisingly, very negative with 62% expecting a poor economy and 35% moderate. Respondents are more optimistic for 2010 with 65% expecting a moderate economy and a few even predicting a strong economy. This is an interesting result given that respondents continue to be more conservative with their personal investment portfolio.



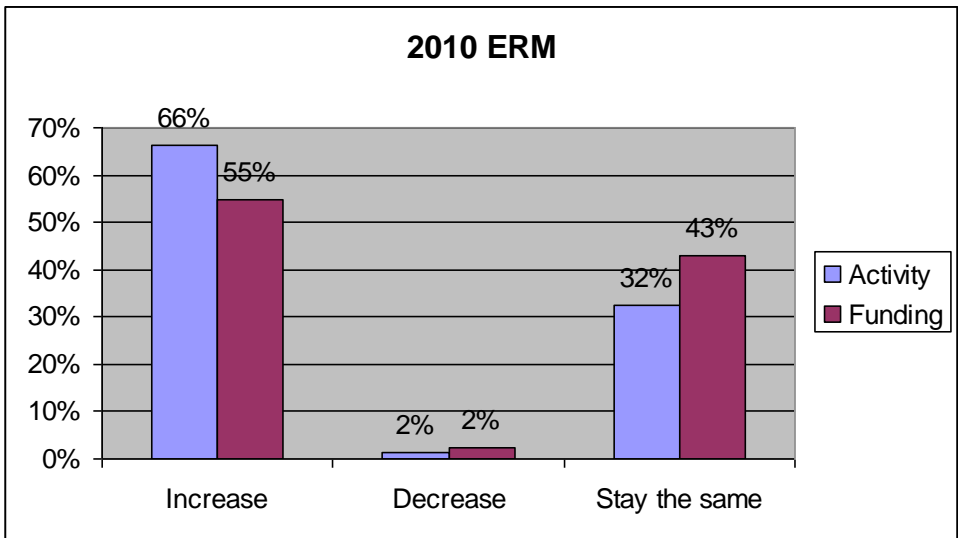
Risk managers have been criticized for not avoiding exposures later impacted by the Global Financial Crisis. While others have argued that culture was the driver and risk managers were generally not in a decision making capacity, most respondents agree that the increased visibility surrounding risk has led to increased activity in their area. The actual result came in very similar to one asking about expectations for 2009 in the previous survey. It will be interesting to see if future years see similar growth or if the recent stressed environment has led to a short term blip with future reductions or stability in activity.



While the activity increased, staffing did not follow quite as aggressively with about a third experiencing staff growth.



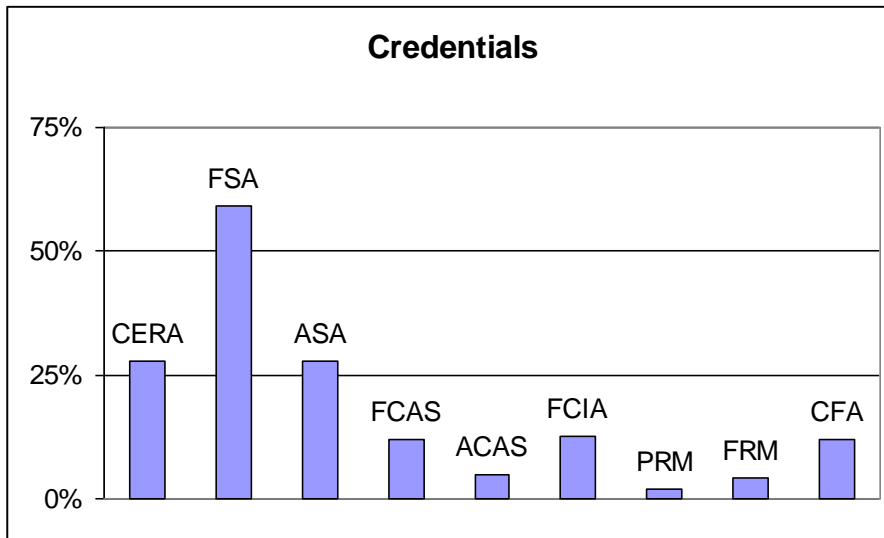
For 2010, survey respondents who expressed an opinion expect continued growth in their activities (62%) and half expect to see increased staff to accomplish this heightened expectation. The staffing result compared to 2009 might be due to timing of the budget setting process and the suddenness of the crisis in Fall 2008. Prior to financial issues at Lehman and AIG exposed in September 2008 there likely was little momentum to increase staff. The 2010 increases may be catching up to pent up demand.



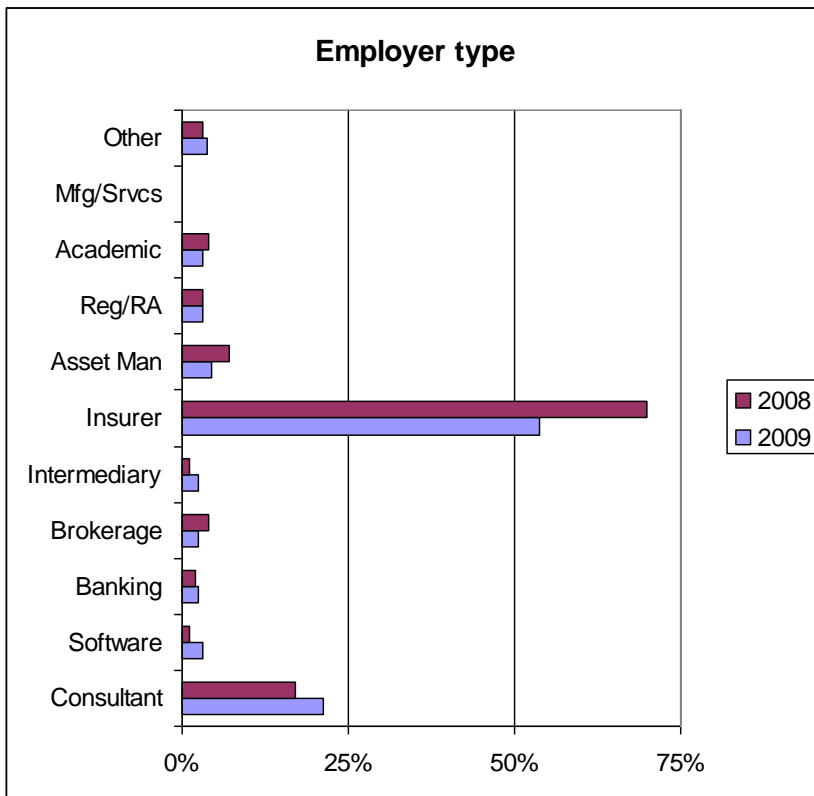
**Section 6: Demographics**

In a change from previous surveys, 24% of the respondents did not state that they hold an actuarial credential. This does not mean that they don't, but one goal over time is to diversify the respondents to include other professions. Previous surveys had immaterial responses from non-actuaries. 28% hold the Chartered Enterprise Risk Analyst (CERA) credential, which is consistent with prior surveys. Actuarial credentials from outside

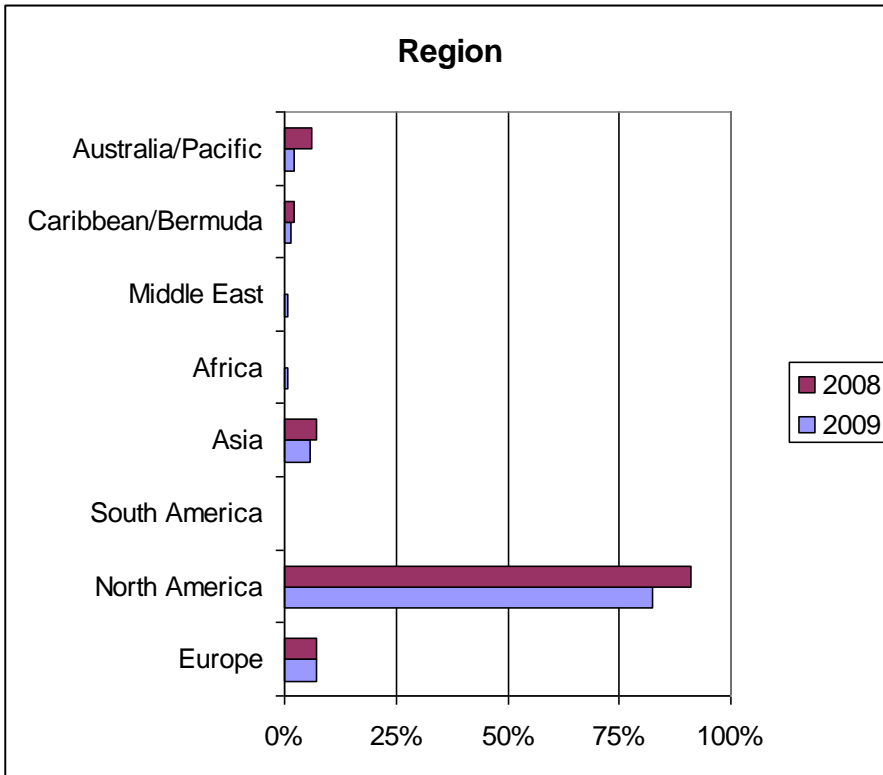
North America came from the United Kingdom, Australia, Switzerland, Germany and South Africa. Several also stated that they hold a CPCU credential (4) or an MBA (4).



