Emerging Risks Survey: Guide for Use

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Emerging Risks Survey

Guide for Use

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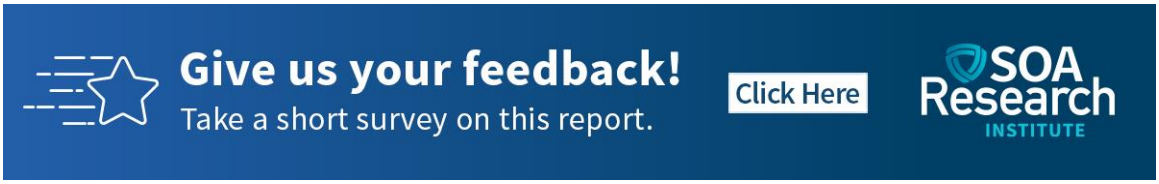

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Emerging Risks Survey

Guide to Use

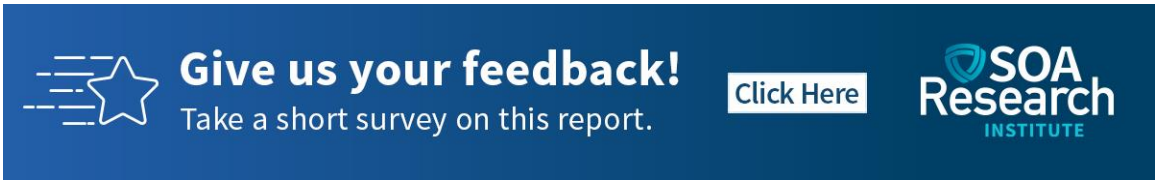
Executive Summary

The annual *Survey of Emerging Risks* is currently in its 15th iteration. Many of the survey questions have been trended over the entire period, providing information about the risk over the period studied. This companion paper should help the reader prioritize their efforts. If you have limited time, read the *15th Survey of Emerging Risk* paper in this order:

1. Section 2 – Top Takeaways (just facts, no charts)
2. Section 1 – Executive Summary (highlights with charts)
3. Section 4 – Main Report (covers most of results, including highlighted comments)
4. Appendix II – Complete Data Set (for those who want to do their own analysis without being encumbered by another researcher's analysis)
5. Appendix I – Risks and Definitions (for the researcher this is the most interesting part of the report as it evolves each year)
6. Tableau exhibit[1] – Discusses Tools Available for Reader to Perform their Own Analysis Online

As you read through the questions and specific risks, think about what you would expect to see in the charts before looking at them. Try to maintain a strategic time horizon of more than five years.

From a regulatory standpoint, many companies are required to complete an ORSA (own-risk and solvency assessment). The survey, and this report, can help you do this. The minimum requirements for identifying risks are quite low from external stakeholders, but it is very useful to internal users to have regular discussions about emerging risks. An annual recap of this survey, or a similar one that does not focus on current risks, could be meetings and brainstorming sessions with rotating leaders who have done their own research and talk about a specific risk that could impact your firm in the future. You could also bring in someone from outside the company to do part or all of this, but ownership of the process should stay internal.



[1] The Tableau data can be accessed here

1. Heat Map: Time Series https://tableau.soa.org/#/site/soa-public/views/EmergingRisks_16571181391190/1_HeatMapTimeSeries?:iid=3
2. Heat Map: One Year at a Time https://tableau.soa.org/#/site/soa-public/views/EmergingRisks_16571181391190/2_HeatMapOneYearataTime?:iid=3
3. Histogram: Time Series https://tableau.soa.org/#/site/soa-public/views/EmergingRisks_16571181391190/3_HistogramTimeSeries?:iid=3
4. Histogram: One Year at a Time https://tableau.soa.org/#/site/soa-public/views/EmergingRisks_16571181391190/4_HistogramOneYearataTime?:iid=3
5. Average https://tableau.soa.org/#/site/soa-public/views/EmergingRisks_16571181391190/5_Averages?:iid=3

Section 1: Adding Value with *Survey of Emerging Risks*

The annual *Survey of Emerging Risks* is a peer-to-peer effort that shares what risk managers are thinking. If you need a regulator or other stakeholder to provide step-by-step instructions about what risks to track, then the report is unlikely to provide a competitive advantage. The benefit is in thinking about emerging risks so that, when a new risk crosses your radar, your first thought is, *How might this impact my specific block of business and where we want it to evolve over the next few years?* Every risk manager has a unique background and experience. Each should be constantly scanning for risks. The best way to learn about dealing with risk is to debrief after another company that has had a related risk event. For example, a risk manager at an insurer with a block of deferred annuities is going to be more worried about interest rates than someone managing health-care risks.

When you listen to investors like Howard Marks or Warren Buffett, notice that they don't tell you what to do. They share their process but do not make specific recommendations. Jeff Bezos, in his 2016 letter to Amazon shareholders, also had interesting things to say about decision making:

> *most decisions should probably be made with somewhere around 70% of the information you wish you had. If you wait for 90%, in most cases, you're probably being slow. Plus, either way, you need to be good at quickly recognizing and correcting bad decisions. If you're good at course correcting, being wrong may be less costly than you think, whereas being slow is going to be expensive for sure.*[2]

Following a required checklist limits the incentive to recognize risks before others. Those who recognize and communicate risks and opportunities early can develop a plan to accept the risk or consciously mitigate or avoid it. These plans do not require perfect knowledge, nor are they predictive. Their value is in thinking about scenarios in advance. This allows a head start over those who don't see the risk/opportunity as quickly.

COVID-19 is a great example. Those who recognized pandemic risk in advance, and had an ERM process that included both the asset and liability sides of the balance sheet, had prepared a game plan. Early results in March/April 2020 showed the initial risk to be highly concentrated in older age groups, so financial impacts from liabilities would not constitute a tail event and the immediate cost to surplus from life insurance would be small. At the same time, asset spreads widened materially. A life insurer with advance preparation would recognize the opportunity to be a source of liquidity as a buyer of assets at fire sales. Those who did were rewarded when governments reacted quickly and provided stimulus. The window was not open very long. As often happens, those who hesitated lost.[3]

Each historical event is unique, but there can be similarities. By paying attention, the risk manager can identify potential discontinuities earlier than others, providing a competitive advantage. Some assumptions cycle or mean-revert, while others generate feedback loops and reach tipping points. Interactions between variables lead to higher-order effects and unknown knowns, where historical data is not predictive.

Risk managers should seek out and teach skill sets with long time horizons and encourage those with differing viewpoints and experience. The risk team should include a variety of backgrounds and have multiple external viewpoints considered.

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[2] Bezos, Jeff. 2016 letter to Amazon shareholders. https://www.aboutamazon.com/news/company-news/2016-letter-to-shareholders

[3] Rudolph, Max J. *Global Concerns During an Influenza Pandemic as of June 2006*. June 2006. LIMRA http://rudolph-financial.com/LWW%20Pandemic%20Rudolph%20LIMRA%20July%202006.pdf

Anticipating what might be important requires foresight. The rest of this section will walk a risk manager through the process and how it can be used by practitioners. By using foresight to proactively prepare we can provide value as we build resilience.

1.1 THE PROCESS

When scanning for emerging risks, a game plan should be developed to prioritize the many sources available. The risk manager role requires knowledge of exposures and multiple time horizons. If there is a potential short-term insolvency event, that will take priority. If not, focus on volatility of short-term results (less than one year) and think further out. Tactical time horizons of three to five years cover most of what a corporate board face. This is the focus of line managers and asset portfolio managers, but they should also look out over longer time horizons of 10 or more years. This is the area of greatest interest for emerging risks, the strategic time horizon. These risks will include both positive opportunities and negative hazards. Learning how multiple risks interact allows the risk manager to have foresight.

1.2 DEVELOPING FORESIGHT

Risk managers have developed many valuable technical tools, including models and rule-of-thumb assumptions, that are being challenged by those who can create statistical models or use predictive analytics. The risk manager's skill set must include a process to make better decisions based on use of all available tools.

We must add value, moving beyond the rationality assumption that defines the efficient market theory to show how and why current beliefs do not optimize results or provide resiliency.

Forecasting is hard because it goes beyond silo results, including higher-order interactions between risks and aggregating them. Many government policies and geopolitical realities tend to cycle, with policies that react to recent events, and emerging risks are expected to appear at any time to disrupt the best plans. Many assumptions mean-revert, while others continue to move away from a steady-state result, leading to a "Minsky moment," when bubbles are recognized and burst. Historical practices work until they don't. We have seen this repeatedly and will experience it again. What will be the trigger that bursts the next bubble?

1.3 BUILDING FROM HISTORICAL DATA

When the future is predicted by historical information the risk manager's job is straightforward. This is also where data tools using artificial intelligence are at their best, typically picking out patterns more efficiently than we do. Humans are better at holistic analysis, thinking about interactions between risks and how different risks aggregate, or about how feedback loops and emerging risks replace linear projections with higher-order results. While some focus on Black Swans[4] and Gray Rhinos,[5] emerging risks are about identifying unknown knowns,[6] where historical data is not predictive and the past is not a prologue.

[4] Taleb, Nassim. *The Black Swan* (2nd Edition). 2010. Random House.
[5] Wucker, Michele. *The Gray Rhino.* 2016. St. Martin's Press.
[6] An example of an unknown known is California wildfires and property insurance, where the risk exposure grew for many years as brush accumulated and droughts worsened, with limited impact on actual claims so that premiums were not increased. Recent fires in the state have created a discontinuity, and the insurance commissioner is hesitant to approve premium increases of a level that would allow profitability of policies. The historical data (claims) was not predictive.

Those with foresight are trained to build on historical data, massaging it based on what the analyst has lived through or read about to develop scenarios. The best forecasters add qualitative analysis to their quantitative skill set. This is the future for some risk managers, especially those involved with strategic planning.

Some patterns cycle in repeatable or similar ways. One way to think of this is using the example of a pendulum. Knowing the current location of the pendulum tells you nothing of where it is going, but it helps to develop probabilities of movement and a model if given information about the initial direction, speed or acceleration. A pendulum mean-reverts and periodically passes through its origin point, but higher-order acceleration data is needed to know when the direction will change. It doesn't stop at the origin point; it moves past it. Financial markets cycle based on underlying factors like debt levels and human behavior.

COVID-19 experience shows many similarities with the influenza pandemic of 1918–1921. A segment of the population contests social distancing and mask mandates. Others who start with no historical knowledge flock to follow every shred of news on the topic and become "experts." True experts are often ignored, especially when they change their opinion after new information is forthcoming. For impactful topics like a pandemic, it is not necessary or even encouraged to optimize results. Getting a "good enough" forecast that allows a narrative to be built is sufficient. Flexibility allows mitigation techniques to be developed if wrong, and if right it leads to a competitive advantage.

While no one working today was alive in 1918, young actuaries would do well to visit with those near retirement to learn about a time when interest rates were increasing, oil prices spiked and stagflation reigned. One topic to think about today that seems to be a threat multiplier when combined with other risks is climate change. Think about how it interacts with risks like permafrost, ocean acidity and access to fresh water, and then how this group influences economic growth, morbidity and geopolitical conflict.

Other topics that may benefit from this type of analysis include immigration policy and various forms of inequality, whether it be economic or racial. Past tendencies, especially when compared between countries, influence but do not limit the potential outcomes. Many of these risks are threat multipliers when interactions with other risks occur. The invasion of Ukraine has already led to many implications about emerging risks; note the change in currency values, oil, cyber risk and geopolitical tensions, among others.

1.4 HINDSIGHT

Hindsight uses experience and knowledge of a latticework of mental models to better pick up evolutionary changes based on past behavior to anticipate future responses to similar events. Those who anticipated slowing economic growth and lower nominal interest rates during the last decade adjusted products and investments earlier than those who didn't. Those who recognized that a pandemic was inevitable put mitigations in place. This same process allows scenarios to consider, at least qualitatively, tipping points, feedback loops and higher-order interactions for the impact of varying levels of government debt, populism and climate change.

A real-world example considers how these issues will impact immigration and regional conflict over long time horizons as some areas near the equator become inhospitable. The experienced practitioner is more likely to identify when a regime shift is coming that makes current models obsolete, while big data provides information but no context to recognize when the distribution has changed. The two methods work best in concert.

Another tool that incorporates many of these ideas is narrative scenarios, where model assumptions are made consistent with a qualitative scenario. The current (2022) reality could be part of a scenario with low economic growth, high oil prices and high geopolitical tensions that impact assumptions for interest rates, education and health care.

People with the hindsight skill set are rare, but expertise can be learned. They often state conclusions that challenge the status quo. An organization's culture must encourage them, even if they are not accurate on every idea. Their conclusions are often early by many years. This must be differentiated from being wrong. A supportive mentor who is willing and able to protect an employee as they develop a long time horizon adds value for generations after retirement. As the economist John Maynard Keynes said, "Markets can stay irrational longer than you can stay solvent."

1.5 DEVELOPING FORESIGHT SKILLS

The world does not progress linearly, from one point to the next. It is a complex adaptive system that moves forward through interactions. Understanding how these interactions work in the real world is hard to learn. Experience is the best teacher. Someone competent with many years as a generalist typically outperforms the genius newcomer over the long term.

Thinking differently can be learned for those open to it, but it won't blossom unless encouraged by mentors. Track events, both internal and external. Build a process that seeks out why those events turned out like they did, a post-mortem, how the process can be improved and how it can be applied to future situations.

The effects of the COVID-19 pandemic were not a surprise to many who have studied history. We were clearly unprepared, and the ramifications affected not only mortality and morbidity but also supply chains, assets and the general economy. As investors say, being early often isn't different from being wrong when you invest with leverage and can't wait out the event until markets stabilize.

How do you get relevant experience? By seeking out new environments and people, engaging with those who think differently, and listening more than you speak. Seeking out new cultures goes beyond that of a community. Each company, division and department can be learned from, stolen from, and shared with. A proactive approach to get out there early, late and often will create an excellent network that you can learn from and with.

1.6 FORESIGHT CONCLUSION

The typical definition of an unknown unknown is that no one could have anticipated the event, but few are truly in this category. COVID-19 was certainly not one. Many experts expected a new virus that would impact health, supply chains and financial markets. They were ignored. Those who provide these warnings may not be able to lay out their arguments like a legal case. It may be a gut feel, or premonition, based on their knowledge and experience.[7] In a perfect world that would be enough, especially if they have a track record, but preparation is costly and events infrequent.

Climate change interacts with many other risks. Its long-term impact on society will depend on feedback loops and risk interactions. We continually hear of potential tipping points, which will play out in ways that will favor the prepared. Some of the outcomes to watch are immigration policies by region, changes in freshwater availability, and food insecurity in developing nations. Some risk events, like the conflict in Ukraine, act as a threat multiplier. The impact on food production will have material ramifications and make crop shortfalls elsewhere more significant. Resilience is low and the Earth is susceptible to other tail events, like a super-volcano eruption or antimicrobial resistance, that would have a large impact on population and health.

[7] Michael Lewis refers to this in *The Premonition*. 2021. Norton.

Economic impacts are important too. Financial resilience has been reduced by high debt levels and unprecedented levels of stimulus. Risk managers should consider scenarios that assume it doesn't end well, and how this will impact various emerging risks.

Mentors should encourage young actuaries to think about emerging risks and discourage the idea that lack of preparation is okay if everyone else is doing it too. Rules of thumb should be regularly revisited, especially when abnormal conditions are common. Working from first principles is the perfect way to learn. The world is Bayesian. Those who don't adjust and adapt do so at their own risk.

Section 2: How to Interpret Sections with Open-ended Questions

The first part of the survey reflects opinions about relative levels of risks. All the questions are answered by checking a box. Later sections aim to extract current emerging risk and risk management practices and have served as good sources for short articles, found in Appendix A, based on open-ended questions about how practitioners address issues.

2.1 SECTION B: LEADING INDICATORS

This section, with data starting in 2009, provides an opportunity to see how advanced the practice of identifying leading indicators for emerging risks has become. Unfortunately, to this point there are few risk managers who go beyond looking for assets that are undervalued. There is much room for improvement. The profession should seek out quantitative and non-quantitative indicators, going beyond lagging indicators like sales to capture signs that sales are going strong, maybe too strong, so analysis can be performed and decisions made earlier.

