

American Perspectives*

2008 2009 2010 2011 2012 2013

2014 2015 2016 2017 2018 2019

2020 2021 2022 2023 2024 2025

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“I can’t recall a time when it was easier to imagine a true shock scenario that would require a potentially radical response.”

Global technology and consumer goods

Navigating the big risks & opportunities in an interconnected world

The deepening credit crisis in 2008 has opened a window on the evolving nature of risk—and not just in the capital markets.

In historical context, the credit crisis itself may possess greater elements of complexity than past bubbles did. Securitization may have shrouded the awareness of underlying assets. And a “shadow banking system” may have added wiggle room to maneuver. At root, however, the subprime dive more resembles an age-old mania built on leveraged speculation than it does a new-age innovation.

But the spread, speed and depth of the avalanche, starting from a relatively obscure pool of US securities and rolling through developed markets, differs from what might have been expected a few short decades ago. And ironically, securitization, credit swaps and off-balance-sheet vehicles—all intended to distribute risk—wound up amplifying systemic shock.

The credit crisis offers a case in point about what makes the networked world so perilous. Pervasive interconnection of markets and people, speed of travel and communications, and the seamlessness of cross-border flows all create an environment that allows risks to cascade beyond the control of any one authority, whether a

business, regulator or individual. The fallout can be seen throughout the spectrum of economic, environmental, geopolitical, societal and technological risk—everything from the spread of diseases, tainted foods and drugs to suspect capital flows and computer viruses, to terrorism, tsunamis and failed crops.

It’s natural for a sense of uncertainty to follow: It all appears too distant, opaque and turbulent to link causes and effects in a clear line of sight, too big and complex to sort out. Risk-reward decision making can suffer.

But this same picture touches the heart of opportunity—and not just the contrarian chance to find gems amid the current downturn.

A globalized world buoyed by prosperity, advancing technologies and a sense of mutual self-interest means more chance to bring well-being to many—in healthcare, in nutrition, in entertainment, in knowledge. It means an immense opportunity for economies, communities and businesses. But we have to seize it.

John Maynard Keynes, one of the most widely respected economists of the past century, had the vision and optimism to

see this in 1930 at the outset of the Great Depression. He predicted (in “Economic Possibilities for Our Grandchildren”) that within 100 years mankind would solve its basic economic problem—the struggle for subsistence—and turn to a new challenge: learning to enjoy fulfilling lives.

He based his hope on the strength of scientific progress and capital investment together with the ability to limit wars and population growth. We’ve most likely outperformed Keynes’s dreams on the first two criteria. On the last one, while periods of peace have been met with great prosperity, challenges remain.

Managing the downside of an interconnected world begins by understanding and mastering the risks: Avoiding the known ones, hedging against the unknowns that we do understand and planning for the cosmic question marks—the unknowns that strike like comets.

The good news is that we have the tools: vigilance, creativity, science and work. Opportunity is the other side of the coin.

“My concern is that US policy makers could mislegislate around issues intended to help the economy but far more likely to hurt it. We’re seeing it with current immigration policies.”

US-focused manufacturing

“US-only corporations, as opposed to multinationals, will be especially vulnerable to future corrections.”

Global consumer products

“Competition will come from many new places and already has. At this point, I’m not even sure what business we are in. Content? Distribution? Packaging? Talent identification? You tell me what you think.”

US-focused media and entertainment

“I worry a lot about the future of content theft and intellectual property protection. We don’t really know how to make money in the countries where theft is most common.”

US-focused media and entertainment

“We live in a world of increasing transparency, where failures are quickly amplified and memories are long.”

Global software

“Pricing pressure on the core business is going to be huge. Volume will grow strongly, but our business model and revenue streams will be under enormous pressure.”

Global financial services

“The essential challenge is managing the increased complexity of more products, going into more markets, using different distribution and marketing models, and for shorter periods of time.”

Global science/technology manufacturing

“If we are not careful, green legislation will push energy-intensive industries out of the US and into more friendly countries.”

US-focused manufacturing

“We have resisted placing our own manufacturing in China for fear that we would lose control over critical intellectual property.”

Global technology and consumer goods

“FASB is having a massive negative effect, as are FAS 157 and FIN 46. We continue to believe that you cannot regulate the potential for occasional market blowups. More information is not necessarily more transparency.”

US-based hedge fund

“We have concluded that the structural decline of US capital markets is likely to continue beyond the next cyclical downturn and well into the next decade. It may indeed be a permanent shift.”

Global consumer products

“Unlike a lot of businesses in the US right now, we actually make things. In fact, we actually make fairly large things. The environmental impact can be huge. How big is our exposure?”

Global furniture design/manufacturing

“In a networked world, we must carefully manage privacy and trust to avoid consumer backlash or unhelpful regulations.”

Global software

“There are something like 39 active wars in the world right now, and there are only about 190 recognized countries, right? And we know that war is no longer constrained to country against country. Ideology versus ideology can get you there too.”

Global furniture design/manufacturing

“The cost of computing could decrease by a factor of 100 if we succeed with parallel computing. This would be a real discontinuity.”

Global software

“Global covenants are very hard to enforce in distant places, and ‘pollute now, pay later’ is a common approach.”

Global health sciences

What we’re hearing about risk

This crisis looks the same in many ways...

1852

“During the progress of this famous bubble... men were no longer satisfied with the slow but sure profits of cautious industry. The hope of boundless wealth for the morrow made them heedless and extravagant for today.”

Charles Mackay, *Extraordinary Popular Delusions and the Madness of Crowds*

In 1720, at the height of the South Sea Bubble, an enterprising Briton raised 2,000 pounds—or about 236,000 pounds today—with a proposition “for carrying on an undertaking of great advantage; but nobody to know what it is.”¹

While the scheme sounds like the plot of a situation comedy, it also calls to mind economist Joseph Schumpeter’s theory that recurrent manias are normal elements of the business cycle. As humans, we’re sometimes rational and other times irrational. Our moods can swing wildly between optimism and pessimism,

greed and gullibility. And when it comes to profitable speculation, we often move in herds.

A look at history shows the credit crisis more closely resembles a classic bubble bursting than it does a runaway product of modern financial engineering, although excessive complexity and hidden leverage appear to have been part of the problem.

Taking the very long view, Carmen M. Reinhart and Kenneth S. Rogoff analyze eight centuries of financial crises and conclude “major default episodes are typically spaced some years (or decades) apart, creating the illusion that ‘this time is different’ among policymakers and investors. ... [But] ... the recent U.S. subprime financial crisis is hardly unique.”²

Looking at the past two centuries of financial crises and focusing on sovereign default on external debt “one fact that jumps out... are the long periods where a high percentage of all countries are in a state of default or restructuring,” they note. (See Figure 1.) Including government default on its own external debt or private but publicly guaranteed debt, the sample presents a broad yet informative comparison to modern financial crises.

The analysis also shows a parallel between bank crises and increasing capital mobility: instability rises with capital liberalization. (See Figure 2.) Put differently, the modern era may be maximizing productivity and growth for the world, but it also increases volatility for businesses that have to navigate

the turmoil. “It does not seem to matter how capital flows,” note economists Dani Rodrick and Arvind Subramanian. “That it flows in sufficiently large quantities across borders—the celebrated phenomenon of financial globalization—seems to spell trouble.”³

And in fact, the speed, spread and intensity of systemic shock in the new credit crisis do appear to have outpaced most predecessors. In the end, businesses and governments worldwide share a stake in promoting multilateral solutions to address capital market turbulence in a continually globalizing, interconnected world. But globalization is heightening a range of threats well beyond the capital markets. Interconnection weaves a new, complex pattern of risk.

2007

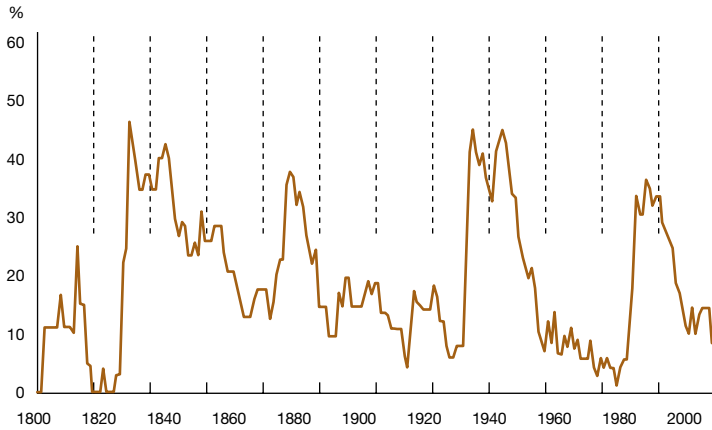
“That tsunami that came across the Atlantic had a dimension, when it came to our borders, which was not the dimension it had in the beginning.”