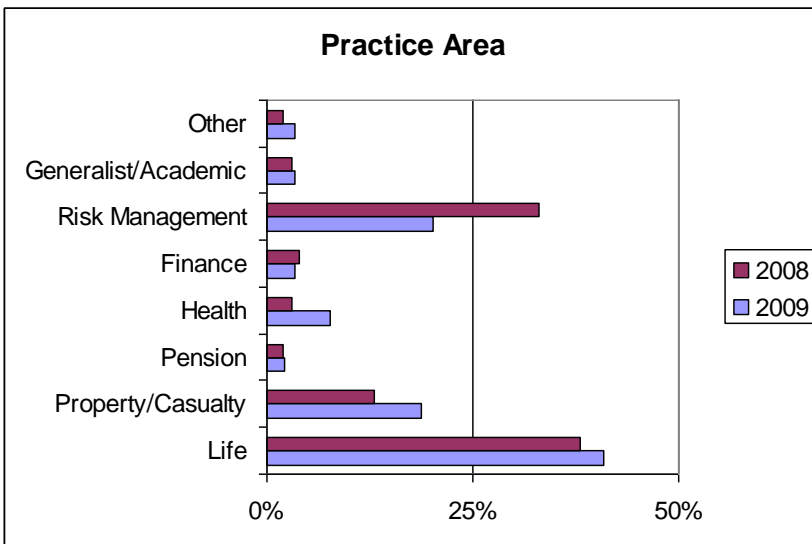
Most survey respondents are employed by either an insurance company (54%) or as a consultant (21%). The distribution is similar to that in the earlier survey. Note that multiple responses are allowed.



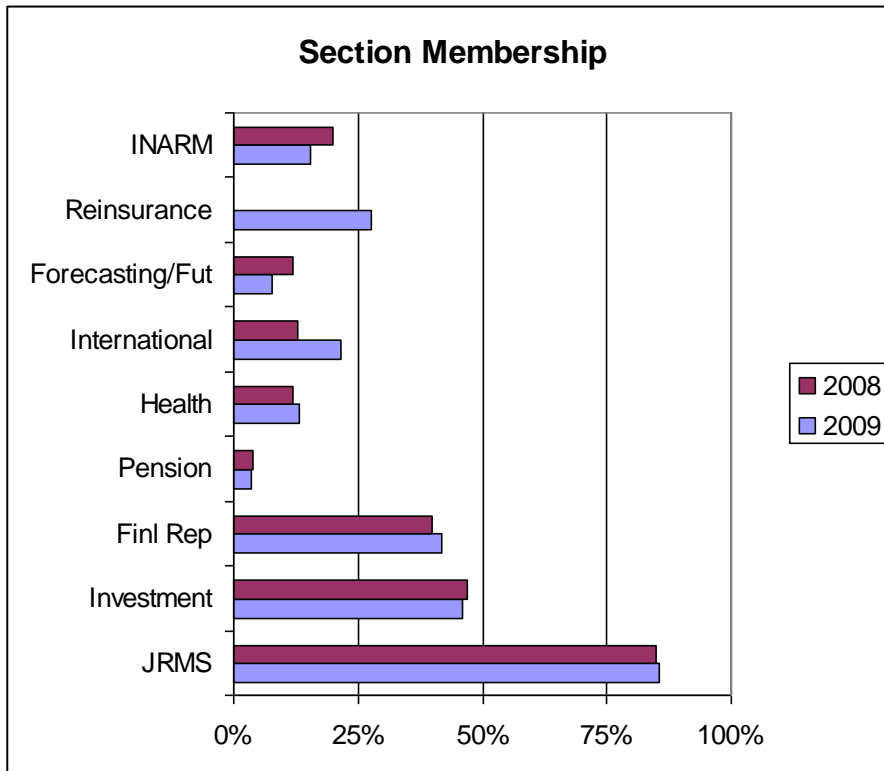
The survey is dominated by North Americans, with fewer respondents from Australia relative to the previous survey. Earlier surveys allowed multiple responses to this question, where in the current survey only the primary region was requested.



The primary area of practice responses continue to be dominated by life insurance (41%), risk management (20%), and property/casualty insurance (19%) accounting for the vast majority of the results.



The survey found that 33% of the respondents belonged to the Joint Risk Management Section, with the Investment Section and Financial Reporting Section also heavily represented. 15% reported belonging to the INARM list serve. The survey was sent to JRMS and INARM members, along with some targeted groups, but many actuaries belong to multiple special interest sections of the SOA. This was the first time respondents were asked if they belonged to the Reinsurance Section, and 28% reported membership.



## **Future Recommendations**

Future surveys should continue to probe the anchoring issue. As managing emerging risks is an evolving discipline, the survey should continue to ask open-ended questions and use the answers to develop future questions. Utilizing the experience of the POG has worked very well so far in developing questions and should continue. The survey should be distributed more widely in order to gain the perspective of those outside North America. Perhaps a partnership could be reached with UK and Australian actuarial risk managers. Additional groups should be encouraged to complete the survey to reduce the reliance on actuaries.

In the next survey a conscious decision needs to be made regarding the original 23 risks. The World Economic Forum has expanded the list to 35 risks, many of which are just more detailed versions of the original set. However, some new risks should be considered for this survey.

The survey should continue to probe risk combinations as well as leading indicators.

## Appendix I - Glossary of Risks

The following 23 core risks were defined in Global Risks 2007: A Global Risk Network Report, and can be found at [www.weforum.org/pdf/CSI/Long\\_Global\\_Risk\\_Report\\_2007.pdf](http://www.weforum.org/pdf/CSI/Long_Global_Risk_Report_2007.pdf). What follows is a summary of the risks.

23 risks

### **Economic**

- Oil price shock/energy supply interruptions
- US current account deficit/fall in US dollar
- Chinese economic hard landing
- Fiscal crises caused by demographic shift
- Blow up in asset prices/excessive indebtedness

### **Environmental**

- Climate change
- Loss of freshwater services
- Natural catastrophe: Tropical storms
- Natural catastrophe: Earthquakes
- Natural catastrophe: Inland flooding

### **Geopolitical**

- International terrorism
- Proliferation of weapons of mass destruction (WMD)
- Interstate and civil wars
- Failed and failing states
- Transnational crime and corruption
- Retrenchment from globalization
- Middle East instability

### **Societal**

- Pandemics
- Infectious diseases in the developing world
- Chronic disease in the developed world
- Liability regimes

### **Technological**

- Breakdown of critical information infrastructure (CII)
- Emergence of risks associated with nanotechnology

## ***Economic Risks***

- Oil price shock/energy supply interruption – Oil prices rise steeply due to major supply disruption.
- US current account deficit/Fall in US dollar - US current account deficit triggers a major fall in the dollar.
- Chinese economic hard landing – China’s economic growth slows, potentially as a result of protectionism, internal political or economic difficulties.
- Fiscal crises caused by demographics shift – Aging populations in developed economies drive economic stagnation by forcing governments to raise taxes or borrowing.
- Blow up in asset prices/excessive indebtedness – Personal assets, such as housing, collapse in the US and Europe, fueling a recession.



## ***Environmental Risks***

- Climate change – Climate change generates both extreme events and gradual changes, impacting infrastructure, agricultural yields and human lives.
- Loss of freshwater services – Water shortages impact agriculture, businesses and human lives.
- Natural Catastrophe: Tropical Storms – Hurricane or typhoon passes over heavily populated area, leading to catastrophic economic losses and/or high human death tolls.
- Natural Catastrophe: Earthquakes – Strong earthquake(s) occur in heavily populated areas.
- Natural Catastrophe: Inland Flooding – Flooding associated with rivers causes significant economic losses, fatalities and disruption.

## ***Geopolitical Risks***

- International Terrorism – Attacks disrupt economic activity, causing major human and economic losses. Indirectly, attacks aid retrenchment from globalization.
- Proliferation of Weapons of Mass Destruction – Trend fatally weakens nuclear Non-Proliferation Treaty and leads to spread of nuclear technologies.
- Interstate and civil wars – Major interstate or civil war breaks out.
- Failed and failing states – Trend of widening gap between order and disorder.
- Trans-national crime and corruption – Corruption continues to be endemic and organized crime successfully penetrates the global economy.
- Middle East instability – The Israel-Palestine conflict and Iraqi civil war continue.
- Retrenchment from globalization – Rising concerns about cheap imports and immigration sharpen protectionism in developed countries. Emerging economies become more nationalist and state-oriented.