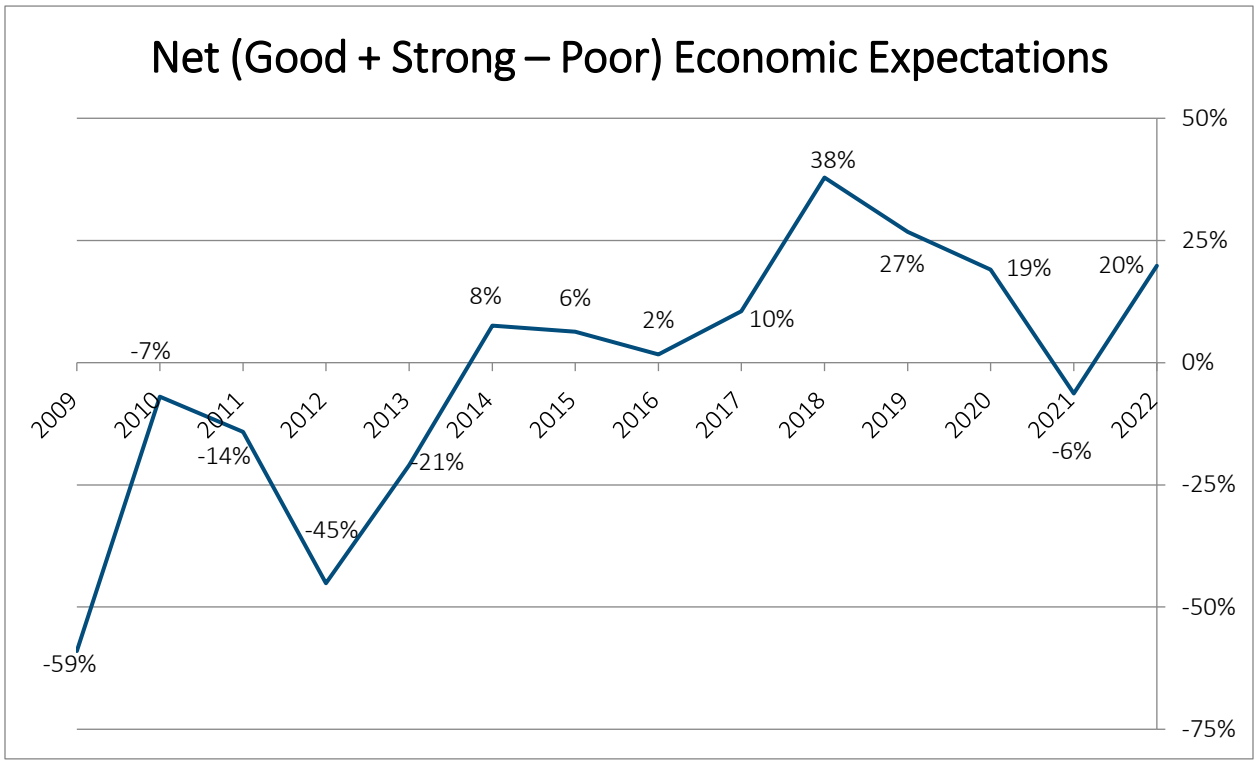
2.2 SECTION C: ENTERPRISE RISK MANAGEMENT (ERM)

This section asks only two quantitative questions yet produces some of the most interesting results based on several open-ended questions that provide examples from practitioners. These include *How a Risk Team Adds Value* and *Lessons from the Masters* (see Appendix A for these posts originally written for SOA members in Canada). Sometimes the comments reflect the positive impact but sometimes they show where the risk management team was not listened to. Each firm's ERM journey is at a unique spot, so reading these comments will mean something different to each reader.

2.3 SECTION D: CURRENT TOPICS

The current-topics section provides an idea about the general optimism in the economy at the time, reflected in Figure 1, as well as actual and expected levels of activity and funding for an ERM team. There has been a steady result of more work and stable funding for risk teams over the 15 years of the survey.

Figure 1
Net Economic Expectations, 2009–2022[8]
% of Responses in Given Year

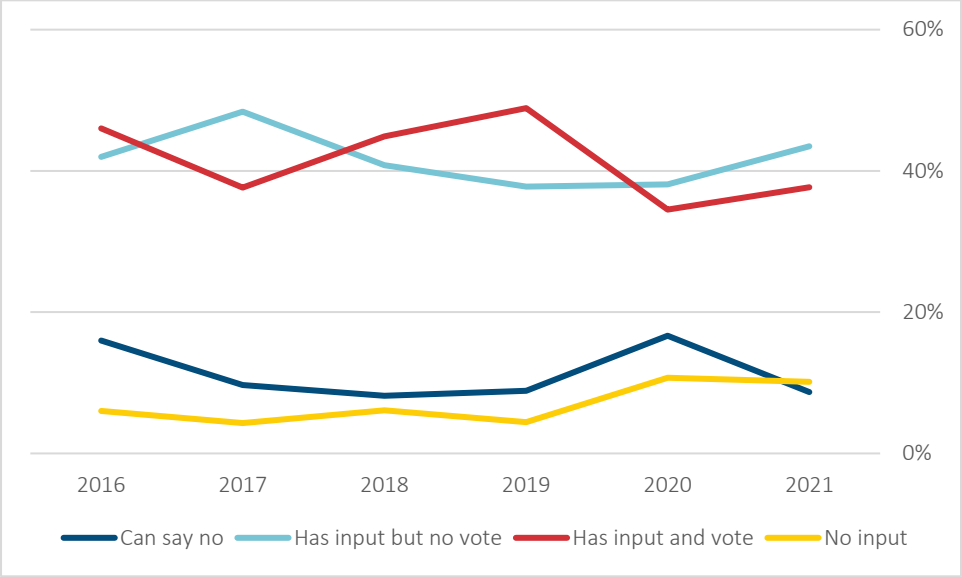


One of the leading questions for practitioner learning from peers, shown in Figure 2, comes from a recurring question asking about the team's role in strategic opportunities. Rotating questions also examine specific topics of interest, such as scenarios developed and the impact of the "great resignation." The choices for respondents have been consistent since 2016. While the numbers often seem volatile from year to year, viewed over a longer time frame they are stable.

[8] Charts in this report show the most recent data on the left, next to the y-axis labels.

Figure 2
Use of ERM Team for a Strategic Opportunity, 2016–2021

% of Responses in Given Year



A series of questions have developed in this section around recognition of the ERM team, bubbles, opportunities and unknown knowns (where historical data is not predictive). Reviewing these comments allows the reader to expand their current knowledge.

2.4 SECTION E: DEMOGRAPHICS

This section reflects the composition of the respondents. Unfortunately, it is consistently based on responses from North American life actuaries and has not expanded internationally or between practice areas as much as hoped.

Section 3: The Risks

The *Survey of Emerging Risks* considers 23 different risks in Section A, with definitions updated annually to bring nuance to the project without losing the effectiveness of the trending feature. They are split into five categories, economic, environmental, geopolitical, societal and technological. Readers that review these risks, and how their definitions change over time, will add value to their personal and corporate risk process. The current report presents the evolution of these risks and their definitions. In this companion report, the focus will be on the risk name and definition in the current iteration of the risk.

Four questions are asked, looking to access practitioners' current thoughts about their top current risk, top five emerging risks, top emerging risk and top risk combinations. Each adds to 100% across each year and question, so an increase in one risk requires a decrease in another. The survey reflects relative importance.

- Current risk – respondents choose one of the 23 (or pick their own)
- Top five emerging risks – respondents choose up to five of the 23 (one can be of their own choosing)
- Top emerging risk – respondents choose one from among their top five emerging risks
- Top risk combinations – respondents choose up to three sets of two risks with important interactions from the 23 (no alternatives are allowed)

Results are compiled by category and by risk.

Economic

1. Energy price shock
2. Currency shock
3. Emergent nation destabilization
4. Asset price collapse
5. Financial volatility

Environmental

6. Climate change
7. Loss of freshwater services
8. Natural catastrophe: tropical storms
9. Natural catastrophe: earthquakes
10. Natural catastrophe: severe weather (except tropical storms)

Geopolitical

11. Terrorism
12. Weapons of mass destruction
13. Wars (including civil wars)
14. Failed and failing states
15. Transnational crime and corruption
16. Globalization shift
17. Regional instability

Societal

18. Pandemics/infectious diseases
19. Chronic diseases/medical delivery
20. Demographic shift
21. Liability regimes and regulatory framework

Technological

22. Cyber/networks
23. Disruptive technology

3.1 ECONOMIC RISKS

Generally, moving away from the great financial crisis (GFC) has led to a reduction in Economic risks.

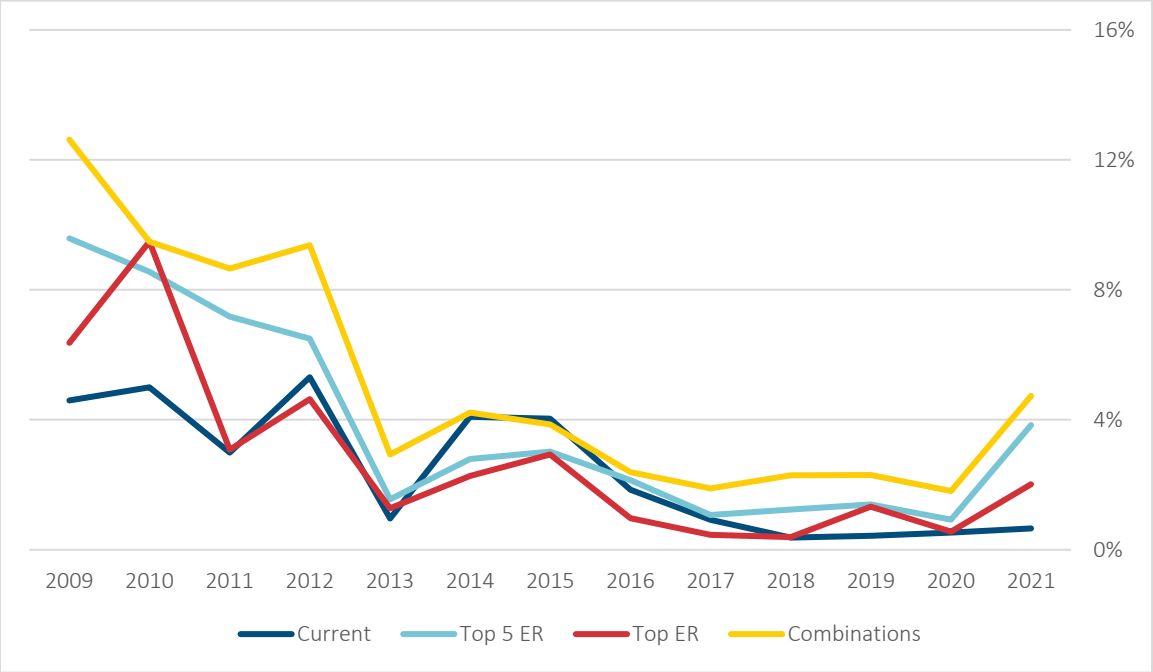
ENERGY PRICE SHOCK

Definition: Energy prices change abruptly.

Across all questions, the trend for *Energy price shock* has been similar, with high energy prices leading to an initially high response rate, with low but stable results after that until recently, when prices surged, and Russia invaded Ukraine.

Figure 3
Emerging risk survey – Energy price shock

% of Responses



An effort has been made to be consistent with risk names in a way that would be inclusive of positive and negative events. Energy prices could go up or down. Energy can be fossil fuels, renewables or something else. Until 2022, the last surge in gas prices was in 2008, just before the annual survey started. We see recency bias in the historical results, but this risk has stayed consistently high when it comes to risk combinations.

IMPACT ON INSURERS: Discontinuities in energy prices often impact discount rates and influence discounted values for reserves, capital, economic value and intrinsic value. Gas prices have been leading indicators for inflation since the Second World War, so impact the value of an insurance policy after a claim relative to the value at issue. For some insurers, claims are tied to inflation (e.g., home replacement cost option). Price changes to fossil-fuel sources also impact plastics and fertilizer, with downstream cost adjustments to food and packaging.

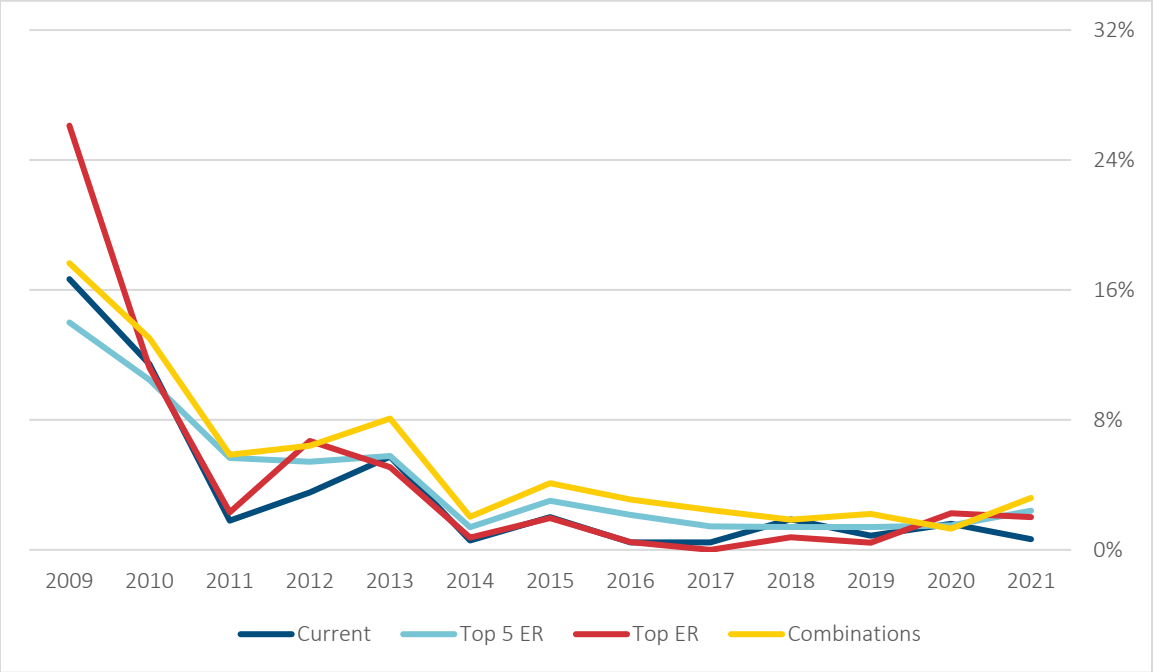
CURRENCY SHOCK

Definition: Material disruptions to currency equilibrium, including central bank devaluations (currency wars) and digital currencies.

Across all questions the trend for *Currency shock* has been similar, with instability following the GFC leading to an initially high response rate, with low but stable results afterward. The combinations question tends to have the highest response rate.

Figure 4
Emerging risk survey – Currency shock

% of Responses



A *Currency shock* can result from central bank miscalculations or from supply/demand equilibrium breaks.

IMPACT ON INSURERS: International insurance companies always need to consider hedging their currency risks, at least for their cash flow needs. While foreign assets are impacted, even domestic insurers are impacted as the payment system flows through and impacts inflation and Treasury rates.

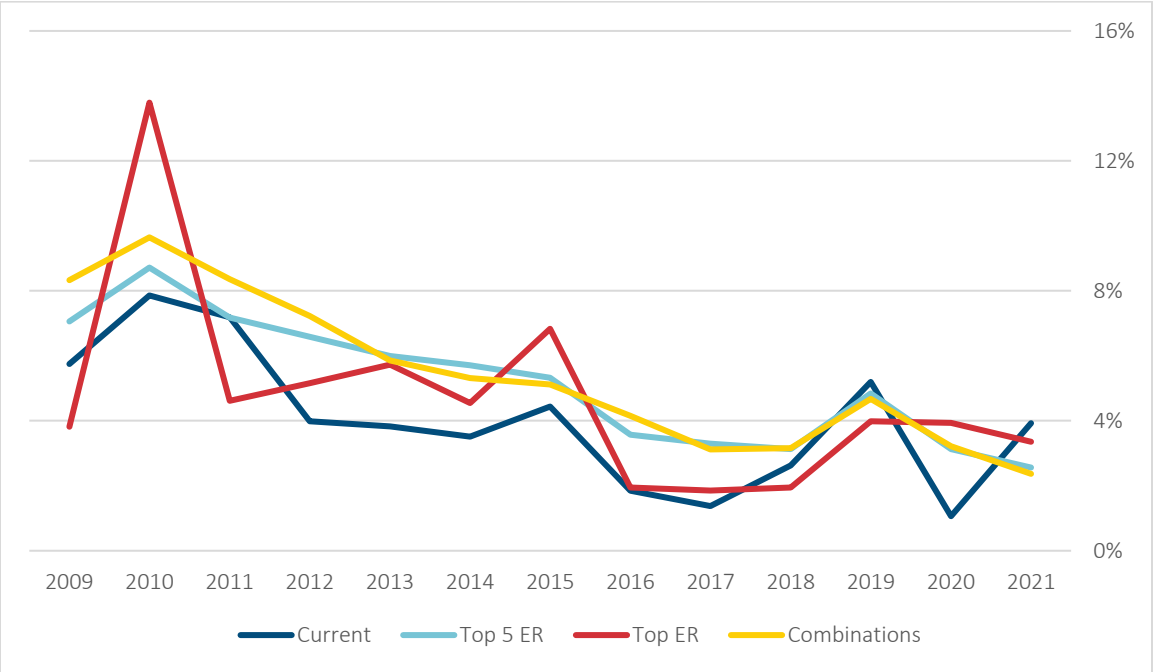
EMERGENT NATION DESTABILIZATION

Definition: Fast-growing country's economic growth slows, potentially as a result of protectionism, demographics, internal politics or economic difficulties.