Jean-Claude Trichet, President, European Central Bank⁴

Through the lens of history

Figure 1
Five default cycles cover two centuries

(Sovereign external debt: 1800-2006)
Percent of countries in default or restructuring)

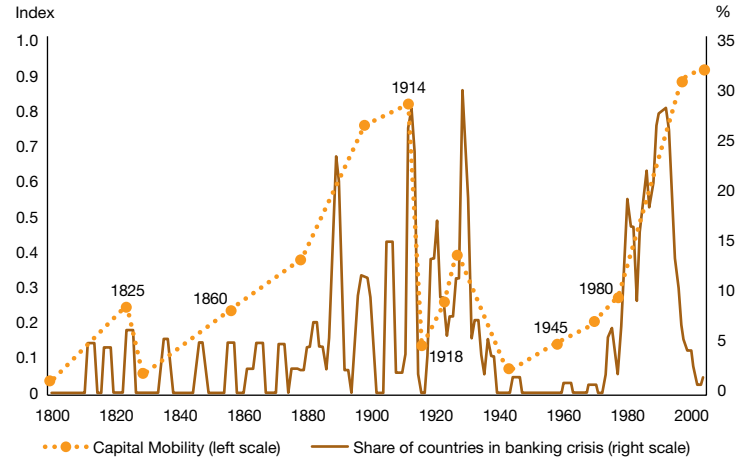


Source (Figures 1 and 2): This time is different: A panoramic view of eight centuries of financial crises, April 16, 2008, Carmen M. Reinhart, University of Maryland and National Bureau of Economic Research (NBER), and Kenneth S. Rogoff, Harvard University and NBER

Tracking nations in default or restructuring over two centuries shows five peaks followed by lulls. We're currently in a lull after the emerging market debt crises of the 1980s and 1990s.

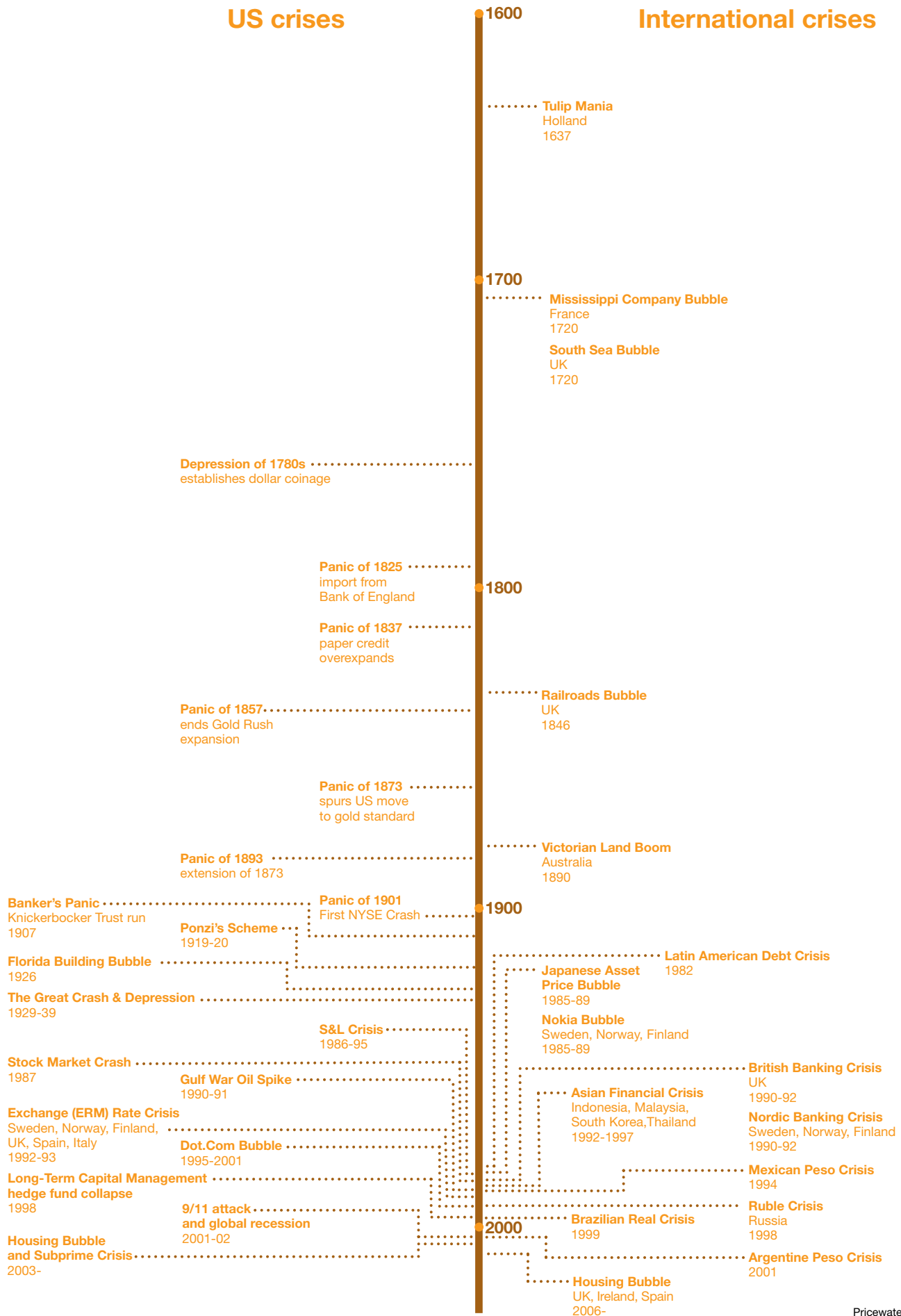
Figure 2
Capital mobility stirs volatility

(Capital mobility and the incidence of banking crisis)
All countries 1800-2007)



High international capital mobility repeatedly produces international banking crises. Among the reasons, liquid cross-border flows free large amounts of capital to swell local markets. Speed and low carrying costs help build the bandwagon. And today's networked world inflates bubbles faster than ever.

...But manias are occurring at accelerating rates...



...And signs of turbulent times cross a range of threats with speed and intensity

Areas well beyond finance are dramatizing how quickly risks spread through networks, how deeply the shock waves penetrate and how important coordination and planning, before and after the fact, are in a globalized world.

This past spring's earthquake in China and cyclone in Myanmar highlight the problem. Both natural disasters caused severe damage. But dramatic differences surfaced in results between a coordinated national and multinational response in the first case and a closed, unilateral one in the second.

The past few years have spotlighted the wide range of trauma that a globalized world transmits through fast, fluid communications and travel. Dense population centers; confluent markets for products, services and capital; and a rising middle class juxtaposed against massive pockets of poverty, all share a hunger for resources.

Some jolts have been chilling. Terrorism wrenched major cities and roadside markets. Hurricanes and tsunamis devastated population centers and beach resorts alike. Harmful products and produce—from toothpaste and spinach to toys and cough syrup—sickened some and frightened families and companies in different corners of the world. Food and water shortages stirred riots. Energy scarcity is a looming problem.

"Interdependency implies that we are all vulnerable to disruptions in the global flow of people, capital and technology," according to the World Economic Forum in its 2008 risk network report.⁵ The report singles out two elements of globalized risk.

First is the risk that harmful effects of production will be "squeezed" or transferred from one geography to another as globalization of governance badly lags

that of capital. In this scenario, risks are "delocalized" to centers of production with lower costs, standards and conditions; and by-products, including pollution and tainted material, are exported back out globally. Second, the report notes "homogeneity" risk is rising in health areas like chronic disease and global pandemics as lifestyles and their risk profiles converge worldwide. For instance, heavy smoking, drinking and eating increasingly imperil sedentary lives.

What if ...?

Lack of coordination disrupted the US and international postal systems after the fatal anthrax attacks following 9/11. The ripple effects of the poisoned letters illustrate the maze that connects networked risk and the need for collaborative planning and preparedness. Parallels echo among many risks broadcast through interdependent distribution systems—pandemics spread by air travel, terror borne by food or water supplies, ruptures that cascade through IT networks, financial shocks distributed through capital markets.

"In this new century, increasing interdependence among people and organizations is creating a new web of challenges. 'Unconventional' events—large scale disasters and disruptions—that evidence the effect of interdependency are becoming the norm," argue Patrick Lagadec, Erwann O. Michel-Kerjan and Ryan N. Ellis in "Disaster via Airmail," their analysis of global reaction capacity after the anthrax attacks.⁶

US leadership

Today's spiderweb of risk defies siloed, self-contained solutions. Collaboration clearly makes sense among companies, between the public and private sectors and across geographies.