## ***Societal Risks***

- Pandemics – A pandemic emerges with high mortality among economically productive segments of the population.
- Infectious disease in the developing world – Incidence of HIV/AIDS continues to spread geographically. Other diseases could develop.
- Chronic disease in the developed world – Obesity, diabetes and cardiovascular diseases become widespread.
- Liability Regimes – US liability costs rise by multiples of GDP growth, with litigiousness spreading to Europe and Asia.

## ***Technological Risks***

- Breakdown of Critical Information Infrastructure (CII) – A major disruption of the availability, reliability and resilience of CII caused by cyber crime, terrorist attack or technical failure. Results are felt in major infrastructure: power distribution, water supply, transportation, telecommunication, emergency services and finance.

- Emergence of risks associated with nanotechnology – Studies indicate health impairment due to under-regulated exposure to a class of commonly-used nanoparticles (used in paint, nano-coated clothing, cosmetics or healthcare) exhibiting unexpected, novel properties and easily entering the human body.

## Appendix II - Survey Results

The following includes both the survey as well as the responses. There were 178 respondents to the survey. Some respondents left certain questions unanswered. The percentages below reflect the number of responses received divided by the number who answered the specific question. Some totals may not add to 100% due to rounding.

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Emerging risks have either not previously occurred or have not occurred for so long that they are not considered possible. With no credible historical data, these risks challenge risk managers. They often seem obvious after they occur but are not considered in advance. Many risk managers are trying to be better prepared by identifying potential emerging risks and prioritizing those that might have the greatest potential impact on society. This survey is sponsored by the Joint Risk Management Section (Canadian Institute of Actuaries, Casualty Actuarial Society and Society of Actuaries). The complete results will be available on the Section webpage at [www.soa.org](http://www.soa.org). A summary article is also expected to be published in an upcoming JRMS newsletter. Thanks for participating.

### ***Default Question Block***

What is the top current risk?

The 23 risks shown were developed by the World Economic Forum in 2007. More detailed definitions of these risks can be found at the World Economic Forum website (also summarized in Appendix I).

#### **174 total responses**

##### **Economic – 112 responses (64%)**

- 8 responses 5% Oil price shock/energy supply interruptions
- 29 responses 17% 2 US current account deficit/fall in US dollar
- 10 responses 6% 5 Chinese economic hard landing
- 13 responses 7% T3 Fiscal crises caused by demographic shift
- 52 responses 30% 1 Blow up in asset prices/excessive indebtedness

##### **Environmental – 17 responses (10%)**

- 13 responses 7% T3 Climate change
- 3 responses 2% Loss of freshwater services
- 0 responses 0% Natural catastrophe: Tropical storms
- 1 responses 1% Natural catastrophe: Earthquakes
- 0 response 0% Natural catastrophe: Inland flooding

##### **Geopolitical – 28 responses (16%)**

- 5 responses 3% International terrorism
- 5 responses 3% Proliferation of weapons of mass destruction (WMD)
- 5 responses 3% Interstate and civil wars
- 5 responses 3% Failed and failing states
- 2 responses 1% Transnational crime and corruption
- 1 responses 1% Retrenchment from globalization
- 5 responses 3% Middle East instability

##### **Societal – 5 responses (3%)**

- 5 responses 3% Pandemics
- 0 responses 0% Infectious diseases in the developing world
- 0 responses 0% Chronic disease in the developed world
- 0 responses 0% Liability regimes
- Technological – 5 responses (3%)**
- 5 responses 3% Breakdown of critical information infrastructure (CII)
- 0 responses 0% Emergence of risks associated with nanotechnology

**Other – 7 responses (4%)**

- Potential power grid sabotage
- Runaway Washington spending
- Double dip recession/very prolonged levels of excess capacity in economy
- Prolonged low interest rates
- Underutilized productive capacity
- Inability of political process to address the other 23 risks
- Operational risk

**Section 1: Emerging Risks**

**Question 1.** Please choose up to 5 emerging risks that you feel will have the greatest impact over the next few years.

**793 total responses from 168 surveys**

**Divisor in percentages for major categories is 793 – for individual categories it is 168.**

- 0 8 surveys
- 1 1 survey (1%)
- 2 3 surveys (2%)
- 3 8 surveys (5%)
- 4 18 surveys (11%)
- 5 138 surveys (82%)

**Economic – 370 responses 47% (previous surveys F2008/S2008 44%/44%)**

- 76 responses 45% (39%) 3 Oil price shock/energy supply interruptions
- 111 responses 66% (48%) 1 US current account deficit/fall in US dollar
- 56 responses 33% (27%) 4 Chinese economic hard landing
- 45 responses 27% (22%) Fiscal crises caused by demographic shift
- 82 responses 49% (64%) 2 Blow up in asset prices/excessive indebtedness

**Environmental – 94 responses 12% (10%/18%)**

- 45 responses 27% (25%) Climate change
- 17 responses 10% (10%) Loss of freshwater services
- 13 responses 8% (3%) Natural catastrophe: Tropical storms
- 11 responses 7% (4%) Natural catastrophe: Earthquakes
- 8 responses 5% (1%) Natural catastrophe: Inland flooding

**Geopolitical – 161 responses 26% (32%/18%)**

- 50 responses 30% (29%) 5 International terrorism

- 24 responses 14% (13%) Proliferation of weapons of mass destruction (WMD)
- 15 responses 9% (10%) Interstate and civil wars
- 30 responses 18% (26%) Failed and failing states
- 12 responses 7% (8%) Transnational crime and corruption
- 30 responses 18% (25%) Retrenchment from globalization
- 47 responses 28% (34%) Middle East instability

**Societal – 67 responses 8% (9%/13%)**

- 42 responses 25% (22%) Pandemics
- 8 responses 5% (9%) Infectious diseases in the developing world
- 7 responses 4% (6%) Chronic disease in the developed world
- 10 responses 6% (4%) Liability regimes

**Technological – 46 responses 6% (5%/7%)**

- 35 responses 21% (16%) Breakdown of critical information infrastructure (CII)
- 11 responses 7% (6%) Emergence of risks associated with nanotechnology

**Other – 8 responses (1%)**

- Infrastructure failures
- Pricing of generic drugs
- Economic instability and low growth
- Digital crime
- 2008 crisis recovery policies fail, re-enter recession
- Growing income disparity
- Regulatory risk
- Operational risk

Another way to review this data is as a percent of the total responses. For example, Climate change had 45 responses in this survey. In the previous analysis just shared,  $45/168 = 27\%$ . In this next section we will look at  $45/793 = 6\%$  and compare the results from all 3 surveys. **Bold** signifies higher than the average in the current survey

**Economic (44% average – 47%/43%/42% December 2009, November 2008, April 2008)**

- 10% - 10%/8%/13% Oil price shock/energy supply interruptions
- 11% - 14%/10%/9% **US current account deficit/fall in US dollar**
- 7% - 7%/6%/9% Chinese economic hard landing
- 6% - 6%/5%/6% Fiscal crises caused by demographic shift
- 10% - 10%/14%/5% Blow up in asset prices/excessive indebtedness

**Environmental (13% - 12%/9%/17%)**

- 7% - 6%/5%/9% Climate change
- 2% - 2%/2%/3% Loss of freshwater services
- 2% - 2%/1%/2% Natural catastrophe: Tropical storms
- 1% - 1%/1%/2% Natural catastrophe: Earthquakes
- 1% - 1%/0%/1% Natural catastrophe: Inland flooding

**Geopolitical (25% - 26%/31%/18%)**

- 5% - 6%/6%/4% **International terrorism**
- 3% - 3%/3%/4% Proliferation of weapons of mass destruction (WMD)
- 2% - 2%/2%/3% Interstate and civil wars
- 4% - 4%/6%/2% Failed and failing states

- 2% - 2%/2%/2% Transnational crime and corruption
- 4% - 4%/5%/2% Retrenchment from globalization
- 5% - 6%/7%/1% **Middle East instability**

**Societal (10% - 8%/9%/12%)**

- 5% - 5%/5%/6% Pandemics
- 2% - 1%/2%/2% Infectious diseases in the developing world
- 1% - 1%/1%/2% Chronic disease in the developed world
- 1% - 1%/1%/2% Liability regimes

**Technological (6% - 5%/4%/7%)**

- 4% - 4%/3%/5% Breakdown of critical information infrastructure (CII)
- 1% - 1%/1%/2% Emergence of risks associated with nanotechnology

**Question 2.** Out of these five, what one emerging risk would you rank number one as having the greatest impact?

**157 total responses**

**Economic – 99 responses**

**63% (65% in last survey)**

- 10 responses 6% (12%) T3 Oil price shock/energy supply interruptions
- 41 responses 26% (18%) 1 US current account deficit/fall in US dollar
- 6 responses 4% (3%) Chinese economic hard landing
- 8 responses 5% (7%) 5 Fiscal crises caused by demographic shift
- 34 responses 22% (25%) 2 Blow up in asset prices/excessive indebtedness