Recent headlines (currency bias) determine changes in the current and top emerging risk questions, but overall, the trend has been down.

Figure 5
Emerging risk survey – Emergent nation destabilization

% of Responses



Emergent or developing nations can be a wild card regarding risk. A recent acronym is BRICS, for Brazil, Russia, India, China and South Africa. Each has created challenges in its own way. Many of these countries are aging demographically and some have moved toward populism and autocracy.

IMPACT ON INSURERS: Beyond assets, international writers and outsourced functions, the economic impact of a country that has been growing economically faster than the global average and then slows down impacts everyone. Human-rights sanctions may limit imports and exports. The 2022 invasion of Ukraine by Russia is an example of impacts that extend beyond borders, especially when cyber warfare is considered. There are large ramifications on demographics, migration and food security in regional conflicts. Each conflict is unique.

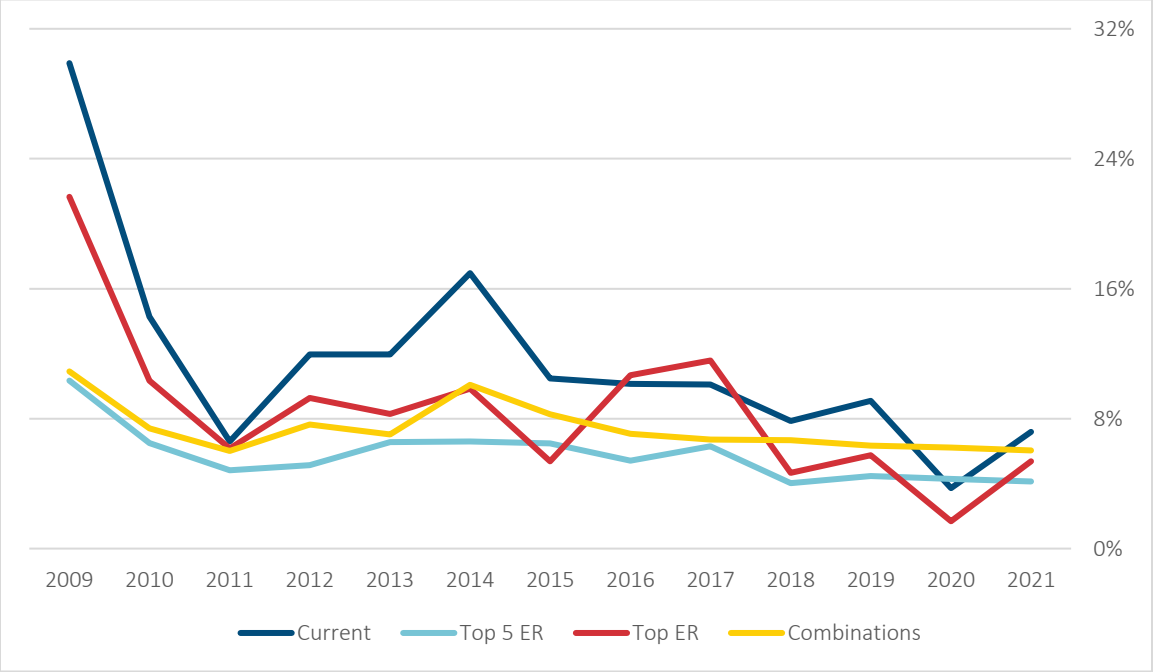
ASSET PRICE COLLAPSE

Definition: The value of assets such as housing and equities collapses.

Not surprisingly, moving away from the GFC and into an era of high government stimulus made this less of an issue. It is likely to return as stimulus is rolled back.

Figure 6
Emerging risk survey – Asset price collapse

% of Responses



A risk going forward is that housing in many regions is stretched, if not in a bubble. While governments try to manage these risks, an event can happen quickly and without warning.

IMPACT ON INSURERS: Insurers are key holders of many asset classes. Their customers can also be impacted by a fall in asset prices, making it more likely that a policy will lapse.

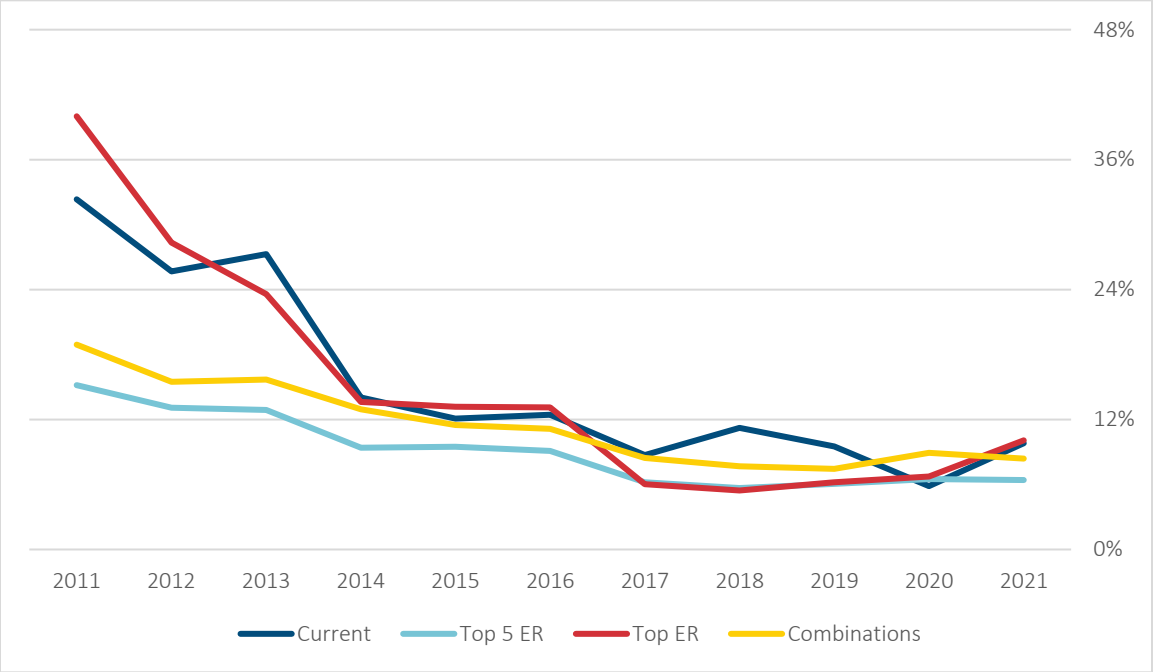
FINANCIAL VOLATILITY

Definition: Price instability and extremes of sectors, including commodities, equities or interest rates.

Both the current and top emerging risk bounced off their low in 2021 after a long steady slide following the GFC.

Figure 7
Emerging risk survey – Financial volatility

% of Responses



Financial volatility was not included as a risk until the 2011 survey, but comments about missing risks made it important to add.

IMPACT ON INSURERS: All insurers hold assets that can have volatile results. Current GAAP accounting rules mean that unrealized gains/losses often go through the income statement, making volatility a key component to understanding value.

2.2 ENVIRONMENTAL RISKS

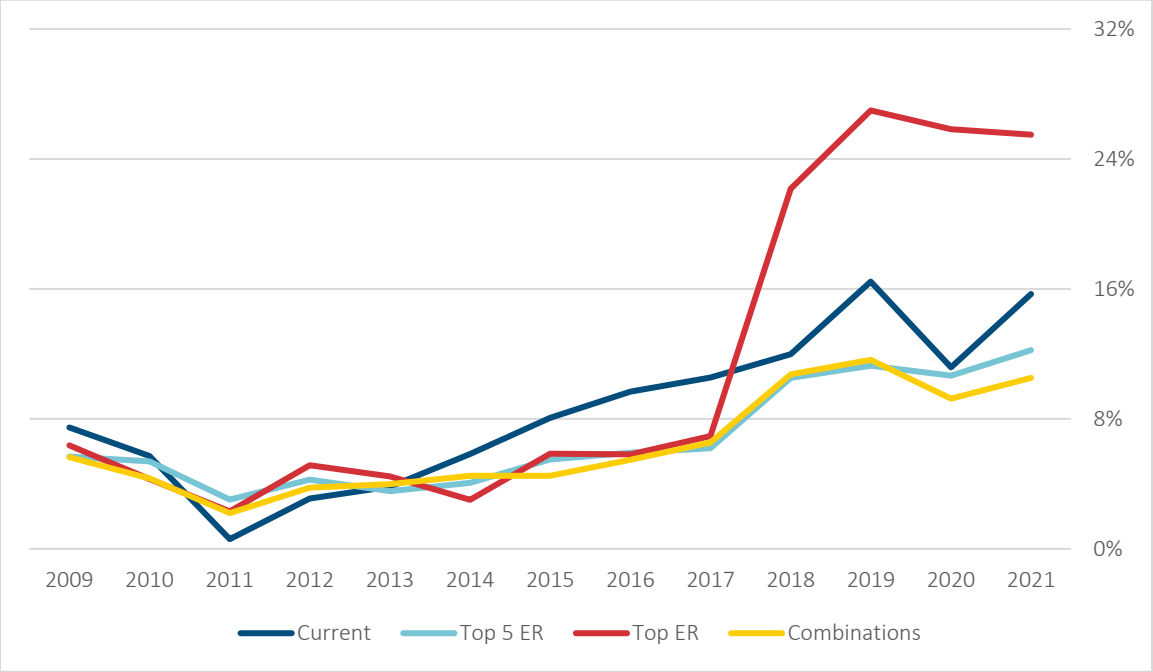
CLIMATE CHANGE

Definition: Change in climate patterns generates both extreme events and gradual changes, impacting infrastructure, agricultural yields, ecosystem biodiversity (e.g., insects, shellfish) and human lives. (Drivers include, but are not limited to, space weather and human influence.) Alternative divisions are physical risks and transition risks.

Climate change has steadily increased over the life of the survey, surging as the top emerging risk over the last four surveys.

Figure 8
Emerging risk survey – Climate change

% of Responses



Following the relative increases in importance surrounding *Climate change* during the survey is one of the key learnings. Risk managers of all practice areas no longer question the importance of considering these scenarios, and looking at *Climate change* in combination with other risks helps to provide foresight.

IMPACT ON INSURERS: Research on climate change has shown impacts on mortality, morbidity, property claims and asset values. Insurers are heavily impacted by the climate issue.

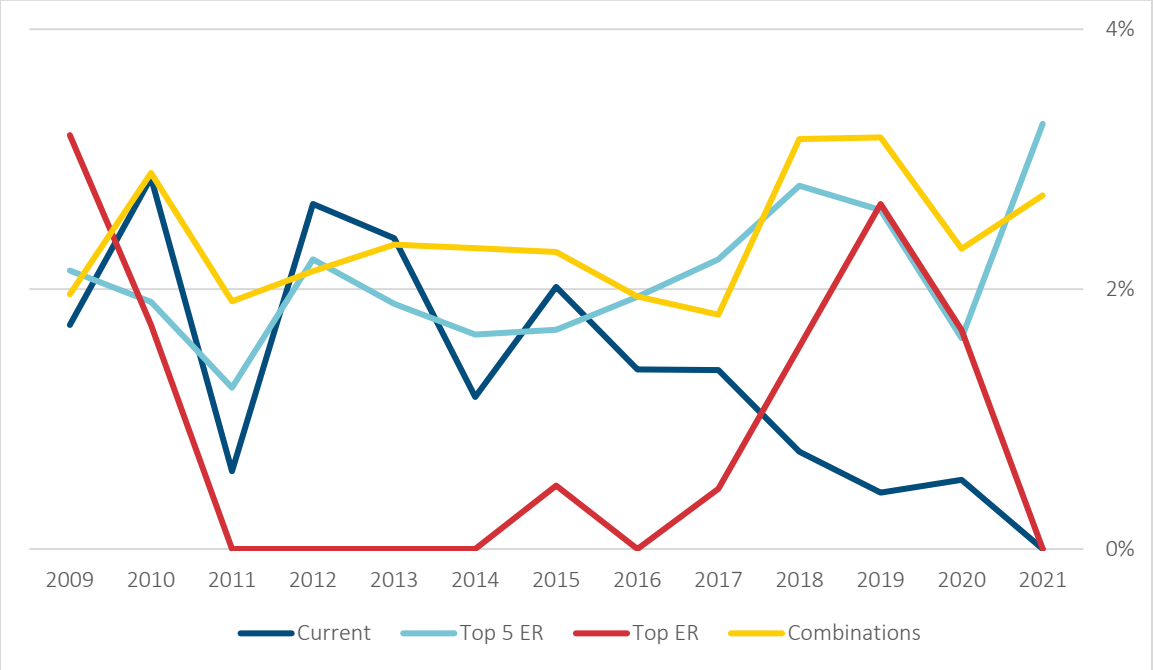
LOSS OF FRESHWATER SERVICES

Definition: Water shortages impact agriculture, businesses and human lives (drivers include, but are not limited to, climate change and human influence).

In the survey, *Loss of freshwater services* has not been considered a top emerging risk and has steadily decreased as a current risk, which is somewhat surprising, but it is increasing as a top five emerging risk and especially as a threat multiplier combination risk. This makes sense as climate change results in reduced water in many regions for drinking and crops.

Figure 9
Emerging risk survey – Loss of freshwater services

% of Responses



Countries are likely to reach out regionally to source fresh water even if it requires force. In the United States, for example, there are jurisdictional fights over the water running in the Colorado River. Reductions in tropical forests and oceanic temperature increases will continue to impact rain patterns.

IMPACT ON INSURERS: Lack of water for humans and agriculture will lead to abandoned assets and migration, even within developed countries.

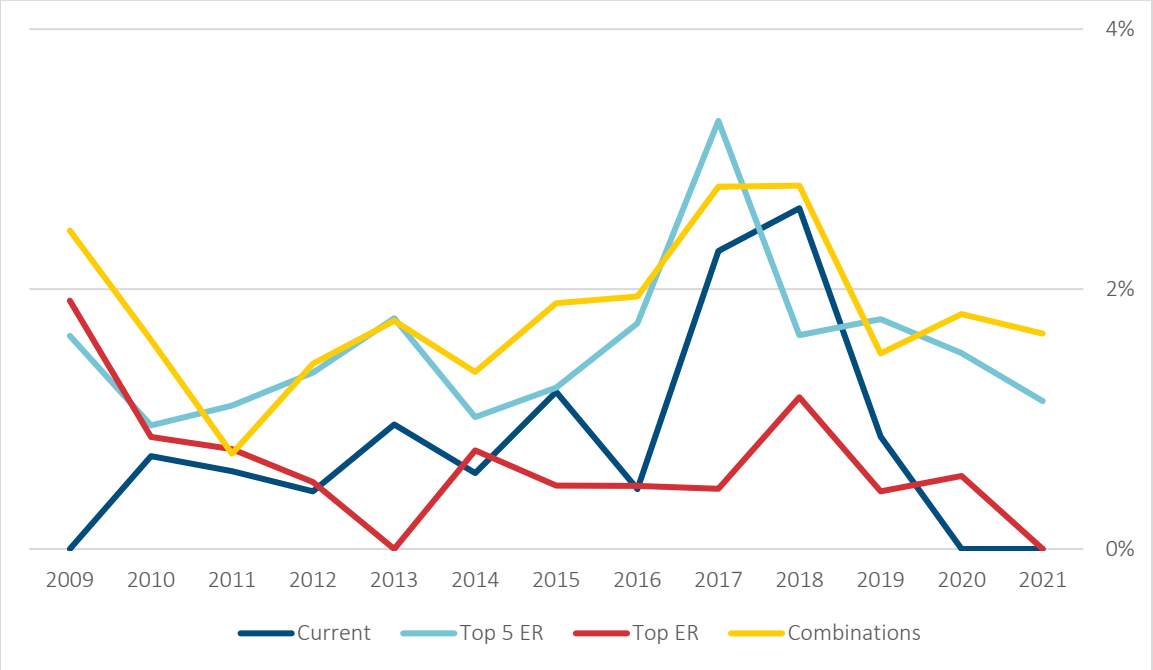
NATURAL CATASTROPHE: TROPICAL STORMS

Definition: Hurricanes, typhoons and cyclones lead to disruption, catastrophic economic losses, and/or high human loss of life.