Regulation and standards would benefit by being as aligned and transparent as possible. Taxation and subsidies offer tactics to reduce threats. Anticipation and response to risk require an open mind as well. Perspectives need to be drawn from new, objective sources. Skeptical eyes should be encouraged to question the status quo, and others to creatively scan the horizon for emerging risks and opportunities.

Taking a step back, this is most likely a time when sustained prosperity requires logic, innovation and direction. These are all roles that US companies understand. By helping to manage a range of risks and seize opportunities, we can continue to lead in new ways for business success and common well-being.

1 Charles Mackay, *Extraordinary popular delusions and the madness of crowds*, 1852. Also, the South Sea Bubble, www.Historic-UK.com/HistoryUK/England-History/SouthSeaBubble.htm.

2 This time is different: A panoramic view of eight centuries of financial crises, April 16, 2008, Carmen M. Reinhart, University of Maryland and NBER, and Kenneth S. Rogoff, Harvard University and NBER.

3 Dani Rodrik and Arvind Subramanian, Why we need to curb global flows of capital, *The Financial Times*, February 26, 2008.

4 Ralph Atkins, "FT person of the year—cultivated polymath with a sure hand on the financial tiller of Europe," *The Financial Times*, December 24, 2007.

5 World Economic Forum, *Global risks 2008*, January 2008.

6 Patrick Lagadec, Erwann O. Michel-Kerjan and Ryan N. Ellis, *Disaster via airmail*, *Innovations*, Summer 2006, MIT Press.

7 Paradise lost: A special report on international banking, *The Economist*, May 17, 2008.

8 Lagadec et al., *Disaster via airmail*.

9 Managing large-scale risks in a new era of catastrophes, Wharton Risk Management & Decision Processes Center, March 2008.

“So far we’ve been lucky,’ says the chairman of one national regulator. ‘There is no formal framework for solving a cross-border crisis.’”

“Paradise Lost,” *The Economist*, 2008⁷

“The beginning of a crisis is not a good time to start exchanging business cards.”

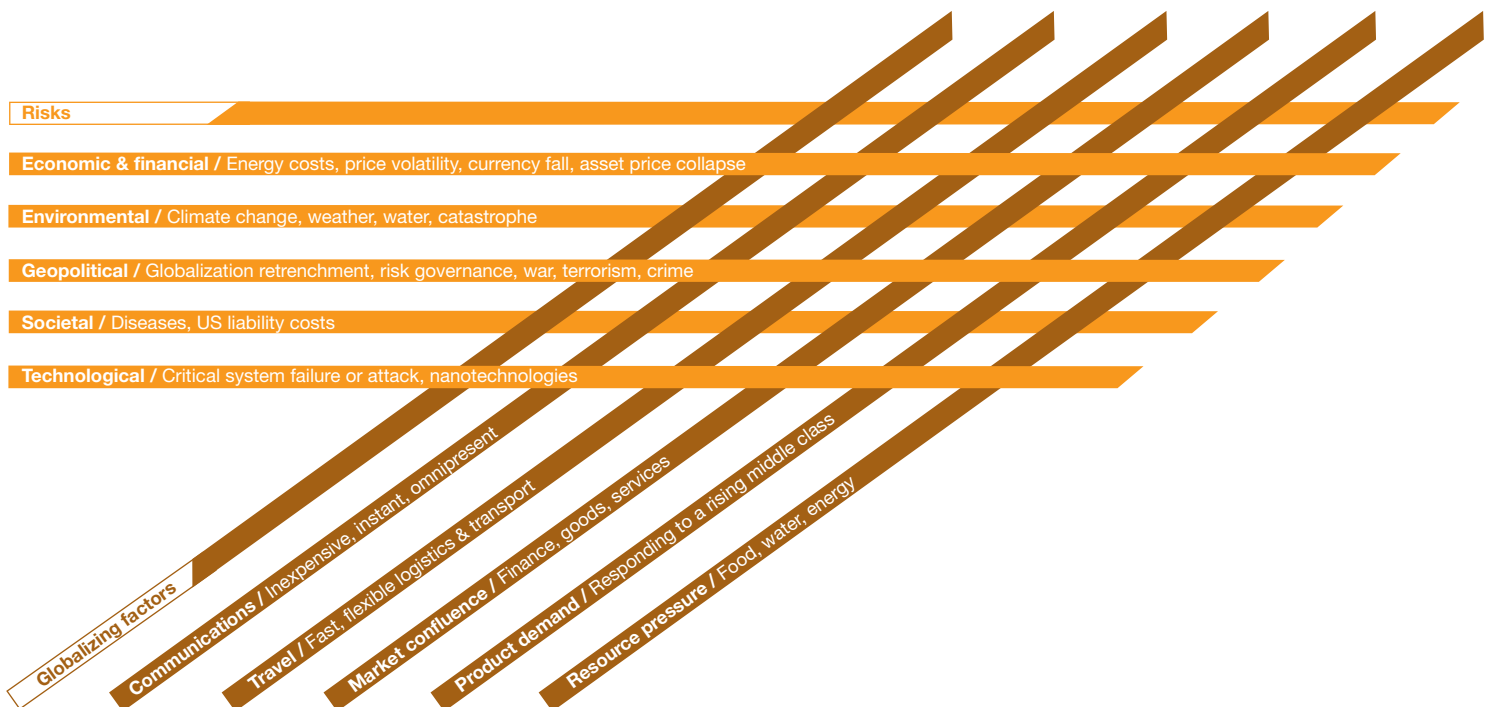
“Disaster via Airmail,” *Innovations*, MIT Press, 2006⁸

“Our nation is facing large-scale risks at an accelerating rhythm, and we are more vulnerable to catastrophic losses due to the increasing concentration of population and activities in high-risk coastal regions of the country.

“The question is not whether catastrophes will occur, but when and how frequently they will strike, and the extent of damages they will cause.”

“Managing Large-Scale Risks...,” Wharton, 2008⁹

Forces of globalization cross the spectrum of risk



Joel E. Cohen

...Takes a step back from the expected risks and looks at the world of threats with long tails and game-changing effects

Joel E. Cohen is the Abby Rockefeller Mauzé Professor of Populations at the Rockefeller University in New York City. He is also professor of populations at the Earth Institute at Columbia University, and is head of the Laboratory of Populations at Columbia and Rockefeller Universities. Professor Cohen's work in mathematical biology has spanned a wide array of topics, from human population growth to infectious diseases to food webs. He was a MacArthur Foundation Fellow and is a member of the National Academy of Sciences, the board of directors of The Nature Conservancy and the board of trustees of the Population Reference Bureau. He has also served as a neutral expert in federal court cases assessing risks and damages from asbestos and breast implants. We talked with him about different types of risks, and how we can better predict and prepare for them.

PwC: From your perspective as a mathematical biologist who studies the earth, its populations, and its vulnerabilities, are there risks you see that you think most business leaders aren't paying enough attention to?

JC: There are some obvious candidates, like global influenza epidemics, which I think are a very serious potential threat to the US economy. Terrorist attacks, including cyber attacks, are risks we should certainly be paying attention to. Some people worry too much about natural disasters—volcanoes, earthquakes, asteroids hitting the earth, etc. If you look at fatalities per year on a global basis, these kinds of events—as well as terrorist attacks—are actually at the low end of the spectrum. At the higher end are things like car accidents and being admitted to a hospital. Medical errors and infectious diseases that you contract in the hospital are major risks to individual lives.

With respect to business interests, I think the principal risk we are underestimating is the inadequacy of the US public education system. The US faces stiff competition from very large numbers of increasingly well educated young people in China, India, Latin America and Southeast Asia. They are hungry, ambitious, hardworking, disciplined, and keen to enjoy the same good life that we have become accustomed to.

PwC: You have helped a wide variety of people—in the courts, in public health, in corporations, in government and academia—try to better estimate and understand risk. What have you learned about natural human tendencies when it comes to thinking about risk?

JC: Some people seem to believe that it's a linear world out there. But we know it's not a linear world. That was one of the great contributions of Benoit Mandelbrot, whose analysis of financial data showed that the normal distribution just doesn't cut it. There are long-tailed distributions with outlying events that are really impossible to predict with a linear model.

On the other end of the spectrum, some people like to frighten themselves with poorly founded assumptions about catastrophic events that could happen in the future. And in between, some people, like some investors, really get it. They live and breathe risk, and as long as they are smarter than they are greedy, they can grasp and use quantified risks quite well.

PwC: Do “linear” and “non-linear” risks call for different kinds of responses?

JC: Take something like an influenza pandemic. This is an abrupt, non-linear challenge that is very difficult to predict.

The average interval between the last six global pandemics was 28 years (ranging from 6 years to 53 years), and it seems very likely that such an event will happen before mid-21st century. For a risk like this, preparedness is the order of the day. No one knows how severe the next pandemic will be.