**Environmental – 19 responses**

**12% (4%)**

- 10 responses 6% (3%) T3 Climate change
- 5 response 3% (1%) Loss of freshwater services
- 3 responses 2% (0%) Natural catastrophe: Tropical storms
- 1 responses 1% (0%) Natural catastrophe: Earthquakes
- 0 responses 0% (0%) Natural catastrophe: Inland flooding

**Geopolitical – 22 responses**

**14% (18%)**

- 3 responses 2% (3%) International terrorism
- 7 responses 4% (3%) Proliferation of weapons of mass destruction (WMD)
- 1 responses 1% (1%) Interstate and civil wars
- 3 responses 2% (2%) Failed and failing states
- 1 responses 1% (1%) Transnational crime and corruption
- 2 responses 1% (2%) Retrenchment from globalization
- 5 responses 3% (4%) Middle East instability

**Societal – 3 responses**

**2% (2%)**

- 3 responses 2% (2%) Pandemics
- 0 responses 0% (0%) Infectious diseases in the developing world
- 0 responses 0% (0%) Chronic disease in the developed world
- 0 responses 0% (0%) Liability regimes

**Technological – 9 responses**

**6% (6%)**

- 7 responses 4% (6%) Breakdown of critical information infrastructure (CII)
- 2 response 1% (0%) Emergence of risks associated with nanotechnology

**Other – 5 responses**

**3% (3%)**

- Pricing of generic drugs

- Economic instability and low growth
- 2008 crisis recovery policies fail, re-enter recession
- Regulatory risk
- Operational risk

**Question 3.** Of the 23 emerging risks, are there combinations that you believe will have a large impact over the next few years? These could occur at the same time (concurrent) or follow each other (sequential). Select up to three combinations of two risks each.

Total mentions (risks are numbered)

**Economic – 53% (49% in last survey)**

- 13% (12%)            1        2    Oil price shock/energy supply interruptions
- 18% (12%)            2        1    US current account deficit/fall in US dollar
- 8% (6%)                3        4    Chinese economic hard landing
- 4% (6%)                4                Fiscal crises caused by demographic shift
- 11% (14%)            5        3    Blow up in asset prices/excessive indebtedness

**Environmental – 13% (9%)**

- 6% (4%)                6        T5 Climate change
- 2% (2%)                7                Loss of freshwater services
- 2% (2%)                8                Natural catastrophe: Tropical storms
- 1% (0%)                9                Natural catastrophe: Earthquakes
- 2% (1%)                10                Natural catastrophe: Inland flooding

**Geopolitical – 25% (32%)**

- 6% (8%)                11        T5 International terrorism
- 4% (3%)                12                Proliferation of weapons of mass destruction (WMD)
- 1% (3%)                13                Interstate and civil wars
- 3% (5%)                14                Failed and failing states
- 1% (1%)                15                Transnational crime and corruption
- 3% (4%)                16                Retrenchment from globalization
- 6% (8%)                17        T5 Middle East instability

**Societal – 5% (8%)**

- 3% (5%)                18                Pandemics
- 1% (2%)                19                Infectious diseases in the developing world
- 1% (1%)                20                Chronic disease in the developed world
- 1% (0%)                21                Liability regimes

**Technological – 3% (2%)**

- 2% (1%)                22                Breakdown of critical information infrastructure (CII)
- 1% (0%)                23                Emergence of risks associated with nanotechnology

Two risk combinations - 408 total responses

Question 3 combinations		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2	<b>32</b>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3	<b>10</b>	<b>43</b>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
4	2	8	2	X	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
5	<b>10</b>	<b>44</b>	9	<b>10</b>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
6	5	1		1		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
7	1					7	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
8	1	1				<b>10</b>		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
9		1				1		1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
10						<b>11</b>	1	4	1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
11	7	4		1				3				x	x	x	x	x	x	x	x	x	x	x	x	x
12		1						1				<b>10</b>	x	x	x	x	x	x	x	x	x	x	x	x
13	1				1			1				1	3	x	x	x	x	x	x	x	x	x	x	x
14	5	2			1				1			6	3	1	x	x	x	x	x	x	x	x	x	x
15					1							1		1	2	x	x	x	x	x	x	x	x	x
16	3	6	2	2	4	2				1		1		1	1	2	x	x	x	x	x	x	x	x
17	<b>24</b>	1	1									8	<b>10</b>	1	3	1	1	x	x	x	x	x	x	x
18	2			2	3	7			1	1				1	1		1	1		x	x	x	x	x
19								1							1					4	x	x	x	x
20				1				1				1								1	1	x	x	x
21				1	2												1						x	x
22			1		4	1			1			5				2		1	1				x	x
23																1		1				1	4	x

Leading combinations are

- 44 responses
  - US current account deficit/fall in US dollar
  - Blow up in asset prices/excessive indebtedness
- 43 responses
  - US current account deficit/fall in US dollar
  - Chinese economic hard landing
- 32 responses
  - Oil price shock/energy supply interruptions
  - US current account deficit/fall in US dollar
- 24 responses
  - Oil price shock/energy supply interruptions
  - Middle East instability
- 11 responses
  - Climate change
  - Natural catastrophe: inland flooding
- 10 responses
  - Oil price shock/energy supply interruptions



- Chinese economic hard landing
- 10 responses
  - Oil price shock/energy supply interruptions
  - Blow up in asset prices/excessive indebtedness
- 10 responses
  - Fiscal crises caused by demographic shift
  - Blow up in asset prices/excessive indebtedness
- 10 responses
  - Climate change
  - Natural catastrophe: Tropical storms
- 10 responses
  - International terrorism
  - Proliferation of weapons of mass destruction (WMD)
- 10 responses
  - Proliferation of weapons of mass destruction (WMD)
  - Middle East instability

Combinations by category

		2009	2009%	2008F	2008F %
Economic	Economic	170	42%	75	34%
Economic	Environmental	11	3%	4	2%
Economic	Geopolitical	67	16%	49	22%
Economic	Societal	11	3%	5	2%
Economic	Technological	5	1%	2	1%
Environmental	Environmental	36	9%	15	7%
Environmental	Geopolitical	9	2%	4	2%
Environmental	Societal	11	3%	11	5%
Environmental	Technological	2	0%	0	0%
Geopolitical	Geopolitical	57	14%	36	16%
Geopolitical	Societal	7	2%	9	4%
Geopolitical	Technological	10	2%	2	1%
Societal	Societal	6	1%	4	2%
Societal	Technological	2	0%	2	1%
Technological	Technological	4	1%	1	0%
		408		219	

**Question 4.** Many of the emerging risks could lead to political instability. Which risks, in your opinion, would be most likely to lead to this potential event? (please select no more than three)

**154 respondents chose at least one for a total of 415 responses (2.7 average)**

**Economic – 134 responses (32%)**

- 46 responses 30% 4 Oil price shock/energy supply interruptions

- 35 responses 23% 5 US current account deficit/fall in US dollar
- 29 responses Chinese economic hard landing
- 6 responses Fiscal crises caused by demographic shift
- 18 responses Blow up in asset prices/excessive indebtedness

**Environmental – 26 responses (6%)**

- 8 responses Climate change
- 14 response Loss of freshwater services
- 1 responses Natural catastrophe: Tropical storms
- 2 responses Natural catastrophe: Earthquakes
- 1 responses Natural catastrophe: Inland flooding

**Geopolitical – 240 responses (58%)**

- 48 response 31% 3 International terrorism
- 25 response Proliferation of weapons of mass destruction (WMD)
- 31 responses Interstate and civil wars
- 50 responses 32% 2 Failed and failing states
- 12 responses Transnational crime and corruption
- 12 responses Retrenchment from globalization
- 62 responses 40% 1 Middle East instability

**Societal – 3 responses (1%)**

- 3 responses Pandemics
- 0 responses Infectious diseases in the developing world
- 0 responses Chronic disease in the developed world
- 0 responses Liability regimes

**Technological – 8 responses (2%)**

- 7 responses Breakdown of critical information infrastructure (CII)
- 1 response Emergence of risks associated with nanotechnology

**Not Sure – 0 response**

**Other – 4 responses (1%)**

- Food shortage
- China invades Taiwan
- Rapidly increasing ratio of Males to Females in China and India
- Chinese communism evils

**Section 2: Leading Indicators**

**Question 1.** Once an emerging risk is identified, do you select leading indicators to measure changing likelihoods? (Example: Last spring, the threat of missiles fired by North Korea received much publicity. One company monitored investment flows to/from North or South Korea as an advance indication of this threat.)