The high impact of hurricanes and similar storms led to a surge in the current risk about five years ago, but, despite record numbers, the lack of major storm devastation has caused a reduction recently. The top five and combination risk questions continue to be stable or increase slightly. The natural catastrophe risks suffer years of neglect before surging during peak years.

Figure 10
Emerging risk survey – Natural catastrophe: tropical storms

% of Responses



Tropical storms, also known as cyclones or typhoons, are likely to become stronger as ocean temperatures become warmer and sea levels rise.

IMPACT ON INSURERS: Physical risk increases as sea levels rise, storms hold more water and infrastructure is built in harm's way. Natural barriers are eroding due to both human and natural causes. Imminent threat warnings continue to improve and human mortality has been reduced.

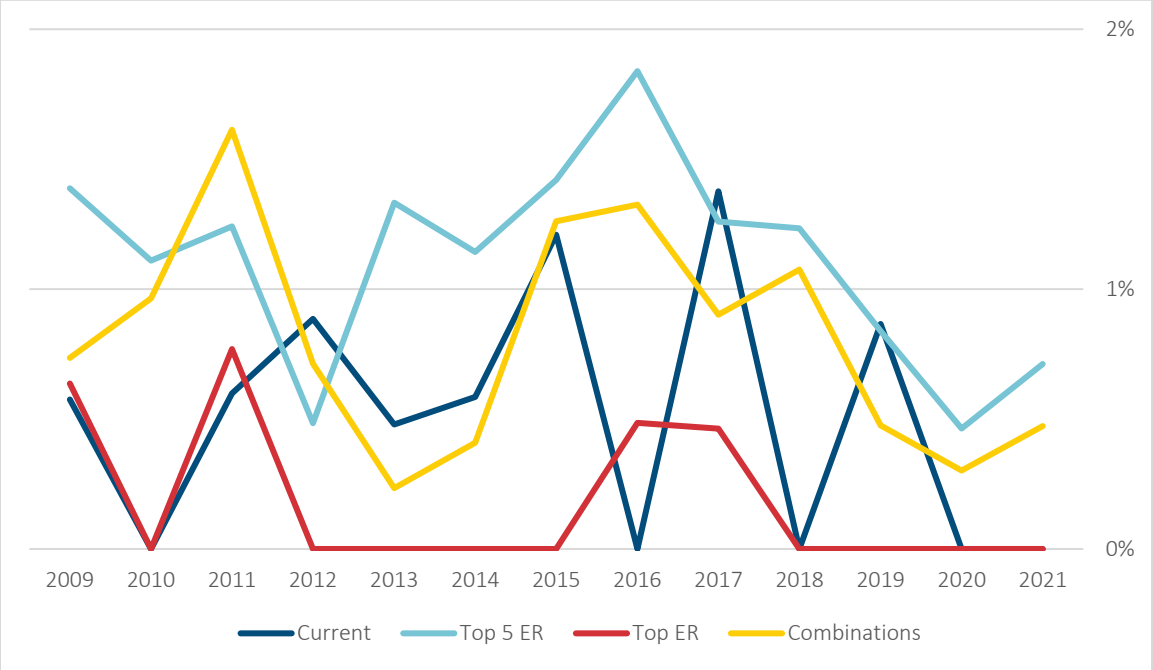
NATURAL CATASTROPHE: EARTHQUAKES

Definition: Strong seismic/volcanic activity lead to disruption, catastrophic economic losses and/or high human loss of life.

Earthquakes have been less in the news during the period of the survey and that is reflected in these results. It would be useful for companies to regularly study their exposure to the risk outside typical regions in California to encourage resiliency in areas like the American northwest (Seattle) and east coast (South Carolina). The survey volatility may be due more to changes in respondents than changes in risks.

Figure 11
Emerging risk survey – Natural catastrophe: earthquakes

% of Responses



Seismic activity impacts more than property. Regional economies can be destroyed in an instant when a volcano erupts or an earthquake becomes active. It has been many years since the Ring of Fire around the Pacific was active and other areas are also overdue for a seismic event.

IMPACT ON INSURERS: The Fukushima tsunami in 2011 showed how quickly a seismic event could devastate an area in many ways. Another event with significant material repercussions would be a large earthquake in the Seattle region of the United States.

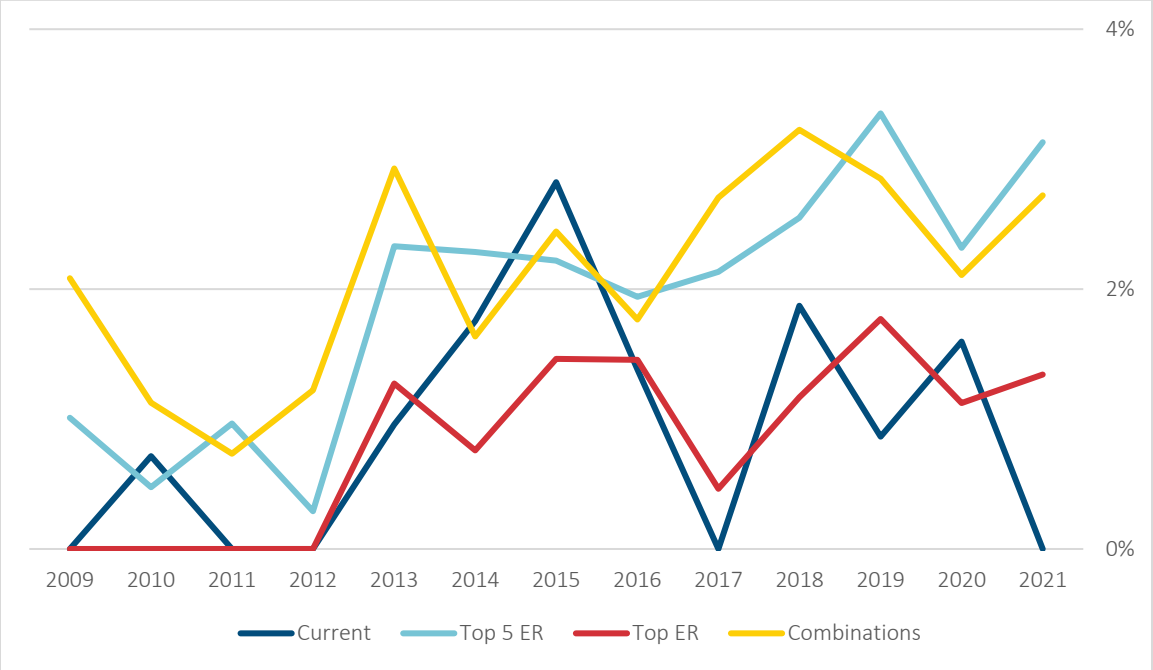
NATURAL CATASTROPHE: SEVERE WEATHER

Definition: Meteorological phenomena lead to disruption, catastrophic economic losses, and/or high human loss of life. Includes inland flooding, tornados, thunderstorms, drought, wildfires, high winds, snowstorms and dust storms.

Except for current risk, severe weather is trending up across the other questions. Many areas around the world have suffered from multiple events recently. No matter your location you are at risk and likely to have suffered a loss near you. This is a good example where leaving a risk on the list even when it seems dormant is useful as one can see the growth in concern.

Figure 12
Emerging risk survey – Natural catastrophe: severe weather

% of Responses



Inland events have been increasing globally over the last few years. Flooding occurs on every continent as storms seem to sit over one location, as occurred with Hurricane Harvey in 2017 in Houston, Texas. Tornados are appearing at times and locations that are unusual if not unheard of. Droughts occur everywhere and wildfire season is now year-round.

IMPACT ON INSURERS: Severe weather events have the greatest opportunity to impact every person as they are not regional in nature. Property claims and asset values are the primary impacts.

2.3 GEOPOLITICAL RISKS

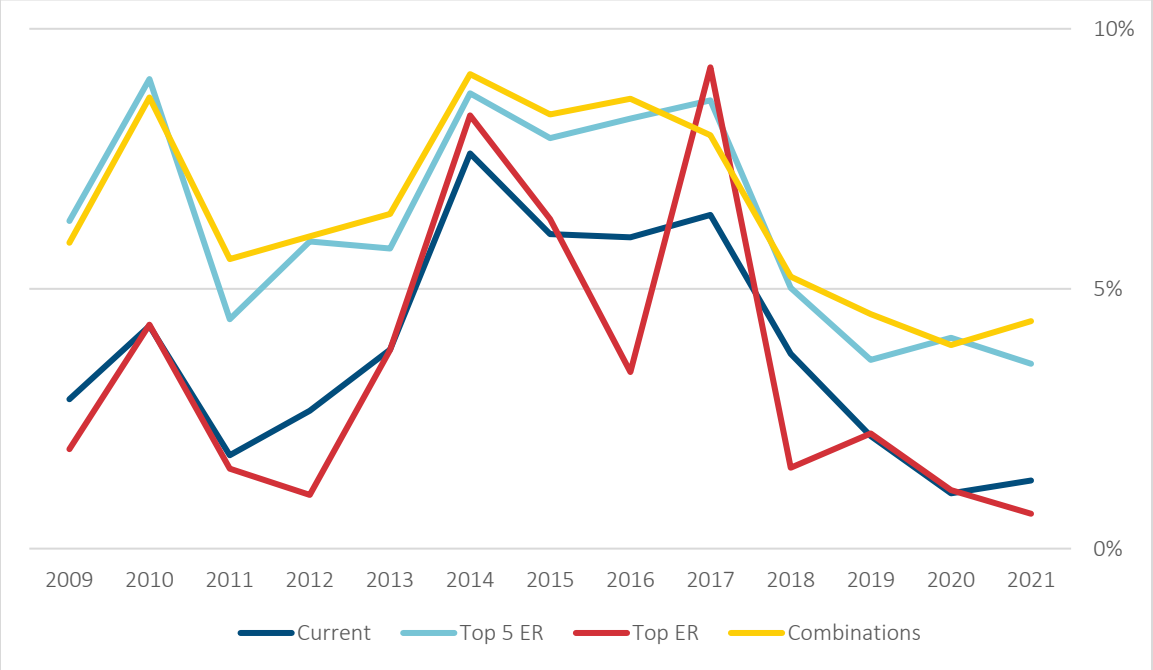
TERRORISM

Definition: Attacks lead to disruption, catastrophic economic losses, and/or high human loss of life.

The recent lull in terrorism in Western countries has reduced the interest in this risk across all questions. A single event would likely spike the results in the year following. Respondents have not seemed to place domestic gun-related violence in this risk.

Figure 13
Emerging risk survey – Terrorism

% of Responses



Terrorism is one of the risks that suffers from recency bias and could return at any time despite major efforts to limit the threat.

IMPACT ON INSURERS: While terrorism has contractually limited coverage, some forms (especially domestic) could result in many years in court. Past events, like the 9/11 attack on the World Trade Center, led to a hard market for property insurers.

WEAPONS OF MASS DESTRUCTION

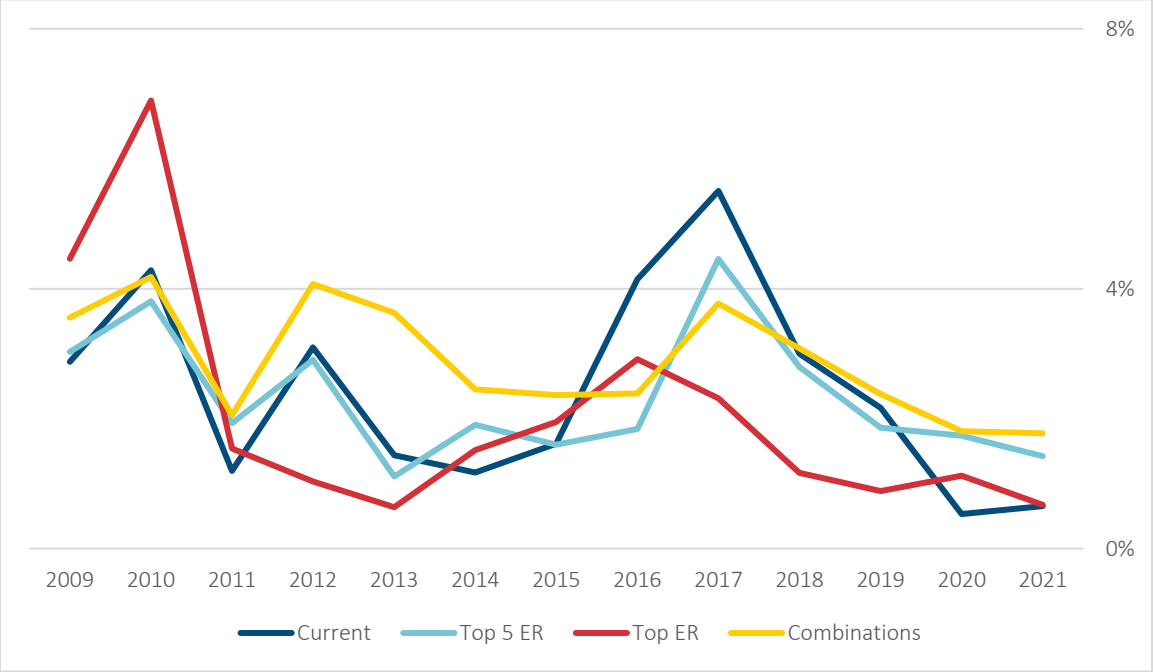
Definition: Nuclear, biological, radiological or chemical technologies are held by unstable groups, leading to disruption, catastrophic economic losses, and/or high human loss of life.

The fear of WMD seems to be tied to surges in news from Iran and North Korea, which are relatively quiet.

Figure 14

Emerging risk survey – Weapons of mass destruction

% of Responses



Release of a nuclear or chemical device in Ukraine or by a non-governmental group like ISIS would quickly raise this perceived risk.

IMPACT ON INSURERS: Warren Buffett noted that a nuclear war is beyond the capability for insurers to cover, but limited biological or chemical weapons would be new territory for the industry.

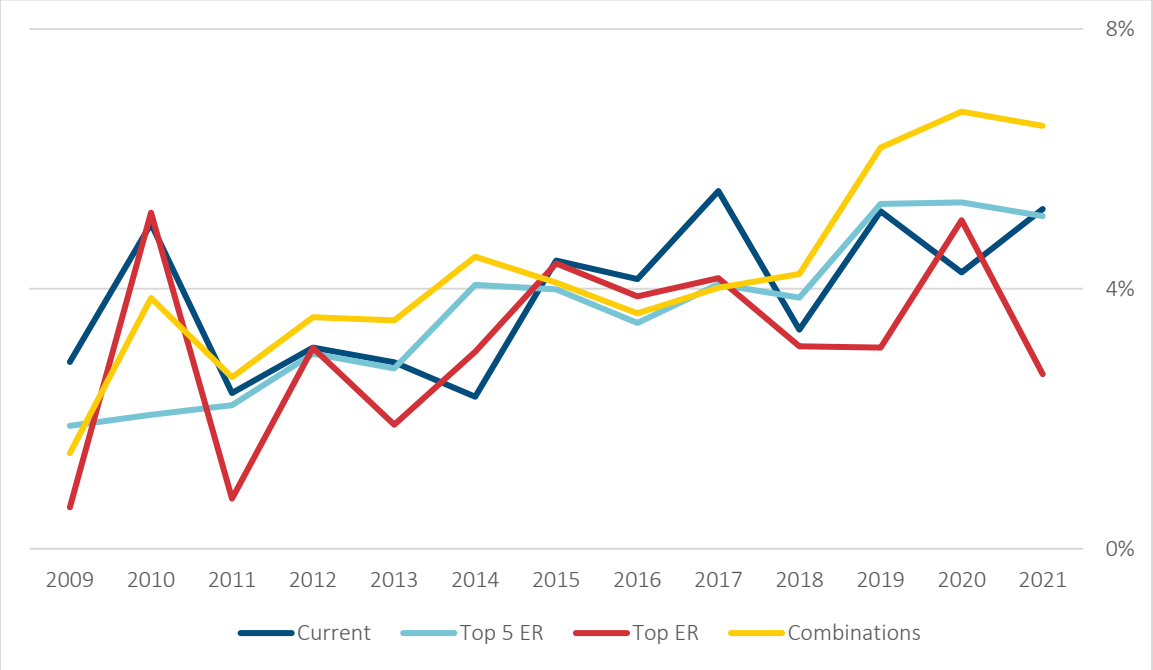
WARS (INCLUDING CIVIL WARS)

Definition: Wars erupt between or within countries, leading to disruption, catastrophic economic losses, and/or high human loss of life.