If I were a corporate executive with a large labor force, I would spend some time thinking about how I am going to operate if a significant fraction of my workforce suddenly gets sick. What will be my priorities for business survival? Do I have back-up? Which positions or people do I need to have backed up in triplicate? What are my essential, core functions? How quickly and completely could I recover afterwards? These are key questions for preparedness.

PwC: And what about linear risks?

JC: Consider something like the aging of the population. This is a challenge you can actually predict quite well, and precise prediction will pay off. We are coming into a decade of a great increase in the “elderly dependency ratio,” or the fraction of people 65+ divided by the fraction of people aged 15 to 64. Since we know that the people who will be 65 in ten years are 55 today, we can predict with some confidence how our population age structure will change

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over the next decade and beyond. We can predict changes in our labor force and the customer population. If I were a business leader, I would definitely have demographers on my staff.

PwC: Any other advice for business leaders on risk?

JC: We have to think about and prepare for risks more globally, and this is relevant for business leaders as well as for governments. For example, I have done research on Chagas disease, which is an infectious disease endemic to Latin America. Hundreds of thousands of people come to the US from that region, but until last year, we weren't screening our blood supply for the infection. The disease has also been transmitted through fruit juice. All that has to happen is for an infected bug to fall into a vat, and then that juice gets packaged and sent all over the world. But most of us don't think about the global risks; we only think about the risks to countries in which Chagas disease is endemic.

So often we take the wrong approaches to global risks. We make people take their belts off at the airport security checkpoint but we have a very inadequate global public health system to detect outbreaks of infectious diseases around the world. We need to think about those investments that will pay off for us in the long run, that will help us stay prepared. To do that, we have to think beyond our borders.

Read more at:
www.pwc.com/AmericanPerspectives



“There are long-tailed distributions with outlying events that are really impossible to predict.”

“Our biggest risk is that we take far too few big risks. Risk aversion within large multi-nationals certainly ranks among the primary barriers to growth.”

Global science/technology manufacturing

“Here’s the case for optimism. US businesses are preeminent in their spaces. We have a massive embedded base. Growth in global disposable income is at all-time highs. Why shouldn’t we do well?”

US-focused media and entertainment

“I think industrial companies with great brands might start to leverage the brand differently. You go to a market like China, let’s say, and you offer to apply your seal of quality or safety approval to existing operations that can make the grade. [The US company] becomes the validator of quality, not the vertically integrated value system.”

University

“The biggest change in computing in the past 30 years is going to happen in the next 5 to 10 years: the rise of parallel computing.”

Global software

“Security is both a massive opportunity and a threat. We can help companies maintain secure transport, but we also have tremendous exposure to a major security breach.”

Global shipping and logistics

“The highest profits also come from niche markets in many cases. For large players like us, we view the next decade as the coming era of the small customer.”

Global science/technology manufacturing

“I spend most of my time thinking about the short term and helping companies win today. But when I do look up at the many things shaping tomorrow, I can’t help but believe that agility will be the number one source of competitive advantage.”

PwC partner

“I can easily imagine entirely new businesses, products and services in and around the consumer products space that are complete game changers.”

Global consumer products

“The market opportunities around distressed assets will be large over the next four to five years.”

US-based hedge fund

“Financial markets in the US will learn to be a bit less reactive and a bit more focused on longer-term results. This correction will prove very lucrative in time.”

Global health science

“Information availability in healthcare is at an all-time high and rapidly expanding. WebMD is not a flash in the pan, and we know that informed customers always have more power.”

Global health science

“Geographic diversification has become a form of recession resistance in our minds. It seems increasingly less likely that the entire globe will sink into recession—or for that matter economic boom—at the same time.”

Global consumer products

“The growing opportunities are not only in moving things around the globe but also in being a broker of relationships between trading partners residing in distant parts of the world.”

Global shipping and logistics

“Markets are democratic forces for managing conflicts among large, entrenched interests—whether corporate, political or populist.”

University

What we’re hearing about opportunity

The upside of down

Global interconnections facilitate collaboration among competitors, communities and skill sets

Networked risk isn't the only result of globalization. An interconnected world offers an upside, too.

Seizing opportunity demands a wider range of resources and broader coordination than any one business or government can command, and collaboration makes more sense in the competitive mix. Examples cross industry lines from heavy manufacturing and pharmaceuticals to publishing and open-source software development.

A good example comes from a large consortium of nonprofit venture capital firms tackling one of the thorniest of problems: poverty at the base of the world economic pyramid. While the firms normally compete for funds, they are collaborating to build a shared, Web-based tool to audit and compare financial and social impact from their investment portfolios. Ultimately, a cohesive management language and fabric will be woven for hundreds of businesses seeking market-driven solutions to poverty.

Engineers from Google volunteered time to build a prototype system, and Salesforce.com has offered to host an improved version of the measurement platform, temporarily called the Portfolio Data Management System and currently being beta tested at about 50 entrepreneurial businesses worldwide.

The Web companies are working closely with Acumen Fund, whose investments focus on health, water, housing and energy businesses in Africa, India and Pakistan. Also involved are dozens of other investors seeking to combine financial returns with social or environmental benefit. The consortium also includes TechnoServe, Root Capital, Agora Partnerships, E+Co and the Kellogg Foundation. The Aspen Institute and the Rockefeller, Lodestar, Skoll and Cisco foundations, among others, contributed direction and funding.

"We need to be able to track and compare a range of data on the revenue and financial side," says Marc Manara, a portfolio associate at Acumen. "But we also need to know how many bed nets a company is manufacturing in Tanzania and how many people are actually being protected from mosquitoes under those nets."

This story of collaboration illustrates the flip side of interconnected risk: networked opportunity.

Risky business

Solutions call for scanning the horizon, maintaining vigilance and mastering agility

It is no small coincidence that successful risk managers rose as the stars of business in 2008. The prescient and prudent few earned well-deserved praise in a year that showcased the downsides of an interconnected world.

But risk management systems too often focus on yesterday's environment or regulatory compliance, not the highly interconnected, complex world in which downturns and shocks can travel faster and wider than ever before, globally or within an organization.

New, overarching and integrated risk management systems are required to address confluent risks and unexpected catastrophes. But systems, too, are often more fragmented than holistic, more historic than prospective and falling short of emerging needs. No one can say with any certainty what trauma will occur next and when. But it is certain that many low-probability, high-impact risks—from droughts to pandemics, to political turmoil—will strike, in addition to the known array of dangers.

Today's systems often lack the agility, comprehensiveness and foresight to guard against this emerging range of risk.

Companies often apply a quick fix whenever a new risk or regulation arises. Systems are designed to address what went wrong in the past and not to manage what might go wrong in the future. Defenses often grow weaker because companies lack well-defined and well-understood risk appetites and cultures.

Enterprise-wide risk is minimized only when systems, organizational structures and cultures align. Systems must be forward-looking, clear, coordinated and comprehensive. Business structures themselves cannot create obstacles or walls. And corporate cultures must foster environments where the right people do the right things at the right time—regardless of the circumstances.

“Companies need to establish a happy medium where they have healthy dialogue around risk, where people focus not just on the lagging indicators but on the predictive ones as well,” says Catherine Jourdan of PwC's Governance, Risk & Compliance practice. “They have to pay attention to the levels and timing at which the dialogue is happening—make sure it occurs early, that it cuts across the business and involves all cross-functional risk experts no matter what silo they're in or where they reside up or down the management chain. Ultimately, this entire picture needs to be incorporated in business planning and decision making.”

All of this may seem like a tall order given the day-to-day demands of managing a business, but the results speak for themselves. For example, in the case of fraud, PricewaterhouseCoopers found in our 2007 Global Economic Crime Survey that all categories of economic fraud—asset misappropriation, accounting irregularities, corruption and bribery, money laundering and intellectual property infringement—decrease in those companies that combine compliance programs with ethical guidelines, incentives and training.

Centering on the problem

The correct outlook and structure are needed to orient the risk environment

“There’s no education in the second kick of a mule,” longtime South Carolina Sen. Fritz Hollings often quipped in warning against making repeated mistakes. But in a globalized world, the barnyard brims with ever more ornery and unpredictable threats waiting to blindside businesses. Anticipation, preparation, broad perspective and agility demand greater attention than simply focusing on hindsight, even with the perfect vision the past affords. Here, then, are some lessons drawn from PricewaterhouseCoopers’ experience and a range of successful tactics.