**155 responses**

- 7 responses 5% Yes for all
- 55 responses 35% Yes for some
- 29 responses 19% No
- 41 responses 26% We do not formally identify emerging risks
- 23 responses 15% Not sure

**Question 2.** If yes, please provide examples.

- Of the previous we only follow US \$
- Agent surveys for withdrawal risk
- Employment
- For increasing interest rates, track forward rates, CPI and GDP
- To measure the likelihood of a hard landing in China, I look at how China is spending its money. For example, it is building huge excess capacity in sector after sector. China's excess steel producing capacity is greater than all the steel producing capacity in South Korea and Japan combined. Another example of spending where there is little demand is that the largest mall in the world is located in Southern China and it is virtually empty. It is a combination of Disneyland, Las Vegas and the Mall of America, yet it sits virtually empty. It's a project that is too big to fail. There are other malls in China in a similar situation. So China's ability to stimulate its economy will not continue much longer because it is not based on demand. A hard economic landing in China is in our near future. I also look at fundamentals for the U.S. Do the projected eye-popping deficits for the next 10 years make sense? Would this kind of spending make sense for a family that suddenly found itself unemployed? The answer is that this kind of spending does not make sense. Therefore, we're headed for trouble in the next few years. The Bush tax cuts will expire in 2011. It is likely that this will send us back into a recession. Also, it is likely that China will be experiencing hard times by 2011. Therefore, it is likely that some time around 2011-2012 the United States could be in big trouble trying to finance its debt. I also look at the future in the Middle East. What are the kids being taught in Palestinian schools? What does Islam teach? It's all bad news for the possibility of peace in the Middle East. Next I look for change. What is changing in the Middle East? Iran is acquiring the ability to produce nuclear weapons. What will this mean in the next five years? It will mean that Israel's neighbors are likely to become more aggressive. Both Syria and Hezbollah now have chemical weapons and the missiles to deliver them on Israeli cities. This means there is a real chance for the Middle East to blow up into a nuclear war.
- Mortgage foreclosure preceded by house price depreciation
- Korea example mentioned above
- Follow reporting by WHO etc. with respect to pandemic infection and fatality rates
- Interest Rates, Equity Returns, etc. – economic indicators are followed/tracked
- Global coverage of the event on the media/global financial transaction direction and volume
- Double Dip recession/prolonged excess capacity. Vigilant watch on economic statistics
- Oil price as indicator for energy shocks
- Percent of companies with default probability > 1%, ABS spreads
- The risk of greater regulatory requirements as a result of the financial meltdown means more diligent monitoring not only of own regulator's announcements/remarks but also of other regimes' which may spill over. The

emerging risk of an H1N1 pandemic required creating and monitoring a metric specific to H1N1-related absences.

- Trends like population growth, water shortages, rising temperatures, loss of topsoil
- Increase of hot spots leading to increases of terrorists' attacks.
- For asset depreciation risk, a daily market value vs. book value ratio will be established to monitor the risk.
- Oil and refined product stock levels.
- Inflation associated with oil (energy) costs.
- Change in China's inventories as an indicator of the economy's ability to continue growth.
- Chinese economic hard landing is a significant risk. We monitor multiple indicators of China's macroeconomic conditions, such as GDP growth rate, power utilization rate, stock market indexes, and so on.
- Current US deficit/Oil prices.
- US dollar deficits will lead to instability of the world economic order resulting in trade imbalances and political instability.
- Available credit and cost.
- Disruption in oil-monitor flow and prices of oil.
- Market risk – movements in equity markets, credit spread widening or narrowing. VIX changes.
- Monitoring of claim trends to track change in the litigation environment.
- IT privacy risk
- Leading economic indicators, blogs
- Watching incidence of flu for the spread of a pandemic.
- Economic and capital market trends (interest rates, GDP, etc.)
- Credit options lead to downgrades (which are basis for SII) [Researcher's note: assume this is Solvency II)
- Real estate market risk looks at interest rates as an indicator
- Internal risks – measures that are correlated.

**Question 3.** If you identify leading indicators of emerging risks, do you have criteria for when to take action to mitigate (or accept) the risk?

**59 responses**

- 6 responses 10% Yes for all
- 23 responses 39% Yes for some
- 17 responses 29% No
- 10 responses 17% Not sure
- 3 responses 5% Not applicable

**Question 4.** If yes, please provide examples.

- Modify product based on feedback

- I look at trends 5 to 20 years in the future. As we get within a few years of a tipping point then I start recommending that we focus more closely.
- As a regulator we would ask the institutions we supervise for their exposures and potential impact in the event the risk emerged
- Details are proprietary
- Education is the key.
- For solvency ratio risk, the company established an operational target (a little bit higher than regulatory minimum) which once falling hit the threshold, a set of predefined actions (capital injection for instance) will be taken.
- Inflation thresholds trigger investment actions.
- LOC capacity and cost
- Storage, lower gas cars...
- Determine what corrective actions are the most appropriate to take.
- Limits based on capital %
- Various “value-at-risk” type measures calibrated to pre-established thresholds/control points
- More than x% change in interest rates leads expected increase in loan defaults.
- Values outside range

**Question 5.** Once an emerging risk is identified, do you have a process to measure, monitor, and/or mitigate the risk?

**58 responses**

- 4 responses 7% Yes for all
- 38 responses 66% Yes for some
- 11 responses 19% No
- 5 responses 9% Not sure

**Question 6.** If yes, please provide examples.

- Hedge, FX, etc.
- Risk reporting
- For interest rate risk/price inflation, hedge
- I basically monitor the news very closely to see future trends
- We have a basic measuring schedule to score and prioritize some of the emerging risks. We have each risk being actively monitored.
- As a regulator we would ask for regular reporting of exposures and losses from the institutions we supervise.
- Incidence rates, vaccination rates and mortality rates for H1N1 pandemic
- We have a quarterly reporting of risks, emerging and otherwise which includes initiatives to mitigate the risk and reporting on progress with respect to those initiatives.
- For persistent low interest rate risk vs. implicit guaranteed rate in the participating policies. Transferring from par to non-par products will be encouraged.

- Interest rate hedging
- We are setting thresholds for the geographic concentration of a product, above which the sales in that area will be cut back.
- We closely watch macroeconomic conditions in China.
- Early warning allows for choice of mitigation strategies.
- Level of engagement of board and senior management on risk management practices.
- New exposures are monitored for scientific and legal developments. We also seek to understand the breadth and depth of the hazardous product or process.
- Look at pro-forma impact of various derisking initiatives.
- Company pandemic action plan
- No examples

### **Section 3: Modeling and Metrics**

**Question 1.** When generating financial models for internal use, which primary risk metric do you prefer? (please select one)

**144 responses**

- 41 responses 28% (29%) Value at Risk (VaR)
- 74 responses 51% (54%) Conditional Tail Expectation  
(CTE – also known as TailVaR or Expected Shortfall)
- 18 responses 13% (8%) Not Sure
- 11 responses 8% (9%) Other
  - Capital position
  - Varies
  - Value Added
  - Proprietary measure
  - Not measuring this
  - Conditional expected shortfall minus expected value
  - Scenario Analysis
  - Risk sensitivities
  - Embedded Value
  - GAAP earnings volatility
  - Not used internally

**Question 2.** When generating financial models for internal use, in addition to the primary risk metric you prefer, are there other risk metrics that you find useful? (please select all that apply)

**163 responses**

- 55 responses 34% (31%) VaR

- 41 responses 25% (21%) CTE
- 23 responses 14% (13%) Not Sure
- 13 responses 8% (10%) None
- 31 responses 19% (25%) Other

- Internal modeling
- Loss given default (LGD)
- 99.5<sup>th</sup> percentile minus the mean
- Present value of ending surplus
- Lower Second Moment
- Developing economic capital
- Varies
- Health Care Trends
- MRTL
- Impairments
- Probability of survival
- Excess above VaR
- Economic Gain
- Earnings at Risk
- RBC
- Probability of event
- Percentile
- Stress test
- Capital calls
- Stress tests

**Question 3.** During the recent financial crisis reliance on models was considered part of the problem. How have your modeling practices improved over the past year? (please select all that apply)

**303 responses**

- 61 responses 20% Peer review
- 59 responses 19% Communication
- 59 responses 19% Transparency
- 35 responses 12% More sophisticated techniques
- 31 responses 10% No changes
- 25 responses 8% Staffing levels
- 14 responses 5% Increased ties to market value
- 5 responses 2% Decreased ties to market value
- 1 response 0.3% Less detailed
- 13 responses 4% Other
  - More consideration of extreme events
  - Focused on assumptions put into models
  - Addition of deterministic sample scenarios
  - n/a (2)

- review and recalibration to changed environment
- independent validation
- introduced modeling
- Calibration – missing actual loss amounts/risks added to modeled distributions
- SII from SI now being implemented before legislation roll-out date
- Better documentation
- Understanding the limitations
- Adding behavioral risk

**Question 4.** When generating financial models for internal economic capital purposes, how many years do you run them out? (please select one)