Responses have steadily increased during the survey and will likely surge following the Russian invasion of Ukraine early in 2022.

Figure 15
Emerging risk survey – Wars (including civil wars)

% of Responses



A U.S. civil war would change the world as we know it in many ways that are hard to identify in advance.

IMPACT ON INSURERS: Regional wars not directly involving your country of residence would primarily impact the assets for insurers not located in that region. There would be impacts on food security so would indirectly impact insurers globally.

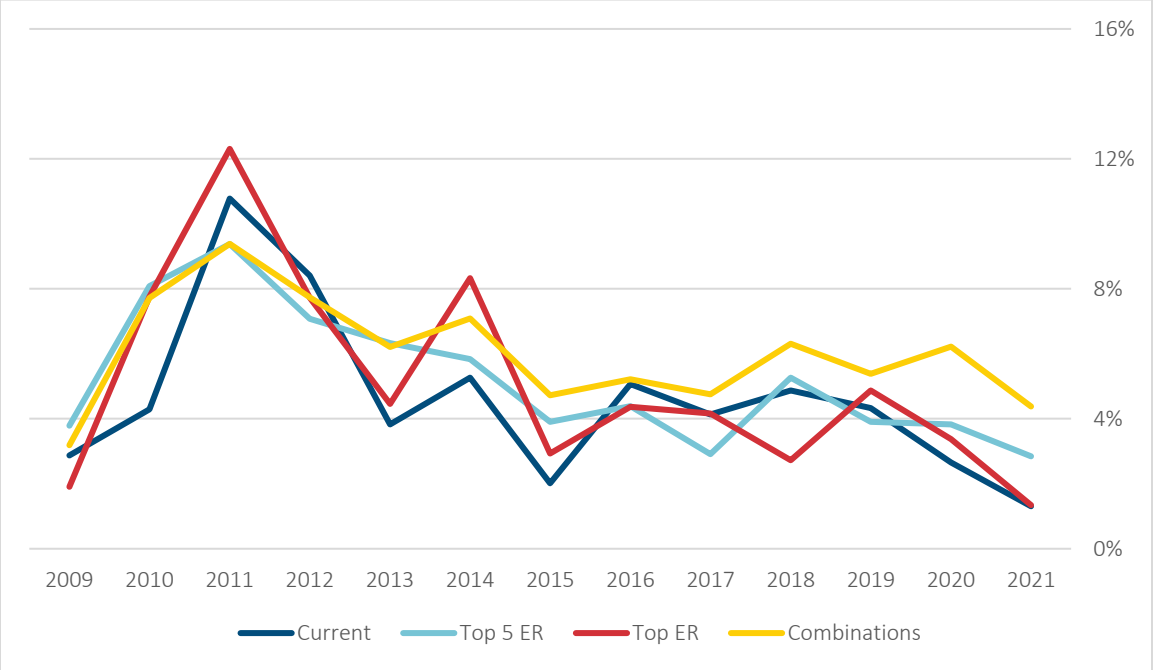
FAILED AND FAILING STATES

Definition: The trend of a widening gap between order and disorder, or widening social rifts.

The events leading up to the Arab Spring in 2011, including high oil prices and food insecurity, was the peak for this risk. This could be a harbinger of things to come as recent events are aligned. Are there implications for your company's unique exposures?

Figure 16
Emerging risk survey – Failed and failing states

% of Responses



Failed and failing states includes caliphates, but some respondents included the United States and other Western countries.

IMPACT ON INSURERS: Beyond international assets, problem states become more of an issue with proximity.

TRANSNATIONAL CRIME AND CORRUPTION

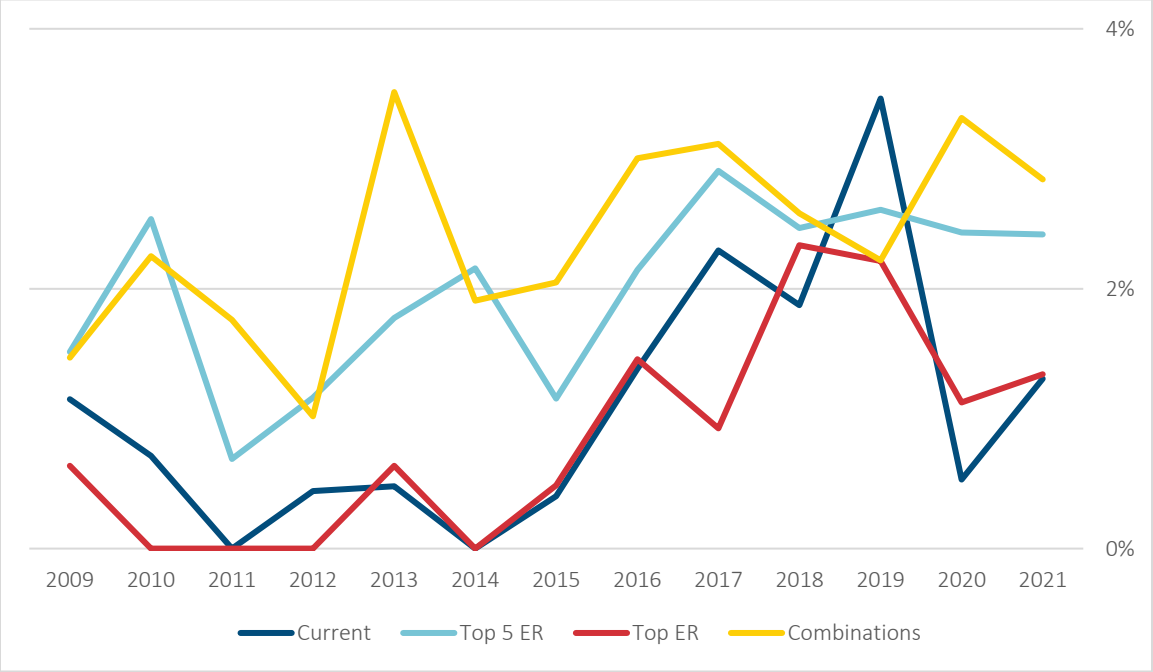
Definition: Corruption continues to be endemic, and non-state entities successfully penetrate the global economy.

This risk has increased, although not steadily, as groups like ISIS and mafia-like organizations have made clear the risk they pose.

Figure 17

Emerging risk survey – Transnational crime and corruption

% of Responses



These groups prefer to be under the radar so it is hard to be aware of them all. Would you include an organized flash mob that filled their pockets at a local pharmacy as their job, turning over everything they take in return for a wage? It's hard to know where to draw the line, but criminal operations are nearly everywhere.

IMPACT ON INSURERS: Much of these thefts are covered by insurance, but over time the premiums adjust so the insurer is strictly a pass-through. Assets are impacted because company debt relies on profits to pay off loans.

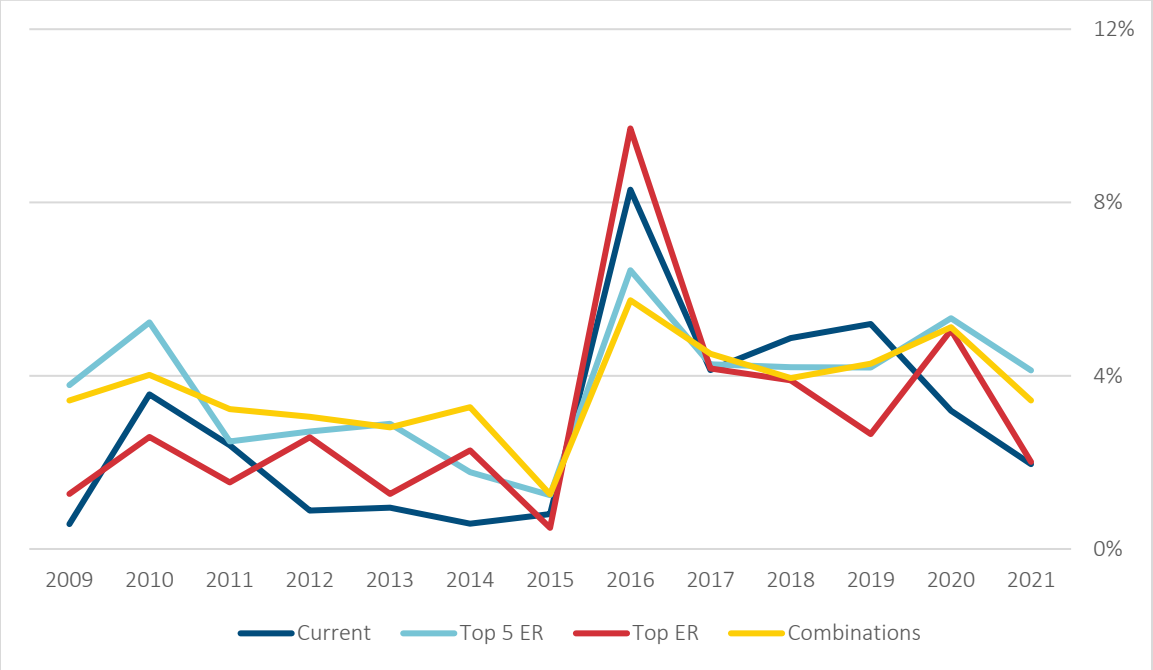
GLOBALIZATION SHIFT

Definition: Preference changes to imports and immigration. Populism, political uncertainty. Countries retrench and become more nationalistic and protectionist, or open up their economies to outsiders. Inequality and food insecurity challenge the concept of fairness and egalitarianism.

This risk spiked when Donald Trump was elected U.S. president and populism surged. It has stabilized since, perhaps as risk managers became used to the risk and developed tools to manage it. While supply chains were also impacted by the COVID-19 pandemic, tariffs and other trade restrictions impact global consumers.

Figure 18
Emerging risk survey – Globalization shift

% of Responses



Populism and inequality are cyclical topics getting more attention of late. This will impact society over the next generation at least.

IMPACT ON INSURERS: Insurers tend to not be major lobbyists at the federal level so would be unlikely to receive favorable treatment. During discussions in the original pandemic-relief legislation, insurers benefited from private equity desires for near-junk-level credit to receive support. Supply chains that go from “just-in-time” to “just-in-case” with domestic production increase costs, which are passed to customers.

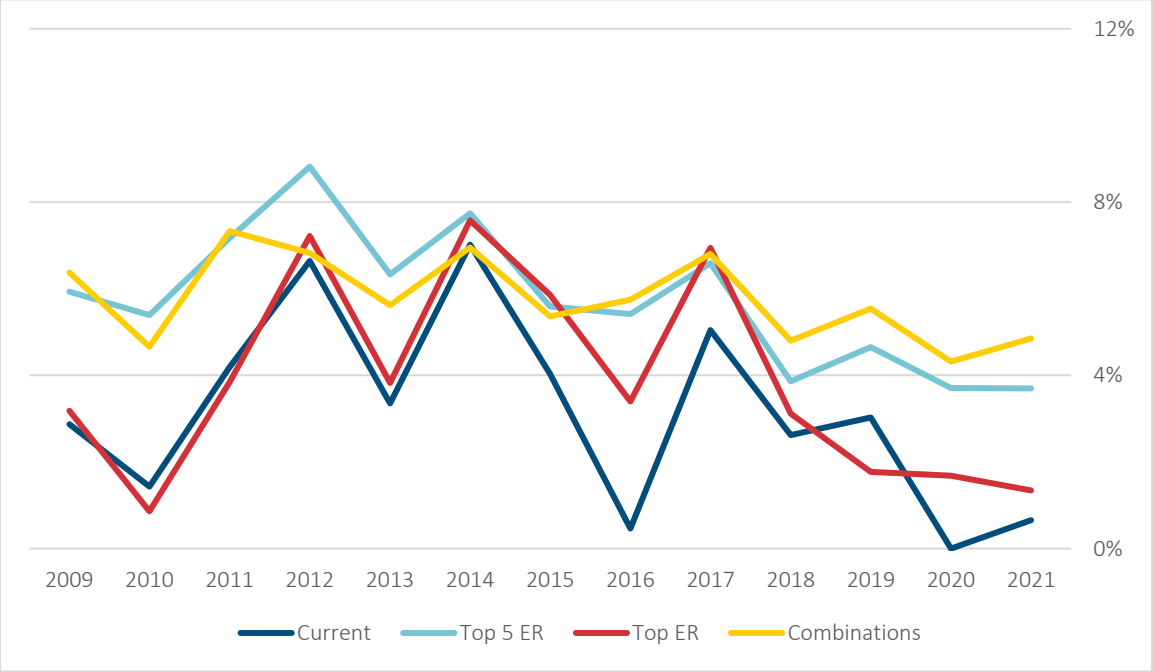
REGIONAL INSTABILITY

Definition: Certain unstable areas may cause widespread political and other crises.

The survey respondents have steadily reduced the response rates for *Regional instability*, with combinations and top five emerging risk rates staying in the 4% range while current and top emerging risk fell to near 0%.

Figure 19
Emerging risk survey – Regional instability

% of Responses



Interacting with other risks like climate change, it is likely that regional conflict will only increase.

IMPACT ON INSURERS: Regional insurers local to the conflict will be impacted, as will others if agriculture and food insecurity are affected.

2.4 SOCIETAL RISKS

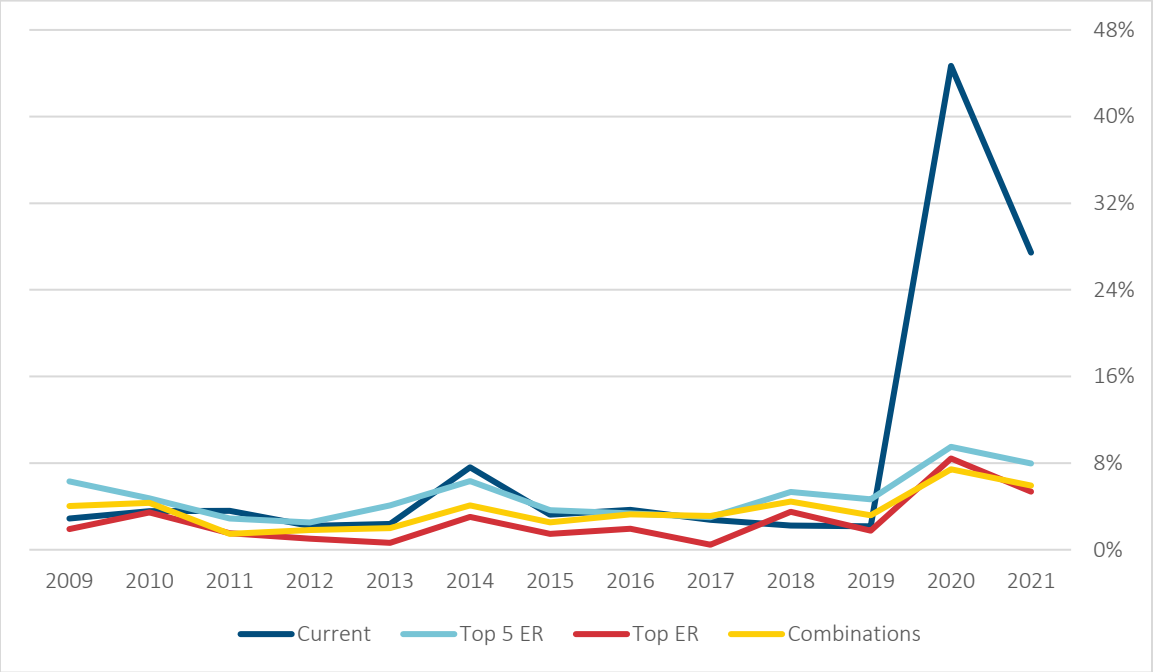
PANDEMICS/INFECTIOUS DISEASES

Definition: A pandemic emerges with high mortality/incidence of diseases such as HIV/AIDS, Ebola, coronavirus or influenza. Antimicrobial resistance becomes common.