Adopting the right outlook

Harness the uncommon: common sense—Markets go up and down. Before the credit crisis, buoyant hopes made it easy to forget that historically towering housing values might some day collapse in a cyclical correction. Turning the clock back to the tech bubble, unbridled optimism outshone the fact that businesses have to make money at some point, not just generate euphoric hopes. History repeats these lessons regularly because “history counts for so little in the world of finance” and amassing huge amounts of money can cloud a sense of reality, according to economist John Kenneth Galbraith. “Thus the rule supported by the experience of centuries: The speculative episode always ends not with a whimper but with a bang.”¹

Keep it simple, at least at the core—“If you can’t understand it, don’t do it,” is a motto associated with the late Sir Dennis Weatherstone, who rose from being a schoolboy clerk to chairman and chief executive of JP Morgan Bank.² This maxim provides a good foundation for judgments beyond financial ones alone. On some level, investments must make basic sense no matter the complexity of a transaction or the distance and the intertwinings of a supply chain.

Guard your reputation—While it takes years to establish a strong reputation and brand, gilt-edged images can tarnish overnight after a mishandled catastrophe or a shift in public perception. In the case of catastrophe, while most companies do recover shareholder value in the long term, the speed of the rebound depends on management’s responsibility for the accident or safety lapse and the extent of financial loss or fatalities.⁵

Reputations can also suffer after product or image problems. And it takes great care and attention to restore a good name. In the case of Mattel, a toy maker with a strong record in quality, the recall of

almost a million toys tainted with lead paint by a Chinese vendor resulted in charges related to the recall. But the company moved quickly to restore consumer confidence by tightening supply chain controls, reexamining internal policies, launching a Web site to help parents track the tainted toys and creating a corporate responsibility unit that reports directly to the CEO.

Wal-Mart has worked hard to restore its image and answer critics after an onslaught of bad publicity accusing it of exploiting its staff and suppliers. A green philosophy has spread through its supply, operations, logistics and product lines. Management is considered “more savvy” in addressing staff diversity and benefits issues. Taken together with a sluggish economy that drives budget shopping, the programs have produced significant results.

Maintain an agile stance and a comprehensive outlook—The speed of change, increasing turbulence and the range of new risks mean businesses have to focus broadly, anticipate threats and be ready to act.

Structuring for success

Eliminate culture shocks—It is said that partnerships control risk effectively because all owners are mutually invested in success and vigilant in guarding against collective risk. But no matter the form of business, everything from governance to corporate culture and incentives should reinforce the company’s risk management objectives. A commitment to integrity or professionalism is hard to shake when it aligns across behaviors, business objectives, language and mutually understood performance goals. For instance, fraud may start as one person’s scheme, but telltale signs often drift to colleagues. A fabric of mutual investment goes a long way toward blowing the right whistles on risk.

Align today’s resources with today’s, and tomorrow’s, risks—Internal audit functions present a case study in the need to synchronize risk management resources for utmost effectiveness. Four-fifths of the rapid declines in shareholder value today arise from two categories of risk: strategic or business risks account for 60% of the falloffs, and operational risks account for 20%. However, over 60% of internal audit time is devoted to compliance and regulation, according to PwC’s 2008 study on the state of the internal audit profession.⁶ Put differently, in internal audit—a business unit integral to risk management—historical concerns eclipse major emerging

“New communications technologies provide opportunities but also introduce enhanced risk of brand bashing. So, remaining vigilant around core values is especially important when reputation can be damaged rapidly through instantaneous, and sometimes incorrect, communications.”

US-focused retailer

risks like supply chain failures that can wind up significantly damaging reputations. Effective risk management demands that company awareness and resources be synchronized with current and emerging threats as well as historical ones.

Stay alert to increased demands for transparency—As the Sarbanes-Oxley Act demonstrated, government, agency and market risk controls do not remain static. Standard & Poor’s (S&P) recently announced that it would begin to assess enterprise risk management (ERM) processes for nonfinancial companies on a four-level scale as a new element in setting credit ratings. The rigor and sufficiency of ERM processes may ultimately have an impact on debt ratings and the cost of debt. Initial reviews will focus on risk management frameworks, governance, management’s risk philosophy and the role of risk control in strategic decision making. S&P plans to begin reporting commentary in the fourth quarter of 2008, and publishing the first formal ratings following that. In the meantime, companies will benefit by assessing and aligning their ERM programs with expectations.

Understand your risk tolerance—Companies must clearly define and enforce thresholds of acceptable risk. Clear understanding of tolerance levels and assessment of risks against them help guide effective planning and response to varying threats.

Broadcast risk news across channels—Allowing quarterly lags in reporting on enterprise risk is a luxury that’s withered in the interconnected world. Organizational structures, geographies and hierarchies must be transparent when it comes to spreading risk alerts, which should be streamlined and sped throughout the company. And no one should stand on ceremony or fear structural walls. If a market risk manager senses a problem, a product risk manager should know and the operations manager should be told. When an alarm rings at the bottom of the ladder, protocol shouldn’t slow its sounding at the top.

Ring the bell from on high—When the CEO and other top executives are seen kicking the risk tires—understanding and getting their hands dirty with the core issues of risk—risk awareness levels will rise and blowouts will most likely diminish. Senior-level concern sends the right message for the most right reasons and reinforces the right culture.

Open the door to the good; bar the bad and the ugly—Opportunity is the other side of risk. The same complex and changing environment that throws expected and unexpected curves can also open doors for a company that keeps an eye roving across the horizon. Since its creation in 1996, Shell’s GameChanger Program has generated an average of one successful project a month simply by enlisting ideas from anywhere inside or outside of the company. Notable technical advances have emerged on everything from developing oil and gas wells to alternative fuels.⁷ Similar successes are being discovered in many corners of industry by reaching way beyond the usual sources for ideas. “You can be an ‘expert,’ but the collective way is so much richer and deeper that it’s almost impossible to compete with,” CNet.com founder Halsey Minor says regarding his decision to enlist readers to generate content for a magazine.⁸

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Bread-and-water politics

Vital resource risks stir the pot as populations and prices rise, climates change and shortages strike

For decades, food supply rarely appeared in the pressure cooker of internationally sensitive issues. Real food prices declined 75% over a 30-year period, and while hunger still existed in many parts of the world, food prices were never blamed.¹ The development of chemical fertilizers fed a 600% jump in food production during the past century. And scientists credit that as the primary reason the world was able to add 5 billion people since 1900.²

Today, however, the recipe is changing entirely, with population growth, rising demand for food in the developing world, falling grain stocks, claims on corn and palm oils to make biofuels, and simultaneous shortages and price spikes for fertilizers.³ In a small but pointed fact, Prof. Vaclav Smil of the University of Manitoba calculates that if not for nitrogen fertilizers, 40% of the world's population would get insufficient food based on today's diets.⁴ Water is subject to similarly confluent pressures.

Food and water are suddenly loaded issues, as growing populations—striving for economic expansion—find themselves in global competition for natural resources.

The stakes are enormous. History shows many instances of catastrophic famine and drought that follow large-scale mismanagement. Some of these tragedies, as in Africa, are still playing out in the headlines. Food shortages are causing major protests and economic turmoil everywhere from Argentina and Indonesia to Egypt and from India to Morocco and Bangladesh.

While companies have long factored in the politicized nature of oil and other commodities, food and water are newly politicized, leading sometimes unsteady governments to react to internal pressures to control prices and generate restrictive trade policies.

However, these setbacks present opportunities for strategic leadership at US companies. Businesses that hope to navigate the politicization of food and water must recognize the needs of local communities and take the lead in protecting natural resources. Managers must learn to understand how their corporate goals can synchronize or clash with the critical needs of developing countries.

Lighting the fire

Food inflation has prompted a wave of protectionism in a number of countries. The recent collapse of the Doha Round of trade talks, ending with India and China taking protectionist stances on their

food supplies, disappointed the World Trade Organization. Several emerging-market governments, in the name of self-sufficiency, have increased subsidies, imposed price controls and raised wages. Such policies are expensive and hard to reverse. They also make the trade landscape far trickier for companies to navigate. During the “tortilla riots” in Mexico during 2007, Cargill and other companies agreed to a price cap that would make the price of tortillas less than half the reported prices.⁵

The urge to restrict is not confined to emerging markets. In April 2008, warehouse stores Sam's Club and Costco made headlines when they limited bulk sales of rice in the US, reacting to panic buying among small store owners.⁶

At the extreme, natural resource constraints could spark unrest and threaten political stability. The perception of scarcity feeds into political pressures and policy responses that threaten to undo the growth and business reforms emerging markets have achieved in the past few years.

Both Aon Corporation and Lloyd's have reported greater demand for political risk insurance based on problems related to food shortages.⁷ In this environment, companies should closely monitor political climates in their markets.