**144 responses**

- 28 responses 19% Short (e.g., 1 year)
- 36 responses 25% Intermediate (e.g., 3-5 years)
- 40 responses 28% Long (e.g., 30 years)
- 17 responses 12% Not sure
- 9 responses 6% Not calculated
- 14 responses 10% Other
  - Not performed
  - Lifetime of risks
  - 5-15 years
  - 50 years
  - 1 underwriting year, all liabilities to extinction
  - One year risk period, combined with terminal provision that reflects lifetime run off of the business
  - Not used internally
  - Multiple time horizons
  - 1 year for some calculations and 3-5 for all but 1 other (30 yrs in this last case)

**Question 5.** Do you include new business in your analysis for Question 4?

**113 responses**

- 70 responses 62% Yes
- 39 responses 35% No
- 4 responses 4% Not calculated

**Question 6.** What do you expect to be the primary source of modeling improvements in the next few years? (please select one)



## 144 responses

- 43 responses 30% (38%) Model efficiencies (fewer scenarios, faster run time)
- 39 responses 27% (28%) Tail correlations (e.g., using copulas)
- 22 responses 15% (19%) Dependency metrics
- 30 responses 21% (7%) Not sure
- 10 responses 7% (8%) Other
  - Computer power
  - Scenario generation techniques
  - Better assumptions
  - More scenarios
  - More refined loss distributions (i.e., geographic breakdown, instead of countrywide)
  - Management actions
  - More data
  - Faster run time allowing increased sensitivities hence better understanding of key assumptions
  - Scenarios
  - Better reflection of reality

Last survey's comments included

- Hard to effectively model random, rare events
- Correlation understanding
- Extreme scenario modeling

## **Section 4: Accounting**

**Question 1.** Which accounting regime do you expect to be prevalent in your jurisdiction 10 years from now? (please select one)

## 149 responses

- 67 responses 47% European Embedded Value
- 22 responses 15% US Statutory (current)
- 17 responses 12% US GAAP
- 13 responses 9% IFRS (International Financial Reporting Standards)
- 8 responses 6% Solvency II
- 5 responses 3% Market consistent embedded value
- 5 responses 3% Canadian GAAP
- 1 responses 1% US Statutory (proposed principle-based approach)
- 0 responses 0% Cash flow based principles methodology
- 1 responses 1% Not sure
- 5 responses 3% Other (no comments were received)

## **Section 5: Current topics**

**Question 1.** Do you manage your personal investments?

**144 responses**

- 102 responses 71% Yes
- 19 responses 13% No
- 23 responses 16% Yes, for less than 50% of portfolio

**Question 2.** Currently, your personal investment portfolio is:

**143 responses**

- 52 responses 36% (26%) More conservative than usual
- 69 responses 48% (54%) Same as usual
- 16 responses 11% (20%) More aggressive than usual
- 3 responses 2% (0%) Not sure
- 3 responses 2% (0%) Prefer not to answer

**Question 3.** Your expectations for the 2010 global economy are:

**144 responses**

- 30 responses 21% (61%) Poor
- 94 responses 65% (35%) Moderate
- 18 responses 13% (3%) Good
- 2 responses 1% (0%) Strong
- 0 responses 0% (1%) Not sure

**Question 4.** As a result of the recent turmoil in the financial markets, did you experience a change in the level of ERM-focused activities for your organization or clients in 2009? (comparison is to similar question asked a year ago regarding anticipated changes, so the reader can think of it as an actual to expected comparison)

**143 responses**

- 95 responses 66% (65%) Increased
- 2 responses 1% (3%) Decreased
- 33 responses 23% (21%) Stayed the same
- 13 responses 9% (10%) Not sure

**Question 5.** Did your internal ERM staff increase in 2009?

**142 responses**

- 51 responses 36% Yes
- 80 responses 56% No
- 11 responses 8% Not sure

**Question 6.** Do you anticipate a change in the level of ERM-focused activities for your organization or clients in 2010 relative to 2009?

**142 responses**

- 88 responses 62% (65%) Increase
- 2 responses 1% (3%) Decrease
- 43 responses 30% (21%) Stay the same
- 9 responses 6% (10%) Not sure

**Question 7.** Do you anticipate a change in the level of funding dedicated to ERM-focused activities for your organization or clients in 2010 relative to 2009?

**144 responses**

- 71 responses 49% (33%) Increase
- 3 responses 2% (8%) Decrease
- 56 responses 39% (48%) Stay the same
- 14 responses 10% (11%) Not sure

**Section 6: Demographics**

**Question 1:** What credentials do you currently hold? (please select all that apply)

**285 responses from 109 surveys (144 completed this section)**

Percentages are based on 144 surveys.

- 40 responses 28% (27% in last survey) CERA
- 85 responses 59% FSA
- 40 responses 28% ASA
- 17 responses 12% FCAS
- 7 responses 5% ACAS
- 18 responses 13% FCIA
- 3 responses 2% PRM
- 6 responses 4% FRM
- 17 responses 12% CFA
- 31 responses 22% Other actuarial credential (please specify)
  - MAAA (20) - USA
  - FIA (8) - UK
  - FIAA (3) - Australia

- SAV-ONA – Switzerland
- Aktuar (DAV) - Germany
- FASSA – South Africa
- 21 responses 15% Other non-actuarial credential (please specify)
  - CPCU (4)
  - MBA (4)
  - CPA (2)
  - PhD (2)
  - MSc
  - ChFC
  - PMP

**Question 2:** How long have you been a risk manager?

**144 responses**

- 45 responses 31% Not applicable
- 22 responses 15% Less than 3 years
- 39 responses 27% 3-10 years
- 38 responses 26% More than 10 years

**Question 3.** Employer type (please select all that apply)

**160 responses**

- 34 responses 21% (17%) Consultant
- 5 responses 3% (1%) Software
- 4 responses 3% (2%) Banking
- 4 responses 3% (4%) Brokerage
- 4 responses 3% (1%) Intermediary
- 86 responses 54% (70%) Insurance
- 7 responses 4% (7%) Asset Management
- 5 responses 3% (3%) Regulator/Rating Agency
- 5 responses 3% (4%) Academic
- 0 responses 0% (0%) Manufacturing/Services
- 6 responses 4% (3%) Other
  - Reinsurance (2)
  - Energy
  - Insurance company director
  - Retired (2)

**Question 4:** Primary Region (please select one) – in the past survey respondents could list multiple regions where they practice

**142 responses**

- 10 responses 7% (7%) Europe
- 117 responses 82% (91%) North America
- 0 responses 0% (0%) South America
- 8 responses 6% (7%) Asia
- 1 response 1% (0%) Africa
- 1 response 1% (0%) Middle East
- 2 responses 1% (2%) Caribbean/Bermuda
- 3 responses 2% (6%) Australia/Pacific
- 0 responses 0% (0%) Other

**Question 5:** Primary area of practice (please select one)

**144 responses**

- 59 responses 41% (38%) Life
- 27 responses 19% (13%) Property/Casualty (General Insurance, Non-Life)
- 3 responses 2% (2%) Pension
- 11 responses 8% (3%) Health
- 5 responses 3% (4%) Finance
- 29 responses 20% (33%) Risk Management
- 5 responses 3% (3%) Generalist/Academic
- 5 responses 3% (2%) Other
  - Life/Health risk management
  - Life and Health
  - Annuities
  - M&A
  - Investments

**Question 6.** Which of these groups/sections of the SOA and its partners do you belong to?

**377 responses**

- 123 responses 85% (85%) Joint Risk Management Section
- 66 responses 46% (47%) Investment Section
- 60 responses 42% (40%) Financial Reporting Section
- 5 responses 3% (4%) Pension Section
- 19 responses 13% (12%) Health Section
- 31 responses 22% (13%) International Section
- 11 responses 8% (12%) Forecasting and Futurism Section
- 40 responses 28% (NA) Reinsurance Section
- 22 responses 15% (20%) International Network of Actuarial Risk Managers (INARM)

**Question 7.** Do you have any comments or suggestions for future iterations of this survey?

- Shorten it
- No (4)
- The implication of the questions is that someone believes that risks can be managed via the use of increasingly sophisticated models. In that regard, we should take heed of Warren Buffett's quote: "Beware of geeks bearing formulas." Risk management should involve both quantitative tools and qualitative observations of the world around us. What formula would have told Microsoft ten years ago that its number one risk was Google?
- Your accounting question was a poor one as globally we are all headed to IFRS for public reporting. However, for solvency reporting there may be a variety of approaches which are different (i.e., Solv II, US stat, Canadian regulatory capital, etc.).
- Investigate the kind of professionals currently involved in the ERM/for example, actuaries/accountant/CERA/FRM others.
- List of risks probably needs updating for economic developments.
- I found it hard to rank emerging risks given such a large (23 choices!) and diverse list.
- Very easy to use.
- Add a not applicable to most questions/ask by which means/systems emerging risks are identified
- Great survey – but consider self signification before constructing survey questions.
- Update list of emerging risks (add to, clarify based on current events). Clarify meaning of "greatest impact" in emerging risk questions – what scope? Add more risk measures to modeling question choices (only VaR and CTE are there).
- Questions 1 & 2 need to be clearer. Impact on what?
- Doing this periodically is a very good idea...
- Not all risks can be counted and not all counted numbers are meaningful. I thought "people" play KEY role in risk management field rather than model.
- Focus on survey of understanding and management of Operational Risk. If defined correctly, operational risk exacerbates and is most combinatorial with all the other risks mentioned in this survey.
- One technical comment: I got fouled up when I hit the "back" button of my browser. You should add a statement at the bottom of each page instructing the surveyor to not hit the back button. Other than that, this is good. I'm interested to see the results (and how they will change over time...)
- 1) "Do you have a reporting standard which you would most prefer to have in your jurisdiction?" (rather than what you think you will have) 2) definition/alternate to "few years": if "emerging", I'm more concerned 10-20 years out, but don't consider that "few".