Not surprisingly, in 2020 the pandemic risk spiked. This was especially true for the top current risk, which increased from 2% to 45%. Questions covering emerging risk topics increased as well, reducing other top risks and mean-reverting in the current survey.

Figure 20
Emerging risk survey – Pandemics/infectious diseases

% of Responses



Pandemics and spillover diseases will be topics of interest going forward. While there is much we don't know, the science that identified COVID-19 and created a vaccine was extraordinary and yet the recent pandemic continues to divide communities and task the medical profession.

IMPACT ON INSURERS: Insurers have won a vast majority of the court cases about business interruption due to the pandemic. Asset portfolios were saved by government intervention that should not be counted on in the future. Auto insurers faced reduced mileage driven so lower claims, but many refunded a portion of the premiums paid. Pandemic mortality at younger ages would be more material to life insurers. Due to canceled voluntary procedures and government subsidies for vaccines and testing, health insurers collected premiums that were not offset by claims. The big unknown at this point for insurers is the impact of long COVID on disability insurance. Many insurers are wondering how the recent pandemic will impact mortality improvement scales, and it seems especially confusing to discern the impact on long-term case policies and nursing homes in general.

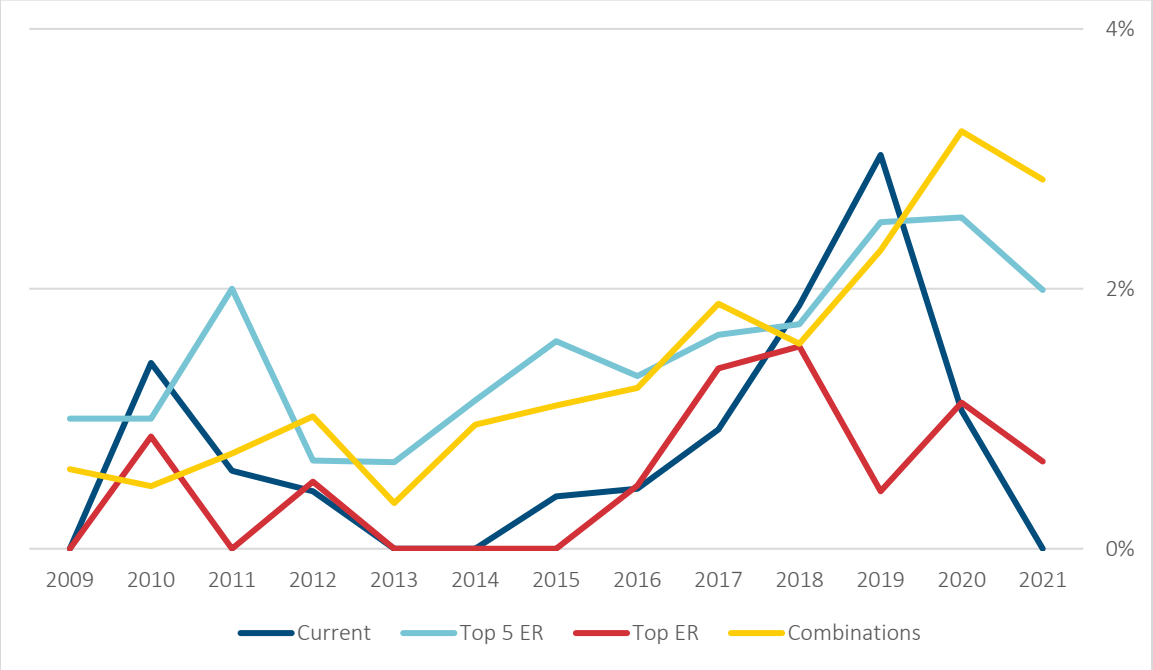
CHRONIC DISEASES/MEDICAL DELIVERY

Definition: Diseases such as obesity, diabetes, cardiovascular and substance abuse become widespread. Material change to medical delivery or financing ensues.

Combinations and top five emerging risk responses for chronic diseases/medical delivery continues to increase while the current and top emerging risk remain low.

Figure 21
Emerging risk survey – Chronic diseases/medical delivery

% of Responses



Chronic diseases were upended by the pandemic, with cancer checks and annual physicals missed. The United States moved closer to 100% coverage, but this may not be permanent.

IMPACT ON INSURERS: Demographics will interact with disruptive technology to determine the outcome from chronic diseases. Technological breakthroughs could extend life expectancies while obesity and opioids move in the other direction. A single-payer system in the U.S. would be a major disruption to the insurance industry, although some functions may be outsourced to existing facilitators.

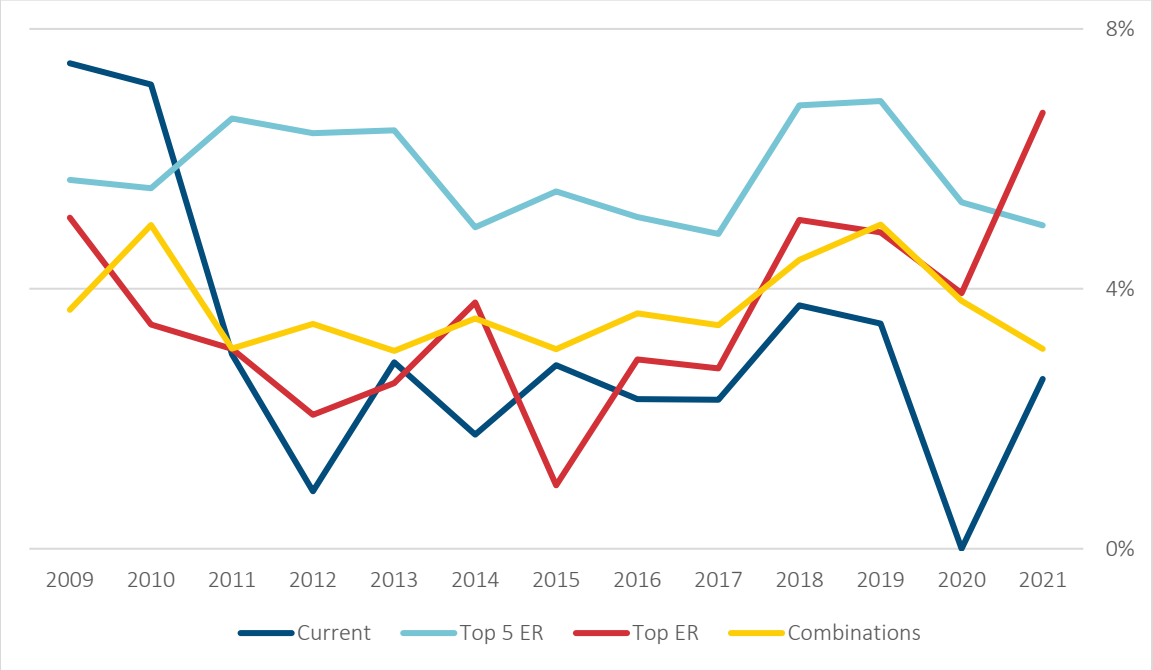
DEMOGRAPHIC SHIFT

Definition: Evolving populations (e.g., age, size, race, migration trends, skills shortages) drive changes in economic growth and levels of government intervention.

Demographics are considered an actuarial specialty, so it is not surprising that this risk is on the minds of risk managers. As the top emerging risk, it ranked in the top five overall and is in the top ten for the other questions.

Figure 22
Emerging risk survey – Demographic shift

% of Responses



The global economy will be driven by demographics over the next century. In most countries the fertility rate is below the level needed to sustain the population, and those countries are aging with little redundancy built into their social safety nets. While the United States is aging, it will follow Japan, Europe and China through the process.

IMPACT ON INSURERS: Fewer young families could have a negative impact on sales without product adjustments. An older demographic will also upset the investment world and pull down interest rates and economic growth.

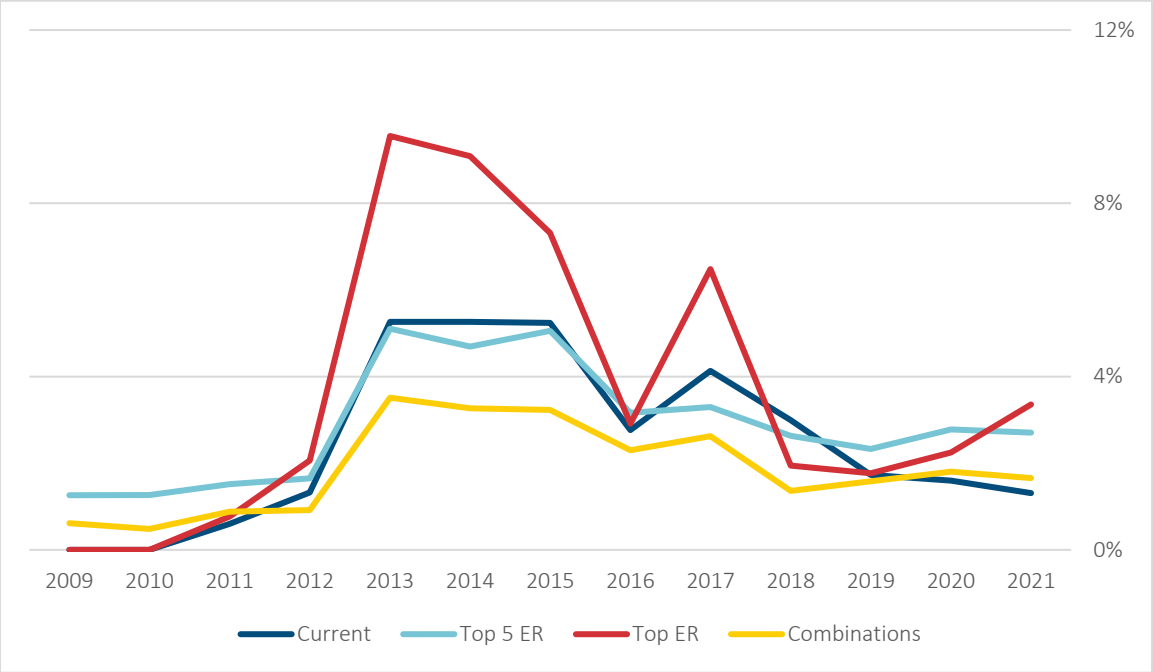
LIABILITY REGIMES/REGULATORY FRAMEWORK

Definition: Costs increase faster than GDP, with increases in the spread and size of litigiousness (e.g., social inflation) and speed of regulatory revisions.

While risk managers are always busy with regulatory updates, sometimes distracting them from adding value with their limited time, this risk surges when insurance regulators add new modelling requirements. When something new is presented, it becomes a top emerging risk.

Figure 23
Emerging risk survey – Liability regimes/regulatory framework

% of Responses



Regulatory modelling requirements are constantly changing. Once principles-based reserves are implemented something new, like IFRS 17, will come along to take its place. Sometimes regulatory compliance takes time away from value-added risk team duties, and that is unfortunate.

IMPACT ON INSURERS: Insurers will support the ERM team when the regulators require it, but not always otherwise. The teams that grow their risk teams when times are stable will outperform in the long run. A renewed emphasis on ORSA, audited by someone expert in risk, would help both companies and regulators.

2.5 TECHNOLOGICAL RISKS

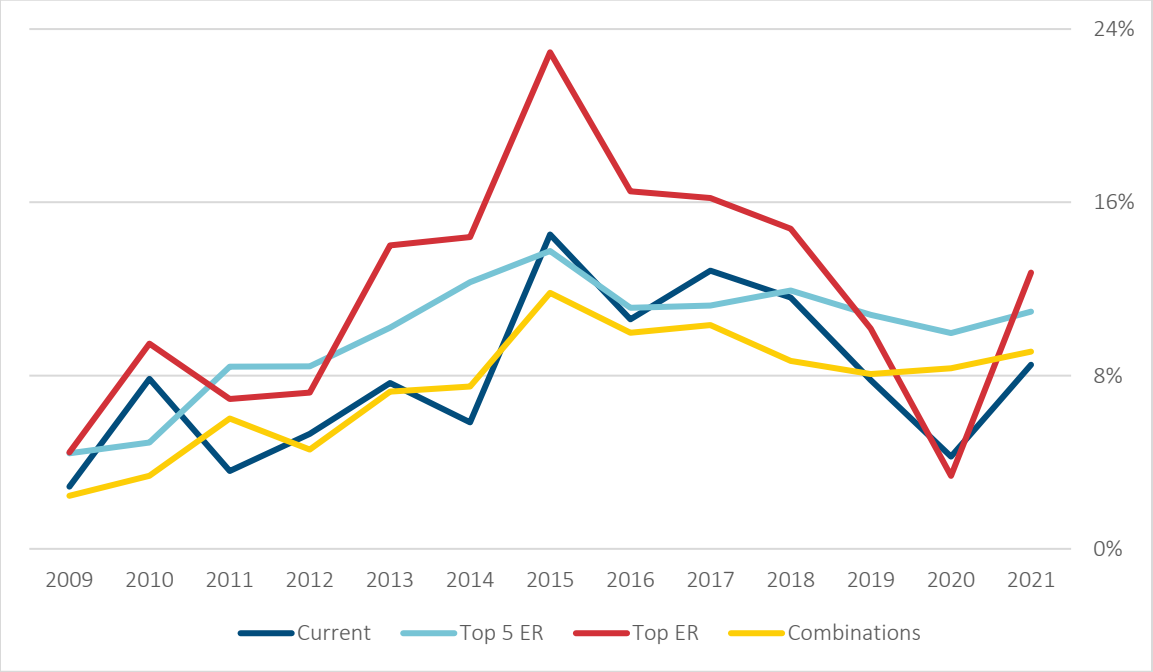
CYBER/NETWORKS

Definition: A major disruption of the availability, reliability and resilience of critical information infrastructure caused by cyber risks, terrorist attack or technical failure. Results are felt in major infrastructure: power distribution, water supply, transportation, telecommunications, emergency services and finance.

Various cyber breaches caused this risk to increase during the early years of the survey, then stabilize as tools became available to manage the risk. Cyber/networks decreased in 2020, especially as the pandemic risk spiked, but that may have been a short-term blip.

Figure 24
Emerging risk survey – Cyber/networks

% of Responses



Cyber risk is constantly evolving. The only constant is that you don't want to do it part time. Hire an expert or outsource it to a firm. With the war in Ukraine there is concern that infrastructure is under threat.

IMPACT ON INSURERS: Insurers hold private data about a large proportion of the population. A breach can disrupt operations and cause problems for clients.

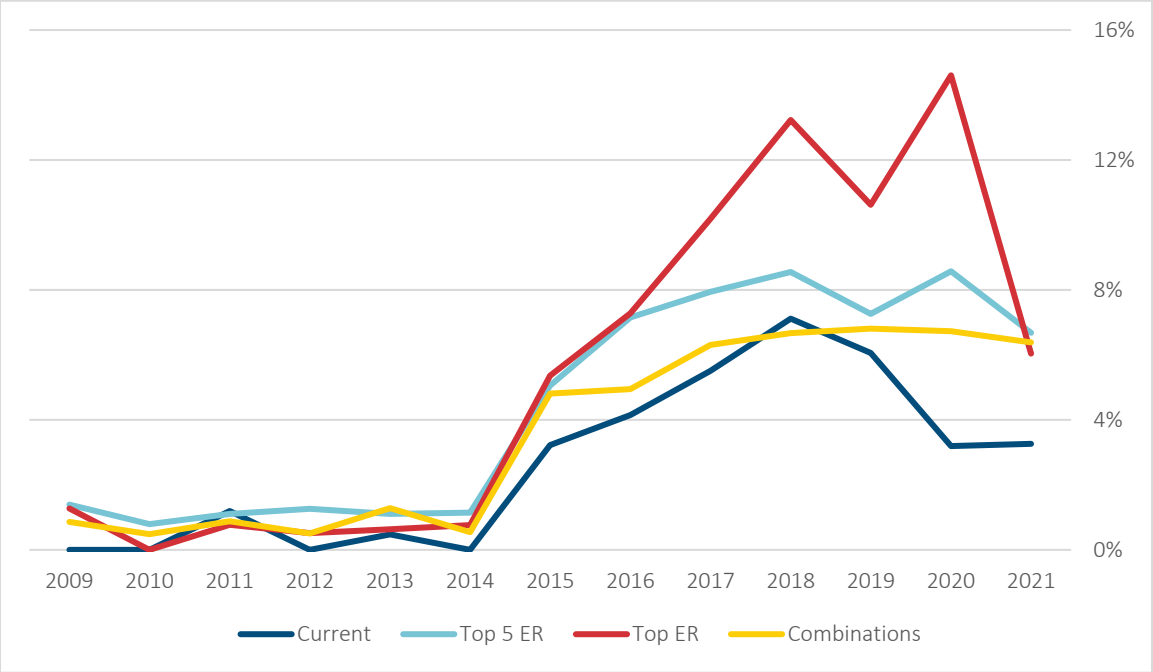
DISRUPTIVE TECHNOLOGY

Definition: Unintended consequences of technology leads to abrupt change (e.g., drones, self-driving cars, additive manufacturing, the internet of things, nanoparticles). Models become more complex but less descriptive over long time horizons.