Agricultural companies will need to confront certain important reputational risks as well. Even as food prices spark riots and hoarding, some companies are reaping huge gains, and that can create a potential public-image problem. Grain-processing giant Archer-Daniels-Midland's profit in third-quarter 2008 jumped 42%, and the *Wall Street Journal* reported it under the headline “Fat Profits Test Public-Relations Skills.”⁸

The low-water mark

Water could easily boil into the next flash point. Citing a confluence of population growth, urbanization and climate change, JP Morgan foresees water problems heightening risks in the power-generation, mining, semiconductor-manufacturing and food and beverage sectors. The firm warns investors to assess their portfolios in this context and faults corporate disclosure of water risks as inadequate.⁹ Dow Chemical chairman Andrew Liveris told the World Economic Forum in February 2008 that water “is the oil of this century.”¹⁰

“The environment will be a key business constraint going forward, and scarcity will be a big part of the story over the next 10 years.”

University

In India, since 2003, Coca-Cola and PepsiCo have been the focus of water supply complaints. In 2008, the Energy and Resources Institute, an environmental research group based in India, asked Coca-Cola to shut down a bottling plant in the state of Rajasthan, accusing it of draining a scarce supply.¹¹ Yet scarcity is also encouraging the development of new water-saving technologies and better managements. Levi Strauss, Nestlé and SABMiller, among others, are working with the United Nations as part of the CEO Water Mandate, a project intended to help companies better manage water use in their operations and throughout their supply chains.¹²

Sustainable profits

Successful companies are finding that promoting sustainable food and water use not only helps their reputation; it's also good for business. H.J. Heinz Company, for example, runs a program to promote sustainable agriculture, supplying hybrid tomato seeds that allow farmers to produce high yields without genetic modification. The HeinzSeed program helps farmers reduce the environmental impact of chemical pesticides and fertilizers and conserves water resources. The program has been particularly successful in China and is popular in Egypt and Ukraine.¹³

In today's growing, interconnected world, food and water are likely to remain politicized. US companies can thrive by combining sustainability in their core businesses with partnerships that support healthy and prosperous societies worldwide.

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Supply chain disruptions

Long-term fallout suggests care in analysis and engineering will pay dividends

Ongoing PricewaterhouseCoopers research conducted in collaboration with supply chain expert Vinod Singhal, professor of operations management at Georgia Institute of Technology, finds that the drive to reduce costs through outsourcing may be causing long-term harm when companies experience supply chain problems*. In a sense, the immediate goal of reducing costs may be projecting other, potentially greater, risks into the future.

Our analysis shows that companies experiencing supply chain disruptions suffer long-term loss of shareholder value and profitability. The study focuses on 600 companies experiencing disruptions. It reveals that their average shareholder value plummeted when compared with peers, their stock prices experienced greater volatility and they suffered sharp declines in return on sales and return on assets. The effects of the disruption remained apparent two years after they occurred.

The research concludes that major disruptions are caused not by a single risk factor but by a convergence of many. In fact, it is not always easy to distinguish between operational and reputational supply chain risk factors. Importing items containing lead, for example, is an operational error with profound consequences for a company's reputation.

Recently, supply chain risks have multiplied dramatically because of a combination of forces ranging from greater regulatory scrutiny in the US, an altered manufacturing landscape in China, the weakened dollar, shortages of raw materials and rampant increases in energy costs.

Supply chain integrity itself presents a puzzle that companies must solve in a challenging environment: The very practices that have driven costs out have also opened the door to increased risks with long-lasting consequences. And while it's relatively easy to demonstrate the financial benefits of cost reduction, it's far more difficult to make a business case for investments that improve the resilience of supply chains.

The results of the PwC study also show that supply chain investment can be regarded as a kind of insurance against economic loss from supply chain breakdowns. Every day companies are being forced to recall products, delay launches, and answer tough questions from regulators and consumers. Some global businesses are now designing their supply chains to support organizational objectives, instead of simply wringing costs out. These companies are achieving supply chain integrity by balancing operational objectives with reputational risks related to environment, ethics and labor.

*The complete study will be published this autumn in a PwC white paper on ensuring supply chain integrity.

“Many of the early global partners of multinational firms will eventually become competitors. I think a lot of companies are missing this with the race to outsource. They are effectively arming the future enemy.”

University

The cloud of uncertainty

Ambiguity can hobble basic risk-reward decision making in today's environment

Anyone who's ever hesitated before diving into a dark, cold lake or phoning a new acquaintance to arrange a meeting understands that uncertainty can paralyze effective decision making: we tremble in the face of events even when they are hardly likely to kill us (as long as we can swim, that is).

But uncertainty freezes us in our tracks and triggers a range of emotions that hamper clear-eyed reckoning. This applies to many of the decisions that have to be made in today's fast-moving, opaque and interdependent world. From buying complex financial instruments to selecting spinach, the risks may not be all that apparent.

It's simply too hard, increasingly often, to see and connect causes and effects. And our thinking isn't programmed for ambiguity. We're hardwired to make snap clear-cut survival judgments on whether to chase a mammoth for dinner or run to avoid that same fate.

In the classical definition, uncertainty is a situation where no probability distribution can be attached to the underlying set of outcomes and risks.¹ We make decisions based on a balance between logic and reason on one hand, and irrationality on the other. "It's kind of back and forth between emotion and cognition," says Colin Camerer, Rea and Lela Axline Professor of Business Economics at California Institute of Technology, describing choices in an experiment on uncertainty in human decision making.²

Ambiguity aversion

Our hearts compete with our minds. And that can help or hinder us. In the case of financial securities traders, "likely to be among the most rational decision-makers in the general population [and]

ideal subjects for examining the role of emotion in rational decision-making processes," intuition definitely makes a difference, as a Massachusetts Institute of Technology study found by measuring the physiological characteristics of traders in live financial risk processing.³ That research showed "significant differences in physiological responses across the 10 traders [studied], which may be systematically related to the traders' experience."

Neuroeconomists have also shown that ambiguity aversion throws a monkey wrench into decision making: We stay away from choices that are less than clear. In the CalTech experiment using functional MRI (fMRI) to investigate emotion's role in risk-reward judgments, participants in quizzes or card games were given two choices each with the same level of risk. In one choice the odds were clear. In the other they were less so. Ultimately, people avoided picking from the more uncertain deck.⁵

Camerer, who conducted the experiments,⁶ says that ambiguity complicates choices from food to finance: "For example, you're traveling in a foreign country and you don't know what to order on a menu or you're a venture capitalist trying to figure out whether nanotechnology will be a billion-dollar business in 10 years. In these situations, it's really hard to pin down the possibilities."⁷

Distinguishing between risky events and ambiguous ones—as in a roulette bet and a terrorist attack, respectively—"many people are more willing to bet on risky outcomes than on ambiguous ones, holding judged probability of outcomes constant,"⁸ the fMRI study notes. That touches on the conundrum that business decision makers face today. Uncertainty isn't just an updated synonym for old-fashioned risk.

"Real world decision-makers frequently appear not to evaluate uncertain events according to the laws of probability."

Nobel Prize, Information for the public, 2002⁴

Companies need to take extra care in analyzing risk-reward decisions in today’s environment, understanding the core of an issue, nimbly timing entrance and exit strategies and remaining constantly vigilant yet focused on longer-term goals (despite the day-to-day hubbub of 24-hour news). Finally, they need to resist the urge to follow the pack if it doesn’t make sense—the way that generations of American grade school teachers once admonished students to avoid “walking off the Empire State Building just because Janie and Jimmy are doing it.”

In the next few pages, Dan Ariely, a behavioral economist at Duke University and the MIT Media Lab, offers his insights on uncertainty and irrationality in business decision making. We also examine whether information technologies offer new solutions to risk and uncertainty—specifically covering the Semantic Web, a powerful enhancement to the World Wide Web with potential to find

the needles buried in the deepest, most disparate haystacks of information. Technology introduces vulnerabilities of its own, and PwC professionals offer hints on ways to retain focus and avoid the downsides.

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“The heart of the recent crisis is a rise in uncertainty—that is, a rise in unknown and immeasurable risk.”

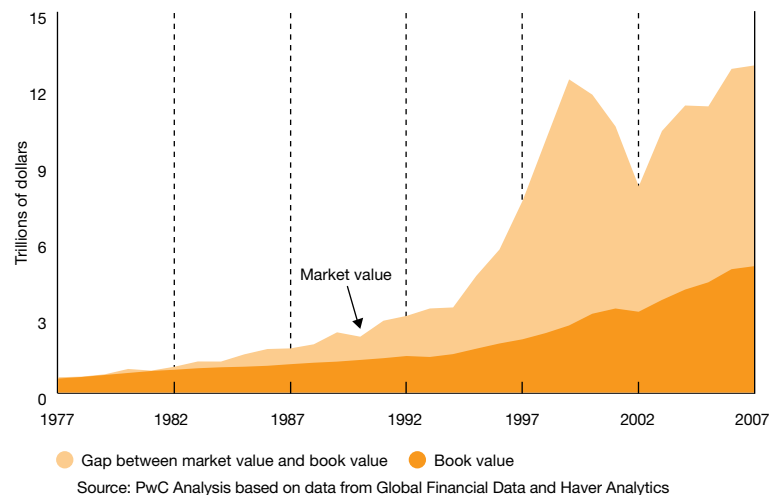
Banque de France, 2008⁹

Mind the gap?