Thanks for your participation!

[Researcher's notes for future questions]

Add questions getting at

- Is accounting useful – why or why not?
- Section 3 Question 5 – how do you integrate new business
- For demographics ask specifically if respondent does not have an actuarial credential
- Does an emerging risk leading indicator ever get dropped? Why?

## Appendix III - Survey Results from Fall 2008

The following includes both the survey as well as the responses. There were 89 respondents to the survey. Some (only a few) respondents left certain questions unanswered. The percentages below reflect the number of responses received divided by the number who answered the specific question. Some totals may not add to 100% due to rounding.

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Emerging risks are the ones that seem obvious after they happen but were not considered in advance. Many risk managers are trying to change this by identifying potential emerging risks and prioritize those that might have the greatest potential impact on society. This survey is sponsored by the Joint Risk Management Section (Canadian Institute of Actuaries, Casualty Actuarial Society, Society of Actuaries). The full report will be found at the section website on [www.soa.org](http://www.soa.org). A summary article will also be published in an upcoming JRMS newsletter. Thanks for participating.

### **Default Question Block**

What is the top current risk?

### **Section 1: Emerging Risks**

**Question 1.** Please choose up to 5 emerging risks that you feel will have the greatest impact over the next few years. The 23 risks shown were developed by the World Economic Forum ([www.weforum.org](http://www.weforum.org)).

#### **403 total responses**

##### **Economic – 179 responses**

- 35 responses 39% Oil price shock/energy supply interruptions
- 43 responses 48% US current account deficit/fall in US dollar
- 24 responses 27% Chinese economic hard landing
- 20 responses 22% Fiscal crises caused by demographic shift
- 57 responses 64% Blow up in asset prices/excessive indebtedness

##### **Environmental – 39 responses**

- 22 responses 25% Climate change
- 9 responses 10% Loss of freshwater services
- 3 responses 3% Natural catastrophe: Tropical storms
- 4 responses 4% Natural catastrophe: Earthquakes
- 1 response 1% Natural catastrophe: Inland flooding

##### **Geopolitical – 129 responses**

- 26 responses 29% International terrorism
- 12 responses 13% Proliferation of weapons of mass destruction (WMD)
- 9 responses 10% Interstate and civil wars
- 23 responses 26% Failed and failing states
- 7 responses 8% Transnational crime and corruption
- 22 responses 25% Retrenchment from globalization
- 30 responses 34% Middle East instability



**Societal – 37 responses**

- 20 responses 22% Pandemics
- 8 responses 9% Infectious diseases in the developing world
- 5 responses 6% Chronic disease in the developed world
- 4 responses 4% Liability regimes

**Technological – 19 responses**

- 14 responses 16% Breakdown of critical information infrastructure (CII)
- 5 responses 6% Emergence of risks associated with nanotechnology

**Question 2.** Out of these five, what one emerging risk would you rank number one as having the greatest impact?

**Economic – 58 responses 65%**

- 11 responses 12% Oil price shock/energy supply interruptions
- 16 responses 18% US current account deficit/fall in US dollar
- 3 responses 3% Chinese economic hard landing
- 6 responses 7% Fiscal crises caused by demographic shift
- 22 responses 25% Blow up in asset prices/excessive indebtedness

**Environmental – 4 responses 4%**

- 3 responses 3% Climate change
- 1 response 1% Loss of freshwater services
- 0 responses 0% Natural catastrophe: Tropical storms
- 0 responses 0% Natural catastrophe: Earthquakes
- 0 responses 0% Natural catastrophe: Inland flooding

**Geopolitical – 16 responses 18%**

- 3 responses 3% International terrorism
- 3 responses 3% Proliferation of weapons of mass destruction (WMD)
- 1 responses 1% Interstate and civil wars
- 2 responses 2% Failed and failing states
- 1 responses 1% Transnational crime and corruption
- 2 responses 2% Retrenchment from globalization
- 4 responses 4% Middle East instability

**Societal – 2 responses 2%**

- 2 responses 2% Pandemics
- 0 responses 0% Infectious diseases in the developing world
- 0 responses 0% Chronic disease in the developed world
- 0 responses 0% Liability regimes

**Technological – 5 responses 6%**

- 5 responses 6% Breakdown of critical information infrastructure (CII)
- 0 response 0% Emergence of risks associated with nanotechnology

**Not Sure – 1 response 1%**

**Other – 3 responses 3%**

- Financial sector implosion
- Investor nationalism
- Global recession: rising unemployment, reduced consumer demand & large company failures

**Question 3.** Are there combinations of emerging risks that you believe will have the greatest impact over the next few years? List up to three combinations of two risks.

Total mentions (risks are numbered)

**Economic – 49%**

- 12%        1        Oil price shock/energy supply interruptions
- 12%        2        US current account deficit/fall in US dollar
- 6%         3        Chinese economic hard landing
- 6%         4        Fiscal crises caused by demographic shift
- 14%        5        Blow up in asset prices/excessive indebtedness

**Environmental – 9%**

- 4%         6        Climate change
- 2%         7        Loss of freshwater services
- 2%         8        Natural catastrophe: Tropical storms
- 0%         9        Natural catastrophe: Earthquakes
- 1%         10       Natural catastrophe: Inland flooding

**Geopolitical – 32%**

- 8%         11       International terrorism
- 3%         12       Proliferation of weapons of mass destruction (WMD)
- 3%         13       Interstate and civil wars
- 5%         14       Failed and failing states
- 1%         15       Transnational crime and corruption
- 4%         16       Retrenchment from globalization
- 8%         17       Middle East instability

**Societal – 8%**

- 5%         18       Pandemics
- 2%         19       Infectious diseases in the developing world
- 1%         20       Chronic disease in the developed world
- 0%         21       Liability regimes

**Technological – 2%**

- 1%         22       Breakdown of critical information infrastructure (CII)
- 0%         23       Emergence of risks associated with nanotechnology

Two risk combinations

Question 3 combinations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
2	11	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
3	6	4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
4	1	5	2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
5	8	22	6	10	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
6	1		2			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
7				1		5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
8						6		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
9							1		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
10						2		1		x	x	x	x	x	x	x	x	x	x	x	x	x	x	
11	2	1			2		1	1			x	x	x	x	x	x	x	x	x	x	x	x	x	
12											4	x	x	x	x	x	x	x	x	x	x	x	x	
13	1		1		1						2		x	x	x	x	x	x	x	x	x	x	x	
14	1	1	1		6					1	4	3	3	x	x	x	x	x	x	x	x	x	x	
15											4		1		x	x	x	x	x	x	x	x	x	
16		6	3	2	5							1		1		x	x	x	x	x	x	x	x	
17	14	1	1			1					7	4	2				x	x	x	x	x	x	x	
18	1	1		1		2	7		1		2					1	2	x	x	x	x	x	x	
19						1							2	1		1		2	x	x	x	x	x	
20				1	1													1		x	x	x	x	
21																				1	x	x	x	
22	1			1							1							2					x	
23															1								1	x

Leading combinations are

- 22 responses
  - US current account deficit/fall in US dollar
  - Blow up in asset prices/excessive indebtedness
- 14 responses
  - Oil price shock/energy supply interruptions
  - Middle East instability
- 11 responses
  - Oil price shock/energy supply interruptions
  - US current account deficit/fall in US dollar
- 10 responses
  - Fiscal crises caused by demographic shift
  - Blow up in asset prices/excessive indebtedness

## Combinations by category

Economic	Economic	75
Economic	Environmental	4
Economic	Geopolitical	49
Economic	Societal	5
Economic	Technological	2
Environmental	Environmental	15
Environmental	Geopolitical	4
Environmental	Societal	11
Environmental	Technological	0
Geopolitical	Geopolitical	36
Geopolitical	Societal	9
Geopolitical	Technological	2
Societal	Societal	4
Societal	Technological	2
Technological	Technological	1
		219

**Question 4.** Many of the emerging risks could lead to regional food shortages. Which risks, in your opinion, would be most likely to lead to this potential event? List up to 3.