Disruptive technology has surged since 2014 and become a regular in the top five rankings. The drop in the current survey as the top emerging risk was unexpected.

Figure 23
Emerging risk survey – Disruptive technology

% of Responses

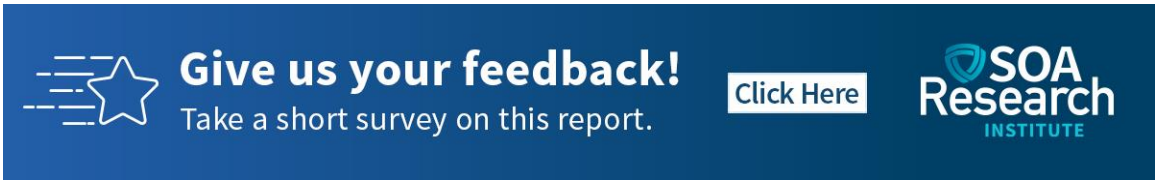


Technological improvements take many forms, and we are all impacted. Most, but not all, will be positive. It is not unusual for technology to have unexpected consequences.

IMPACT ON INSURERS: Health insurers seem very likely to be impacted through telemedicine, remote surgery and artificial intelligence. Driverless technology is likely to make the roads safer for all, but the rare fatality will become national news. Methodologies to extend healthy lives will impact all traditional products. Assets will also be impacted as technological companies take over from legacy firms.

OTHER

The survey respondent also has the option to answer Other, except for the risk combination question.



Section 4: Acknowledgments

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Appendix A-Blog Posts

Two papers were written for SOA News Canada in September 2017 and February 2019 that were based on the emerging risk survey. They are included here and are provided to help practitioners develop an ERM process.

September 2017

This article was written for SOA News Canada and was released September 12, 2017.

ERM Lessons from the Masters

By Max J. Rudolph, FSA CFA CERA MAAA

Everything should be made as simple as possible, but not simpler.

–Albert Einstein

Since 2008 the Joint Risk Management Section, jointly sponsored by the Society of Actuaries (SOA), Canadian Institute of Actuaries (CIA) and Casualty Actuarial Society (CAS), has annually conducted a survey of emerging risks. As the researcher for this project, I have asked open-ended questions thought to be useful to risk managers. Here I will summarize one from the 2015 and 2016 surveys and provide some perspectives for Canadian actuaries: Are there lessons learned that you would like to share with risk managers developing an ERM framework (e.g., what worked, what did not)?

The answers reflected a generally positive view of ERM and can be split into ten themes.

TONE AT THE TOP

For projects requiring cooperation between line and staff functions, support from the top is mandatory. Buy-in goes beyond the CEO to include the board, C-suite and other key stakeholders. This helps to avoid those who hope to "wait it out" until a new CEO takes over.

Since the CEO may not come from a technical background, and the board rarely spends more than a few hours on any topic, it is important that the risk manager use qualitative descriptions (telling a story) and graphics when possible.

SPEED

A successful ERM process often starts slow and builds credibility rather than charging full speed ahead. Firms must prioritize their efforts. Set up lots of checkpoints, confirming leadership commitment before moving on from each one.

BREADTH

The process works best when the risk unit fully engages others, both staff and line, with diversified thoughts and methods. Respondents suggest avoiding extreme precision in quantification efforts. It is better to start with a 5-point scale rather than a detailed model that promises more than it can deliver.

ROLE OF CRO

A titled risk officer continuously improves the ERM process, engaging others in the organization through leadership and communication as competencies and goals are developed. The CRO should keep it simple, initially focusing on education. The risk team adds value as a sounding board resource, giving honest feedback before projects are formalized. The primary purpose of the risk team is to work with the risk owners to understand how new opportunities impact the aggregate risk of the firm and overall objectives.

COMMUNICATIONS

Building awareness of ERM benefits is the most important aspect of the risk team's existence. Honest insights are relied on by leadership and rank and file alike.

WORKING WITH THE BUSINESS UNITS

A successful ERM process involves line functions directly, not by completing templates with no feedback but making it a regular part of their process. Risk owners, the primary decision makers, trade their knowledge of specific risks in return for the risk team's understanding of how the risks interact and aggregate. The risk team should maintain its independence from the business units. Both groups should contribute to emerging risk discussions. The risk team provides oversight mainly by embedding a consistent risk process that improves decision making and allows senior management to decide between alternative options.

INTERACTIONS

The risk team learns how risks interact, especially when such interaction varies by scenario. Risks that are normally independent can quickly become correlated during a crisis.

HOW TO MAKE IT LONG LASTING

Risk becomes part of the normal decision making process, leveraging tools to meet regulatory needs and building both a top down and a bottom up approach. Dashboards that update frequently, in real time if possible, maintain interest and provide current information.

Risk management continues to evolve. Governance is maturing. Defining terms like risk appetite, with trigger levels, guardrail levels, and leading indicators is hard. Getting something done now and reviewing the process throughout the business cycle helps it to evolve and get better.

Don't forget history. Just because hyperinflation, influenza pandemics or war have not happened recently does not mean they won't happen. Current indicators related to volatility and debt levels have been contra-indicators in the past and should be monitored.

THINGS THAT DIDN'T WORK

Creating a risk management report solely for external stakeholders is a compliance exercise. Those who rely on market forces to price risk need to expand the discussion to include cognitive biases and incentives. The contrarian is not always right, but the discussions they start can help improve the decision making process.

CULTURE

A strong culture allows the process to be embedded in the business through education, while a poor culture likely ends up with reports that no one reads and knowledge ignored.

CONCLUSIONS

The Canadian economy survived the financial crisis of 2008 in much better shape than most of the economies around the globe, in large part due to effective risk management. However, sustainability requires diligence, and lessons learned need not become lessons forgotten. A firm should be able to reflect on past decisions and understand any role risk management had in the direction taken.

Risk managers should also remain open to change and react to new methods and products. Further, it is important to prioritize the efforts of the risk team, favoring getting something done now rather than everything done at some point in the future. Having in-depth discussions about balancing risk and reward is more important than the reports generated. Don't forget to communicate. Don't assume that external parties understand your risks better than you do. Governments have biases, and so do investors and rating agencies.

Many strategies that have been used successfully still work: diversification, risk identification and management, qualitative and quantitative methods. Each firm has its own risk culture, and it is better to "nudge" it and slowly make progress rather than push faster and lose overall support for the process.

Max J. Rudolph, FSA, CFA, CERA, MAAA is the founder of Rudolph Financial Consulting, LLC, in Omaha, Nebraska. He can be reached at max.rudolph@rudolph-financial.com.

February 2019

How a Risk Team Adds Value

By Max J. Rudolph, FSA CFA CERA

What would our successors do? – Andy Grove, founder and CEO of Intel

Since 2008 the Joint Risk Management Section, sponsored in partnership by the Canadian Institute of Actuaries (CIA), Society of Actuaries (SOA) and Casualty Actuarial Society (CAS), has annually conducted a survey of emerging risks. As the researcher for this project, I have asked open-ended questions thought to be useful to risk managers. Andy Grove noted the importance of viewing problems from an outsider's perspective. After a strategy he implemented had struggled, he hypothesized how the strategy would change if he was fired. This article summarizes activities that are perceived as adding value by risk managers.

Each company is unique based on the skill set of the risk team and needs of the firm, many of which are strategic and can be fulfilled through well-thought-out scenario testing. These can be split into eight themes.

PROVIDE INPUT TO RISK COMMITTEE

A fully functioning risk team will interact regularly with the risk committee and the board. The risk committee seeks out unbiased input to make decisions. Several respondents shared their experience, with some stating that they had been asked to provide detailed analysis on specific projects with others providing general input on all projects being contemplated. It was noted that recommendations are not always implemented.

RECURRING RISK REPORTS

Some risk teams generate periodic sensitivity tests, along with other risk reports. These allow quicker response times when markets move or claims spike, improving resiliency even if the specific event was not modeled. Specific requests from external stakeholders may also be fulfilled by the risk team (e.g., detailing exposures following a hurricane or wildfire event).

RESPOND TO BOARD REQUESTS

Board members often request the risk team, independent from risk owners, to look at a broad range of issues. Projects have considered merger and acquisition opportunities versus internal growth and looking at competitive trends. Risk teams also ask broad questions; examples include the impact of low rates and how Brexit would impact operations in Canadian and U.S. subsidiaries.

HOLISTIC IDEAS—ENDOGENOUS

Natural hedges (where one risk diversifies another through negative correlations, without having to purchase a hedge or reinsurance) are a common analytical project for the risk team, sharing this knowledge with the business units, as is developing a common language and risk taxonomy. Proactively developing sources of liquidity, testing industry changes (e.g., old-age housing and financial solutions, policyholder behavior) and developing reinsurance strategies are other common themes.

HOLISTIC IDEAS—EXOGENOUS

While holistically considering risks that are currently “owned” can lead to tricky relations with the business units, risk teams have been encouraged to do background research on emerging risks. Some of the topics worked on recently include genetic testing, artificial intelligence, interest rate risks (up or down), asset class risk, mortality/morbidity (including opioid issues), demographic shifts, climate change, public debt levels, international monetary policy and capital market stability. Not all projects look at downside risk; one suggested that long-term care morbidity risk may have stabilized or may even improve going forward.

VALUE INVESTING/BUBBLES

A subset of modelling holistic impacts is the risk team’s search for assets/liabilities where the markets may have overreacted, leading to mean reversion in the near future. Some of those identified could move up in price, while some could move down. While a few still advocated for efficient markets that make bubbles impossible, other respondents believe bubbles exist in private assets, collateralized loan obligations, energy subsidies, infrastructure subsidies (e.g., China’s Belt and Road), auto finance, some Canadian housing markets and general government financial subsidies.

REGULATORY CHANGES

The risk team is often tasked with managing and communicating potential regulatory changes as well as keeping track of regulatory metrics that change on a periodic basis. Expected changes often become part of a scenario set.

ORPHANED RISKS/EXTRA RESOURCES

Many risk managers manage specific risks due either to a temporary staffing vacancy or because the risk does not have a natural home. These could include business continuity, affiliation reputation risk, cybersecurity, severe weather or other general risks. The risk team is also a candidate for special projects.

CONCLUSION

Risk teams are asked to do a variety of tasks. They are asked to produce company-wide scenario tests as well as look at the pros and cons of individual projects viewed using marginal impacts. The risk team acts as the corporate owner of the risk process, so is accountable for sharing it with all areas. The team also keeps track of regulatory changes and helps as needed.

These duties have been shown to work by fellow practitioners. By finding the ones that work best in your organization you can avoid finding out what your successor will do.

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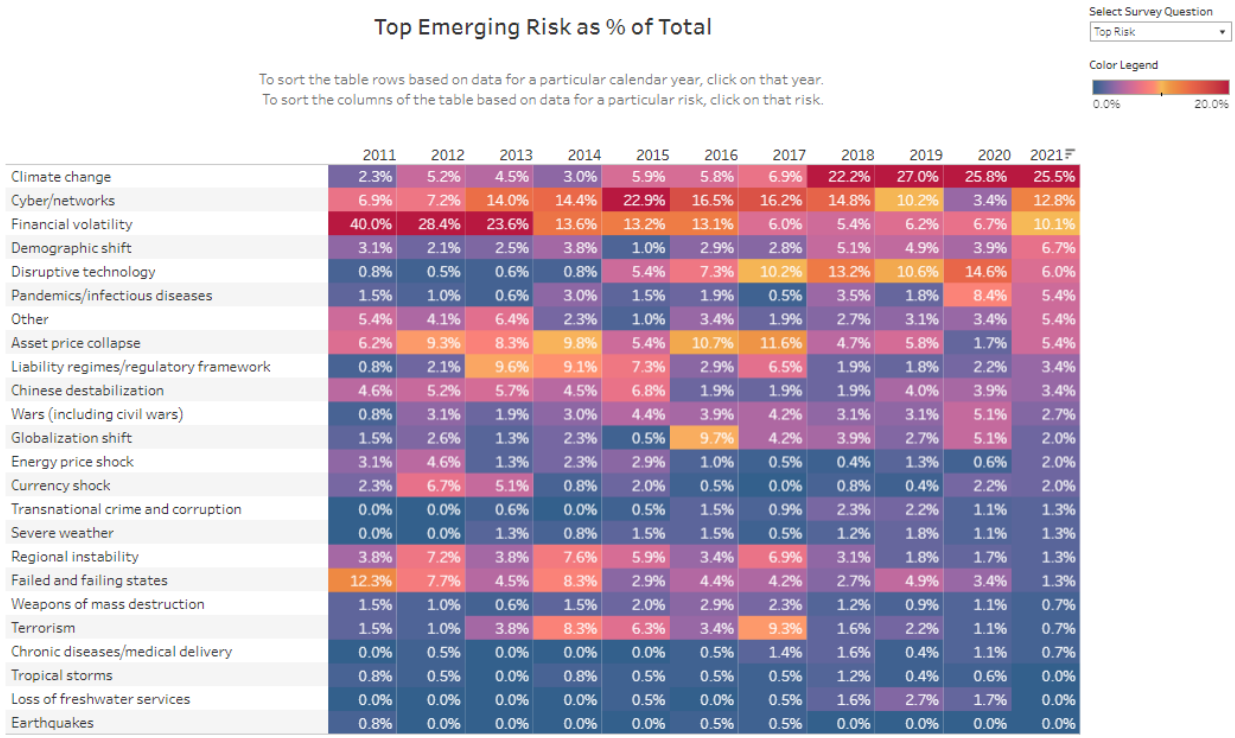
Appendix B-Tableau Screen Shots

The data from Section A of the survey has been entered into Tableau for readers to explore the historical results on their own. The data goes back to 2011 so historical trends can be reviewed, often graphically. Some options available include:

HEAT MAP: TIME SERIES

Data for each of the four questions is available individually with risks listed in rows and years in columns. Sorts can be performed by year.



Top Emerging Risk as % of Total

To sort the table rows based on data for a particular calendar year, click on that year.
To sort the columns of the table based on data for a particular risk, click on that risk.