Uncertainty enters the picture for corporate measurement, valuation and management

In the past 30 years, as the modern knowledge economy has boomed, a major gap opened between the book and market values of the Standard & Poor’s 500 Index companies. Markets are finding significant value in corporate intangibles—talent, research and development efforts, brand name, good will and sustainability—much of which is not reflected in the traditional yardsticks by which companies quantify their performance. Investors have already decided traditional gauges are incomplete. More complete, up-to-date corporate measurements would add clarity for investors.

Figure 3
Accounting metrics explain less and less of the full story



Dan Ariely

... Examines the particular challenges of uncertainty and irrationality in modern decision making

Dan Ariely is James B. Duke Professor of Behavioral Economics at Duke University's Fuqua School of Business. He also holds an appointment at the MIT Media Lab. Ariely wrote the best-selling book *Predictably Irrational* while he was a fellow at the Institute for Advanced Study in Princeton, NJ. His work has been featured in leading scholarly journals and a variety of popular media outlets, including the *New York Times*, the *Wall Street Journal*, the *Washington Post* and *Science*. In this interview, Ariely discusses the uncertain world we live in and some of the irrationalities that creep into our decision making.

PwC: Do we live in times that are more uncertain than the past, and does that affect our decision making?

DA: I think so. There is a well-known phenomenon in psychology called "learned helplessness." In the classic experiments, animals that had some control over when to end a mild shock stayed agile and resilient in the face of future shocks. Animals that experienced the same shocks as random and beyond their control essentially ended up whimpering in a corner. I think this phenomenon applies to the way humans experience uncertainty in the world today.

A sense of control or empowerment—or minimally, a clear understanding of causes and effects—keeps us alert, keeps our decision-making powers sharp. But that's something we humans often lack in today's very complex, fast-changing world. There's a sense that our understanding of the world is eroding, and the relationship between what's happening now and what will come next is increasingly cloudy. I think there's a general depression because of that. For instance, the indicators of the economy are not that terrible, yet consumer confidence is at a 40-year low. We're in a state of collective learned helplessness.

PwC: Do you have a recent example of this erosion of understanding about cause and effect in the world?

DA: Some of the Fed's recent actions are a good example. It's very unclear whom they decide to bail out under what conditions. It all looks so capricious and random. There's no sense of order. Along those same lines, some of the complex financial instruments in place right now have obscured the relationship between cause and effect and decreased trust in the broader financial system dramatically. But for mental health and confidence, we need order, predictability and a sense of trust. I think it will take a long time to regain that. And I'm afraid that if we have another catastrophe soon, it will be just too much.

PwC: One way to think about risk is the probability of a negative outcome in an uncertain situation multiplied by the consequences of that outcome. We know you've thought a lot about the irrationalities that humans bring into their decision-making processes. How do we tend to be irrational when it comes to risk?

DA: A company has to make a lot of decisions having to do with risk and uncertainty. The tendency is to think about each of

them separately; we're so focused on each decision that we almost forget the other ones. But if you think about the questions collectively, you reach different conclusions. It turns out that it's much better not to make one decision at a time but to try to make an overall decision about the strategy you're taking in the face of uncertainty and then execute this strategy without trying to make a decision about every particular instance.

Here's an illustration. If I offered you a gamble in which you'd win \$150 for heads but lose \$100 for tails, would you take it? Most people don't; they are so worried about the possibility of losing \$100 that the possibility of winning \$150 doesn't make up for it. However, if I asked if you wanted to play this gamble every day for a year and then settle up with me at the end, you would probably say yes. You can do the calculation over the long run and figure out that with approximately equal numbers of wins and losses, you'll come out way ahead.

Now, rationally, rejecting a gamble when you will play it only once and accepting it when you will play it many times is inconsistent. This form of irrationality happens frequently when people focus too much on an isolated risk rather than on their entire portfolio of decisions.

“Our understanding of the world is eroding, and the relationship between what’s happening now and what will come next is increasingly cloudy.”

PwC: So it sounds like we are often irrational in the present but that we can counteract that irrationality by taking a longer-term view?

DA: Take procrastination. If you left work to your own discretion every night, every night you will procrastinate, and eventually you will suffer the consequences because you’ll miss a deadline, or you’ll have to pull all-nighters, or the quality of your project will be bad. Because we just can’t leave it to our own discretion. But we can create mechanisms that force us to behave in a certain way by anticipating our inclination to procrastinate.

I’ll give an example. Imagine I was your physician and I told you, “May 15 you’re scheduled for a colonoscopy at 10:00 a.m.” Now, what’s the chance that you will wake up on May 15th and feel that today is a good day for a colonoscopy?

PwC: Zero.

DA: Now, imagine if today I said, “On May 15 you’ll wake up and not feel like having a colonoscopy, but it’s important for you to have one, so I’m giving you a chance today to force your future behavior. How? Give me a check for \$500. If you show up on May 15, I’ll give it back to you, maybe even with interest. But if you don’t show up, I’ll deposit the check.”

Now, on May 15 you will still not feel like having a colonoscopy, but you might also not feel like losing your money, and as a consequence you might actually show up for the exam.

PwC: What are some of the other major sources of irrationality in business?

DA: A big one is group decisions. Research shows that group decisions are poor decisions—and yet corporate America is full of groups and meetings. Another one is intuition. So many business decisions are based on intuition: people *feel* something or other. Advertising is run on intuition, with very little empirical testing. But if you believe that people are irrational, what does that imply about their intuition? Indeed, intuition can be very dangerous. The FDA forces people to do something extremely unnatural: not follow their intuitions and do very rigid experiments. And even then, big mistakes get made. Businesses don’t have the benefit of an FDA. No one forces them to do experiments.

PwC: We’ve talked about how we humans are irrational in many different spheres. Is there anything we can do to control our irrationality?

DA: One thing is to try to get the outside perspective. Think about how you would advise somebody else if it was their problem

and their decision. Once we get a little less emotionally attached, we can sometimes see things a bit better.

Also, if we can create mechanisms that force us to behave in certain ways that counteract our irrational tendencies, we would actually behave better. The key is to recognize our irrationality, because if we understand the limitations, we can get ourselves to behave in different ways.

Humans are great at understanding our physical limitations—but not our mental limitations. We think we’re supermen of the mind: that we can compute everything and take in all considerations; that we’re basically rational. To the extent that we can think about where people are cognitively limited and how we fix that, I’m optimistic that we can build a much better world.

Read more at:
www.pwc.com/AmericanPerspectives



Found in translation

The Semantic Web takes on the hardest information challenges and promises breakthroughs in risk and opportunity management

Ivan Herman, a Hungarian living in the Netherlands but working mainly in France and the US, responds in everyday German when asked whether the Semantic Web will soon fire the magic bullet of technology to solve major risk problems.

“Jain,” he says. This yes-and-no answer evokes the optimism of a hard working scientist in charge of the World Wide Web Consortium’s (W3C) development of the Semantic Web as well as clear-eyed respect for his adversary.

In the case of clarifying uncertainties, Herman’s challenge is a jungle of probabilistic and fuzzy logics. But now, after six years of cutting a trail through an initial maze of difficult questions, the light appears to be nearing in the quest to create “a general lingua franca where all the various data are not physically converted but mapped logically so you can treat them all together, ask questions and solve problems that at first glance are based on relationships among pieces of data that are very far from one another.”

Sir Tim Berners-Lee, inventor of the Web, is spearheading Semantic Web development through W3C, a consortium that unites 400 companies and universities worldwide, cohosted by MIT, the European Consortium for Informatics and Mathematics in France and Keio University in Japan.

The goal is to make the World Wide Web far more useful by enabling Web interoperability; in other words, allowing any hardware and software that access the Web to work together. That will make profound gains by finding and correlating information wherever it is—a Web site, a database or a desktop.

If it all sounds remote, Berners-Lee says “it was really hard explaining the Web before people just got used to it because they didn’t even have words like *click* and *jump* and *page*.”⁴ In companies, he says, the Semantic Web will provide a missing link to connect all data. That promises executives will be able to eliminate internal information silos, connect data across the business and beyond it and respond to unexpected events more effectively.