### **Economic – 50 responses**

- 31 responses Oil price shock/energy supply interruptions
- 5 responses US current account deficit/fall in US dollar
- 9 responses Chinese economic hard landing
- 2 responses Fiscal crises caused by demographic shift
- 3 responses Blow up in asset prices/excessive indebtedness

### **Environmental – 118 responses**

- 42 responses Climate change
- 32 response Loss of freshwater services
- 11 responses Natural catastrophe: Tropical storms
- 6 responses Natural catastrophe: Earthquakes
- 27 responses Natural catastrophe: Inland flooding

### **Geopolitical – 55 responses**

- 1 response International terrorism
- 1 response Proliferation of weapons of mass destruction (WMD)
- 24 responses Interstate and civil wars
- 18 responses Failed and failing states
- 3 responses Transnational crime and corruption
- 6 responses Retrenchment from globalization
- 2 responses Middle East instability

### **Societal – 12 responses**

- 9 responses Pandemics
- 3 responses Infectious diseases in the developing world

- 0 responses           Chronic disease in the developed world
- 0 responses           Liability regimes

**Technological – 1 response**

- 0 responses           Breakdown of critical information infrastructure (CII)
- 1 response            Emergence of risks associated with nanotechnology

**Not Sure – 1 response**

**Other – 3 responses**

- Use of genetically modified food
- Global recession: rising unemployment, reduced consumer demand & large company failures
- Government actions like ethanol requirements

**Section 2: Modeling and Metrics**

**Question 1.** When generating financial models for internal use, which primary risk metric do you prefer?

- 26 responses   29%   Value at Risk (VaR)
- 48 responses   54%   Conditional Tail Expectation (CTE – also known as TailVaR or Expected Shortfall)
- 7 responses    8%    Not Sure
- 8 responses    9%    Other
  - Combination of metrics, including VAR, CTE, confidence intervals, etc.
  - enterprise value
  - Economic Capital
  - stress testing
  - Scenario analysis
  - Franchise Value
  - Embedded Value
  - Value at Risk - Ordinary Environment

**Question 2.** When generating financial models for internal use, in addition to the primary risk metric you chose, are there other risk metrics that you find useful?

- 33 responses           VaR
- 22 responses           CTE
- 14 responses           Not Sure
- 10 responses           None
- 26 responses           Other
  - NAIC RBC
  - Duration, convexity
  - Mean long-term losses
  - Distribution of results
  - Economic value
  - IRR
  - Scenario analysis
  - Probability of events that (separately) ruin the system

- Defined stress tests
- Greatest present value of accumulated loss
- Standard deviations
- Interest rate and equity ‘Greeks’
- VaR at different confidence levels
- Median absolute deviation from the mean
- sensitivity testing; scenario analysis,; economic capital based on market consistent embedded value
- common sense
- rbc sapor (surplus as a percentage of revenue)
- economic capital at risk
- Scenario specific measures(e.g. 3% rate shock)
- Capital at Risk - Extreme risk
- Multiple VAR metrics to illustrate entire risk profile
- Shareholder/economic value added
- Transition and default in stressed historical time periods
- Earnings at risk
- stress tests, sensitivities (delta, etc.)

**Question 3.** When generating financial models for external required capital purposes, which primary risk metric do you prefer?

- 32 responses 37% Value at Risk (VaR)
- 31 responses 36% Conditional Tail Expectation (CTE – also known as TailVaR or Expected Shortfall)
- 14 responses 16% Not sure
- 10 responses 11% Other
  - NAIC RBC
  - Local stat and GAAP
  - Standard deviations
  - MCCR
  - Common sense
  - Sapor
  - RBC and rating agency measures
  - Capital at risk – extreme risk
  - Bank capital requirements

**Question 4.** When generating financial models for external required capital purposes, what time horizon do you prefer to use?

- 28 responses 32% Short (e.g., 1 year)
- 24 responses 28% Intermediate (e.g., 3-5 years)
- 26 responses 30% Long (e.g., 30 years)
- 4 responses 5% Not sure
- 5 responses 6% Other
  - Varies by audience
  - Depends on the nature of the risk

- NAIC RBC metrics
- Short term asset impacts, with long term liability experience

**Question 5.** What do you expect to be the primary source of modeling improvements in the next few years?

- 17 responses 19% Dependency metrics
- 25 responses 28% Tail correlations (e.g., using copulas)
- 33 responses 38% Model efficiencies (fewer scenarios, faster run time)
- 6 responses 7% Not sure
- 7 responses 8% Other
  - Hard to effectively model random, rare events
  - Better calibration of losses
  - Other tail analysis
  - Correlation understanding
  - Extreme scenario modeling
  - Better modeling of correlations between risks (market, credit, spread,...)
  - Better integration of bottom up asset and liability models

### **Section 3: Accounting**

**Question 1.** Which accounting regime is most useful to you for risk management?

- 18 responses 21% Market consistent embedded value
- 5 responses 6% US GAAP
- 14 responses 16% US Statutory (current)
- 7 responses 8% US Statutory (proposed principle-based approach)
- 6 responses 7% European Embedded Value
- 5 responses 6% IFRS (International Financial Reporting Standards)
- 11 responses 13% Solvency II
- 16 responses 18% Not sure
- 5 responses 6% Other
  - Actual cash flows
  - Canadian GAAP
  - None
  - Whatever is required
  - Discounted cash flows, without any regulatory requirements to distort the results

**Question 2.** Which accounting regime is most useful to you for management of emerging risks?

- 15 responses 17% Market consistent embedded value
- 2 responses 2% US GAAP
- 7 responses 8% US Statutory (current)
- 7 responses 8% US Statutory (proposed principle-based approach)
- 4 responses 4% European Embedded Value
- 3 responses 3% IFRS (International Financial Reporting Standards)
- 7 responses 8% Solvency II
- 21 responses 24% Not sure
- 17 responses 19% None are useful
- 4 responses 4% Other
  - None on the list are likely. Mostly it's a much simpler model - frequency times severity - severity probably again represented as effect on cash flows
  - Scenario analysis
  - Need to project both income and regulatory solvency
  - Company mgt places the highest value on US GAAP results, as financial results on US GAAP basis are how the company is valued.

#### **Section 4: Current topics**

**Question 1.** Prior to Fall 2008, your personal investment portfolio was

- 16 responses 18% More conservative than usual
- 60 responses 67% Same as usual
- 13 responses 15% More aggressive than usual
- 0 responses 0% Not sure
- 0 responses 0% Prefer not to answer

**Question 2.** Currently, your personal investment portfolio is:

- 23 responses 26% More conservative than usual
- 48 responses 54% Same as usual
- 18 responses 20% More aggressive than usual
- 0 responses 0% Not sure
- 0 responses 0% Prefer not to answer

**Question 3.** Your expectations for the 2009 global economy are:

- 54 responses 61% Poor
- 31 responses 35% Moderate



- 3 responses 3% Good
- 0 responses 0% Strong
- 1 responses 1% Not sure

**Question 4.** As a result of the recent turmoil in the financial markets, do you anticipate a change in the level of ERM-focused activities for your organization or clients in 2009 relative to 2008?

- 58 responses 65% Increase
- 3 responses 3% Decrease
- 19 responses 21% Stay the same
- 9 responses 10% Not sure

**Question 5.** As a result of the recent turmoil in the financial markets, do you anticipate a change in the level of funding dedicated to ERM-focused activities for your organization or clients in 2009 relative to 2008?

- 29 responses 33% Increase
- 7 responses 8% Decrease
- 43 responses 48% Stay the same
- 10 responses 11% Not sure

### **Section 5: Demographics**

**Question 1:** Do you have an actuarial credential?

- 88 responses 99% Yes
- 1 response 1% No

**Question 2:** Are you a Chartered Enterprise Risk Analyst?

- 24 responses 27% Yes
- 65 responses 73% No

**Question 3.** Employer type

- 17% Consultant
- 1% Software
- 2% Banking
- 4% Brokerage
- 1% Intermediary
- 70% Insurance
- 7% Asset Management
- 3% Regulator/Rating Agency
- 4% Academic
- 0% Manufacturing/Services
- 3% Other
  - Reinsurance only
  - Independent contractor

- Provision of actuarial consulting services

**Question 4: Region**

- 7% Europe
- 91% North America
- 0% South America
- 7% Asia
- 0% Africa
- 0% Middle East
- 2% Caribbean/Bermuda
- 6% Australia/Pacific
- 0% Other

**Question 5: Primary area of practice**

- 38% Life
- 13% Property/Casualty (General Insurance, Non-Life)
- 2% Pension
- 3% Health
- 4% Finance
- 33% Risk Management
- 3% Generalist
- 2% Other
  - Insurance and banking pension product design
  - Education

**Question 6. Which of these groups/sections of the SOA and its partners do you belong to?**

- 85% Joint Risk Management Section
- 47% Investment Section
- 40% Financial Reporting Section
- 4% Pension Section
- 12% Health Section
- 13% International Section
- 12% Futurism Section
- 20% International Network of Actuarial Risk Managers (INARM)

Thanks for your participation!