Select Survey Question: Top Risk

Color Legend: 0.0% – 20.0%

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Climate change	2.3%	5.2%	4.5%	3.0%	5.9%	5.8%	6.9%	22.2%	27.0%	25.8%	25.5%
Cyber/networks	6.9%	7.2%	14.0%	14.4%	22.9%	16.5%	16.2%	14.8%	10.2%	3.4%	12.8%
Financial volatility	40.0%	28.4%	23.6%	13.6%	13.2%	13.1%	6.0%	5.4%	6.2%	6.7%	10.1%
Demographic shift	3.1%	2.1%	2.5%	3.8%	1.0%	2.9%	2.8%	5.1%	4.9%	3.9%	6.7%
Disruptive technology	0.8%	0.5%	0.6%	0.8%	5.4%	7.3%	10.2%	13.2%	10.6%	14.6%	6.0%
Pandemics/infectious diseases	1.5%	1.0%	0.6%	3.0%	1.5%	1.9%	0.5%	3.5%	1.8%	8.4%	5.4%
Other	5.4%	4.1%	6.4%	2.3%	1.0%	3.4%	1.9%	2.7%	3.1%	3.4%	5.4%
Asset price collapse	6.2%	9.3%	8.3%	9.8%	5.4%	10.7%	11.6%	4.7%	5.8%	1.7%	5.4%
Liability regimes/regulatory framework	0.8%	2.1%	9.6%	9.1%	7.3%	2.9%	6.5%	1.9%	1.8%	2.2%	3.4%
Chinese destabilization	4.6%	5.2%	5.7%	4.5%	6.8%	1.9%	1.9%	1.9%	4.0%	3.9%	3.4%
Wars (including civil wars)	0.8%	3.1%	1.9%	3.0%	4.4%	3.9%	4.2%	3.1%	3.1%	5.1%	2.7%
Globalization shift	1.5%	2.6%	1.3%	2.3%	0.5%	9.7%	4.2%	3.9%	2.7%	5.1%	2.0%
Energy price shock	3.1%	4.6%	1.3%	2.3%	2.9%	1.0%	0.5%	0.4%	1.3%	0.6%	2.0%
Currency shock	2.3%	6.7%	5.1%	0.8%	2.0%	0.5%	0.0%	0.8%	0.4%	2.2%	2.0%
Transnational crime and corruption	0.0%	0.0%	0.6%	0.0%	0.5%	1.5%	0.9%	2.3%	2.2%	1.1%	1.3%
Severe weather	0.0%	0.0%	1.3%	0.8%	1.5%	1.5%	0.5%	1.2%	1.8%	1.1%	1.3%
Regional instability	3.8%	7.2%	3.8%	7.6%	5.9%	3.4%	6.9%	3.1%	1.8%	1.7%	1.3%
Failed and failing states	12.3%	7.7%	4.5%	8.3%	2.9%	4.4%	4.2%	2.7%	4.9%	3.4%	1.3%
Weapons of mass destruction	1.5%	1.0%	0.6%	1.5%	2.0%	2.9%	2.3%	1.2%	0.9%	1.1%	0.7%
Terrorism	1.5%	1.0%	3.8%	8.3%	6.3%	3.4%	9.3%	1.6%	2.2%	1.1%	0.7%
Chronic diseases/medical delivery	0.0%	0.5%	0.0%	0.0%	0.0%	0.5%	1.4%	1.6%	0.4%	1.1%	0.7%
Tropical storms	0.8%	0.5%	0.0%	0.8%	0.5%	0.5%	0.5%	1.2%	0.4%	0.6%	0.0%
Loss of freshwater services	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.5%	1.6%	2.7%	1.7%	0.0%
Earthquakes	0.8%	0.0%	0.0%	0.0%	0.0%	0.5%	0.5%	0.0%	0.0%	0.0%	0.0%

HEAT MAP: ONE YEAR AT A TIME

Data for a specific year is provided by individual risk across all four questions. The reader can scroll by year and see how relationships changed over time.

Comparison of Results: 2021

Select Year: 2021

Color Legend: 0.0% – 20.0%

Click on any of the column headings if you wish to numerically sort this dataset

	Combo	Current	Top	Top5
Pandemics/infectious diseases	5.9%	27.5%	5.4%	8.0%
Climate change	10.5%	15.7%	25.5%	12.2%
Financial volatility	8.4%	9.8%	10.1%	6.4%
Cyber/networks	9.1%	8.5%	12.8%	11.0%
Asset price collapse	6.0%	7.2%	5.4%	4.1%
Wars (including civil wars)	6.5%	5.2%	2.7%	5.1%
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Transnational crime and corruption	2.8%	1.3%	1.3%	2.4%
Terrorism	4.4%	1.3%	0.7%	3.6%
Liability regimes/regulatory framework	1.7%	1.3%	3.4%	2.7%
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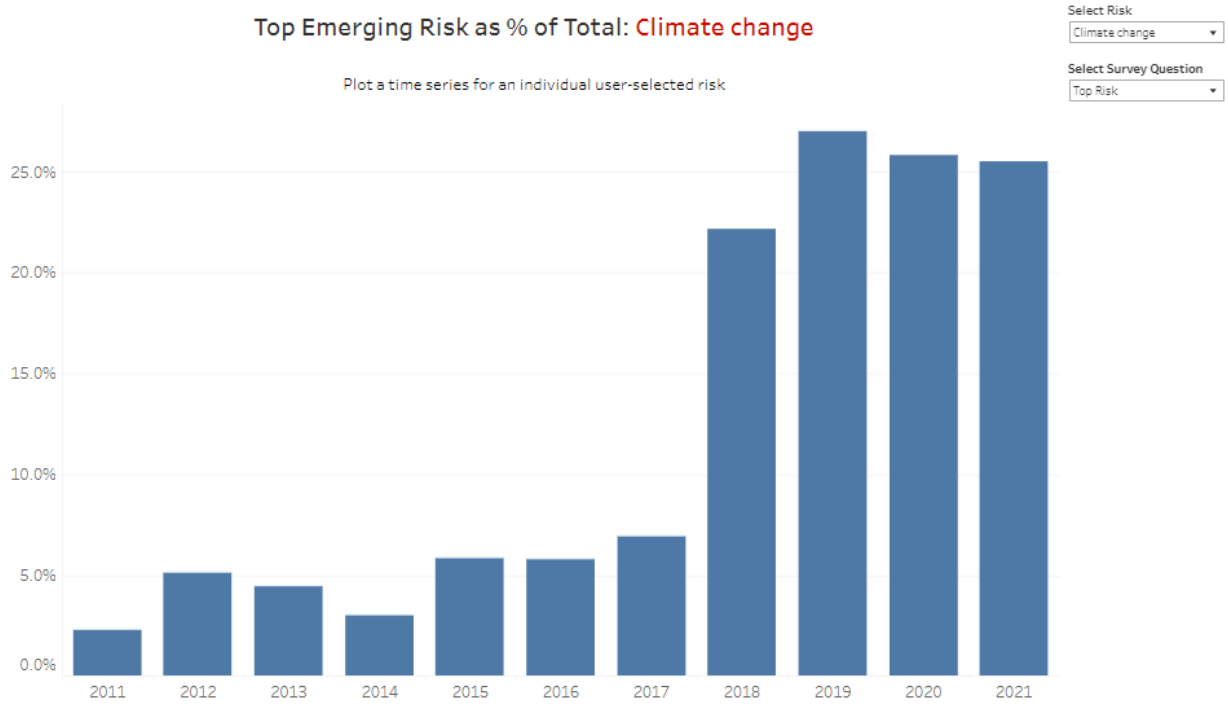
Chronic diseases/medical delivery	2.8%	0.0%	0.7%	2.0%

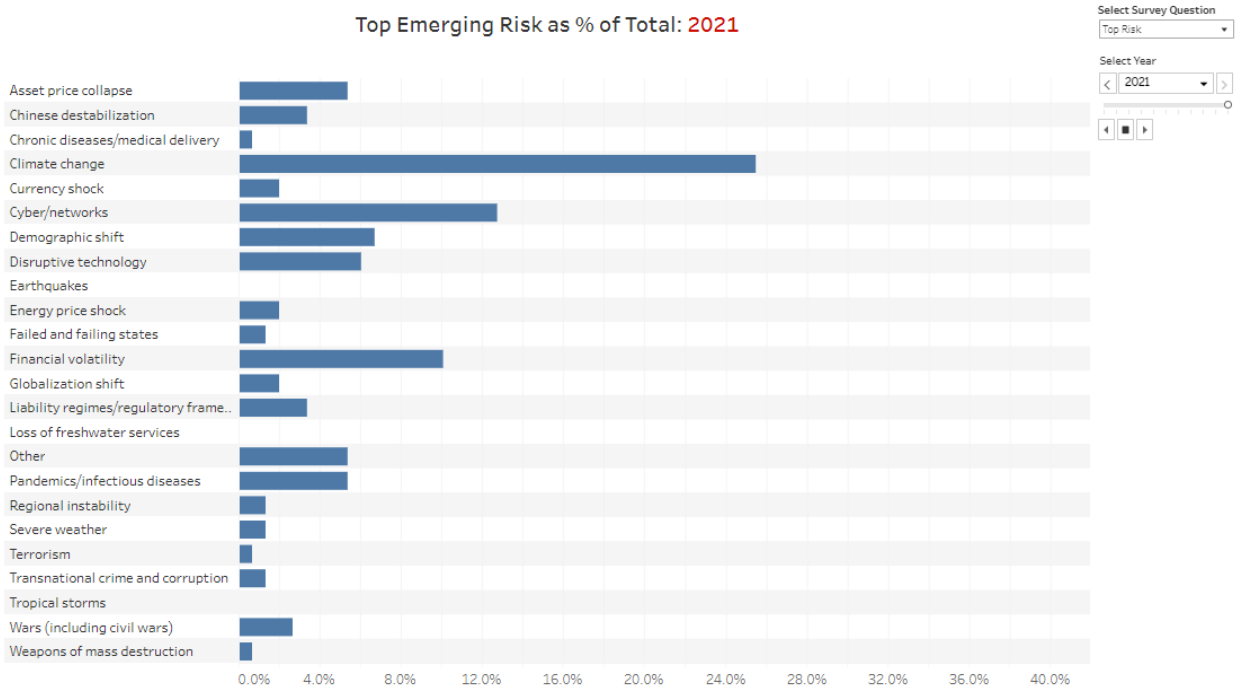
HISTOGRAM: TIME SERIES

Data for a specific risk and question are presented graphically across all years of data.



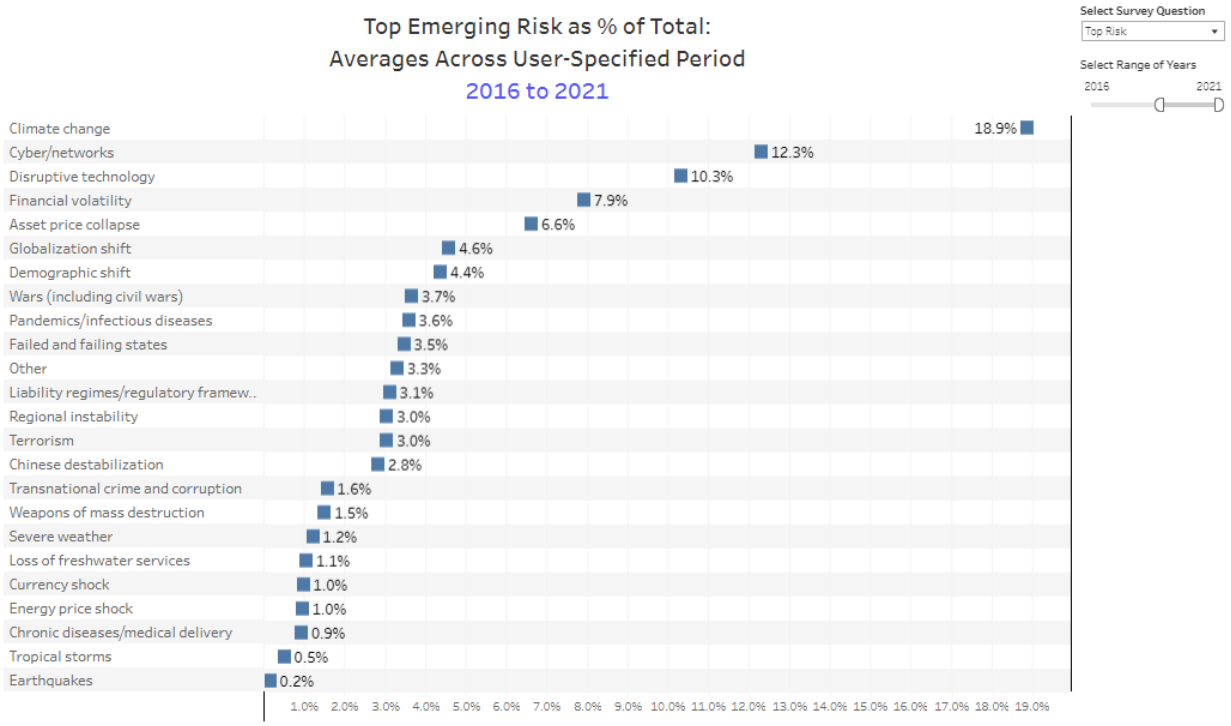
HISTOGRAM: ONE YEAR AT A TIME

Data for a specific question and year are presented graphically across all risks. The reader can scroll the risks to see how relationships changed over time.



AVERAGES

Data for a specified question is reviewed, with an average calculated across a range of years chosen by the reader, who might be interested in the entire range or only more recent information.



This data can be accessed at

1. HeatMap: Time Series	https://tableau.soa.org/#/site/soa-public/views/EmergingRisks_16571181391190/1_HeatMapTimeSeries?:iid=3
2. Heat Map: One Year at a Time	https://tableau.soa.org/#/site/soa-public/views/EmergingRisks_16571181391190/2_HeatMapOneYearataTime?:iid=3
3. Histogram: Time Series	https://tableau.soa.org/#/site/soa-public/views/EmergingRisks_16571181391190/3_HistogramTimeSeries?:iid=3
4. Histogram: One Year at a Time	https://tableau.soa.org/#/site/soa-public/views/EmergingRisks_16571181391190/4_HistogramOneYearataTime?:iid=3
5. Average	https://tableau.soa.org/#/site/soa-public/views/EmergingRisks_16571181391190/5_Averages?:iid=3

About the Canadian Institute of Actuaries

The Canadian Institute of Actuaries (CIA) is the qualifying and governing body of the actuarial profession in Canada. We develop and uphold rigorous standards, share our risk management expertise, and advance actuarial science to improve lives in Canada and around the world. Our more than 6,000 members apply their knowledge of math, statistics, data analytics, and business in providing services and advice of the highest quality to help Canadian people and organizations face the future with confidence.

The CIA Board has 15 actuaries, six councils focused on the core needs of the profession, and over 40 committees and numerous task forces working on issues linked to the CIA's strategic plan.

The CIA

- Promotes the advancement of actuarial science through research
- Provides for the education and qualification of members and prospective members
- Ensures that actuarial services its members provide meet extremely high professional standards
- Is self-regulating and enforces rules of professional conduct
- Is an advocate for the profession with governments and the public in the development of public policy

The CIA and its members are active in the international actuarial community. The CIA is a founding member of the International Actuarial Association and was involved in the 1998 restructuring of the body.

Canadian Institute of Actuaries

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About the Casualty Actuarial Society

The Casualty Actuarial Society (CAS) is a leading international organization for credentialing and professional education. Founded in 1914, the CAS is the world's only actuarial organization focused exclusively on property and casualty risks and serves over 9,100 members worldwide. CAS members are experts in property and casualty insurance, reinsurance, finance, risk management and enterprise risk management. Professionals educated by the CAS empower business and government to make well-informed strategic, financial and operational decisions.

The purposes of the Casualty Actuarial Society are:

- To advance the body of knowledge of actuarial science applied to general insurance, including property, casualty and similar risk exposures
- To expand the application of actuarial science to enterprise risks and systemic risks
- To establish and maintain standards of qualification for membership
- To promote and maintain high standards of conduct and competence
- To increase the awareness of actuarial science
- To contribute to the well-being of society as a whole

In principle and in practice, the CAS values and seeks diverse participation within the property/casualty actuarial profession. In support of those values, the CAS encourages an inclusive community where differences are celebrated and all have the opportunity to participate to their fullest potential in its success. The CAS commits time and resources to accomplish this objective.

Actuaries are required to adhere to the high standards of conduct, practice and qualifications of the actuarial profession, thereby supporting the actuarial profession in fulfilling its responsibility to the public.

The Casualty Actuarial Society

4350 N. Fairfax Drive, Suite 250
Arlington, VA 22203

https://www.casact.org/

About The Society of Actuaries Research Institute

Serving as the research arm of the Society of Actuaries (SOA), the SOA Research Institute provides objective, data-driven research bringing together tried and true practices and future-focused approaches to address societal challenges and your business needs. The Institute provides trusted knowledge, extensive experience and new technologies to help effectively identify, predict and manage risks.

Representing the thousands of actuaries who help conduct critical research, the SOA Research Institute provides clarity and solutions on risks and societal challenges. The Institute connects actuaries, academics, employers, the insurance industry, regulators, research partners, foundations and research institutions, sponsors and non-governmental organizations, building an effective network which provides support, knowledge and expertise regarding the management of risk to benefit the industry and the public.

Managed by experienced actuaries and research experts from a broad range of industries, the SOA Research Institute creates, funds, develops and distributes research to elevate actuaries as leaders in measuring and managing risk. These efforts include studies, essay collections, webcasts, research papers, survey reports, and original research on topics impacting society.

Harnessing its peer-reviewed research, leading-edge technologies, new data tools and innovative practices, the Institute seeks to understand the underlying causes of risk and the possible outcomes. The Institute develops objective research spanning a variety of topics with its strategic research programs: aging and retirement; actuarial innovation and technology; mortality and longevity; diversity, equity and inclusion; health care cost trends; and catastrophe and climate risk. The Institute has a large volume of topical research available, including an expanding collection of international and market-specific research, experience studies, models and timely research.

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