The future is now

Already, Semantic Web applications based on binary logic are yielding impressive practical results. In risk management, the University of Texas Health Science Center’s SAPHIRE is speeding detection and response to outbreaks of influenza and other diseases; researchers at Cincinnati Children’s Hospital are ferreting out the root genetic causes of cardiovascular diseases by combing through and analyzing many massive databases¹; Garlik in the UK is comparing disparate databases to spot identity theft early; and the US military is preventing friendly-fire deaths by using semantic tools that help soldiers recognize friend from foe.

Semantic Web applications are being used by Eli Lilly and Pfizer to develop new medications; British Telecom to coordinate and enable collaborative product development among vendors; MITRE Corporation to help the military manage convoy movements; and social networking system Friend of a Friend (FOAF) to outshine larger rivals by allowing members to share information and imagery in any format. IBM, Hewlett-Packard, Nokia and Vodafone are among the information communications companies promoting Semantic Web frameworks.³

Explaining the potential of the Semantic Web to the House Committee on Energy and Commerce last March, Berners-Lee said, “Progress toward better data integration will happen through use of the key piece of technology that made the World Wide Web so successful: the link.”⁵ We’re nearing a time, he says, when “we can expect the Web as a whole to look more like a large database or spreadsheet, rather than just a set of linked documents.”⁶

On technology time

The common languages and rules to bridge databases and allow reasoning to traverse a universe of Web-based information are now maturing. It’s just a question of when, how and what the results will look like.

“In the next few years the Semantic Web will actually be making a big difference in people’s everyday lives.”

Ivan Herman, W3C

“Digital information about nearly every aspect of our lives is being created at an astonishing rate. Locked within all of this data is the key to knowledge about how to cure diseases, create business value and govern our world more effectively.”

Sir Tim Berners-Lee, World Wide Web inventor²

Kathryn Blackmond Laskey, associate professor of systems engineering and operations research at George Mason University and cochair with her husband, Ken, of W3C’s uncertainty reasoning incubator, says a fully developed Semantic Web is on its way with real promise on risk and uncertainty.

“But what actually comes is going to be a surprise,” she cautions. “Like Yogi Berra says, ‘Prediction is very hard—especially about the future.’” Laskey works on a high plane of uncertainty reasoning yet keeps her eye on the basics. “Technology doesn’t help with people’s motivations. But it does enable advances, especially if we have the right kind of political consensus for information sharing. That just makes it harder to hide things. The Chinese are dealing with that now,” Laskey said, referring to how the Internet opens a window of knowledge into what might otherwise be a closed society.

Mike Willis, PwC partner and founding chairman of XBRL International, predicts the Semantic Web will take giant strides in identifying anomalies and patterns buried in oceans of data and find the risks that are hiding in plain sight.

“Standards increase transparency and the relationships among information, rules, policies, contracts and regulations,” he says. “A transparent and executable information environment on the Semantic Web—a contextual Internet—will help analyze patterns and enable more comprehensive and agile risk management systems. This will cut through a lot of the complexity and uncertainty that’s plaguing us now.”

Magic time? ‘Jain’

Laskey of George Mason balances scientific distance with pragmatism. She comes back to the commonsense core of both risk and opportunity: human motivations.

“What we saw in the global financial crisis was an instance of systemic risk. All the little arrows that usually point in all kinds of different directions and cancel each other out, suddenly they all pointed in the same direction. We had euphoria. It all went up, up, up, up until it reached a tipping point. Then it crashed. ... There were a lot of people who saw this and knew it was coming. However, we lacked the institutions to manage the system appropriately.”

In the end, it circles back to “Jain.” We may well develop the Semantic Web into a powerful enabler to manage risk and seize opportunity. But in the words of Laskey, “it’s not going to be the magic bullet that changes institutions and incentives.” That’s up to us.

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Programming for volatility

Openness, agility and focus are needed to counter unpredictable technology risks

As anyone knows who has struggled with the mysteries of connecting the DVD–VCR–cable TV troika and actually making the television work, or changing a point-of-presence address on e-mail, information communications technology wields a double-edged sword. It offers bouquets of productivity and pleasure, but it hurls a mean brickbat of pain.

Moody's Investors Service acknowledged in July 2008 that a coding bug in one of its mathematical models incorrectly awarded triple-A ratings in 2006 to about \$1 billion in complex instruments known as CPDOs, or constant proportion debt obligations.¹ This not only furnished flawed information to the capital markets but added a chink in the reputation of the ratings agency at a time when the credit crisis had already raised questions.² Economics researchers believe the uniformity of risk models used by financial institutions actually amplifies market volatility by triggering collective, simultaneous actions.³ And of course, effective technology risk management needs to consider all the rogue traders, computer viruses, incursions and systems failures that round out a long list of suspects.

According to PricewaterhouseCoopers professionals who focus on technology and risk, the right risk management profile begins with the basics of culture and controls and extends to maintaining agility and openness in the face of an increasingly volatile environment for business and technology. Here are a few ingredients in the recipe for success:

Continuous change demands an agile planning outlook—No matter the issue—speeds, capacities, environments, emerging risks—“don't get hung up on what the technology is,” says Mark Lutchen, partner in PwC's IT effectiveness practice. “Just know there will be new developments, and keep a flexible planning perspective.” In short, keep both feet on solid technology ground but be ready to move as new developments emerge.

Think people and process, not technology and tools—Information security systems historically focus on the nuts and bolts of technology rather than the people and processes behind them and their link to the wider business. This misalignment opens the door to problems or misses opportunities.

“A red flag may be raised by monitoring a computer network. But without the people and processes synchronized with risk, no one will escalate the problems to higher levels,” says Mark Lobel, lead partner in PwC's information security practice. “Companies need enterprise-wide risk programs that coordinate systems and behaviors.” While Lobel stops short of declaring that steps like this would completely prevent the worst problems, like major fraud, he does believe that a culture grounded in risk awareness and interlaced with fluid communications would stanch damages a lot earlier than often occurs now.

Manage flexibly by principles rather than be harnessed to rules—Control and compliance with lists of activities and processes work as far as they go, ticking off the risks you know. “Business managers need to understand they are operating a principles-based model, which requires their involvement and direction, rather than a one-size-fits-all set of rules,” says PwC's Patrick Pfeil, who focuses on technology risk for financial services companies. “Managing technology risk in the context of the business' objectives and performance measures is critical to enabling discussion and directing investments in risk reduction and response.”

Expect the unexpected; cultivate experience, judgment and responsiveness—The “black swan” risks that swoop down with big, unexpected bombs should remain firmly on the radar screen despite the drive to quantify known risks. “Guarding against emerging threats is really a function of judgment and experience,” says Pfeil. “Obviously, you have to plan for knowable risks, where you look at current threats and vulnerabilities in the environment and operations. But, equally, you also have to emphasize responsiveness, because the unexpected will happen.” Anticipate and prevent on one hand; prepare for the worst on the other.

Build agility into the IT infrastructure—Lutchen, formerly chief information officer of PricewaterhouseCoopers and other companies, stresses the need to develop an IT organization that keeps its eyes wide open in the face of volatility and uncertainty. “You need an organization that works together with the business to learn how to use technology and actually innovate it together,” he says. “You also want a highly agile, high-performing group of people who

understand their role in the absorption of new technologies, who have the skills to see new technologies coming downstream, who try them out, make their bets and then manage their way through the process of making it industrial strength, supporting and eventually sunseting it.”

Set it, and don't forget it—Automated controls and continuous monitoring will look for, and find, predictive anomalies—for instance, someone exceeding limits, whether in illicit trades or unethical payments. But warnings need to travel in the real world. “Innovators of technology don't make it work alone,” Lutchen cautions. “Continuous controls have to be usable and practical—agile enough to adjust to fit in with new developments. That means the architects who delight in designing whizbang applications need to work closely with the technologists and businesspersons who harden them for everyday use in the company.”

Outsource functions, but don't import risk—Outsourcing to reduce technology costs has to be balanced with strict controls to minimize risk on both quality and cost. That may mean lining up the right people and practices to monitor third-party vendors operating half a world away. But without greater controls, risk may actually boomerang back in new ways.

In short, open-mindedness, common sense and a healthy respect for business basics make it less likely anyone will be fiddling alone in the technology silo while Rome burns.

“Managing data security is no longer just a matter of protecting the periphery of the network. For every known person who touches the data, there are another 10 people we don't know.”

Global financial services

1 Sam Jones and Gillian Tett, Moody's to check on accuracy, *Financial Times*, July 3, 2008.

2 Paul J. Davies, Joanna Chung and Gillian Tett, Reputations to restore, and, How Moody's blues began with a bug, *Financial Times*, July 22, 2008.

3 John Kiff, Ulrich Klueh, Laura Kodres and Paul Mills, Can risk models amplify volatility?, IMF, September 27, 2007.

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