Note to the Reader

The following series of short essays was written in the period June – August 2011 and posted on my website: www.leiss.ca. Similar pieces will be added to the series on a regular basis. If you are interested in them you may check the website periodically or follow me on Twitter (@WilliamLeiss), where I post a Tweet (a) each time a new short blog appears on my website and (b) when I read something in the current press relevant to risk issues and provide the URL for those who also might want to read it.

Contact me anytime with requests for information or comments on these blogs.

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Emerging Risks with the Potential For Catastrophic Losses

30 June 2011

I am particularly concerned with emerging risks with the potential for catastrophic losses, which will be, in my view, an integral feature of an increasingly globally-interconnected world. Of course, this is an overriding concern for both the insurance and reinsurance industries as well as for governments (in their capacity as insurers of last resort for their citizens). In my presentation at the iNTeg-Risk conference I mentioned three such events in the past three years: the global financial crisis (ongoing since late 2008, with no end in sight and with almost incalculable levels of realized and projected losses around the globe); the BP spill in the Gulf of Mexico (2010); and the nuclear industry crisis in Japan (2011).

In order to dramatize the seriousness of the potential for catastrophic losses, in my presentation I referred to the choices we make about emerging risks (particularly the choice to remain indifferent to the downside risks) as equivalent to a series of very large bets laid down in the natural and technological casinos.

Under the assumption that the key feature of effective risk management is to "anticipate and prevent or mitigate harms that may be avoidable," these three crises represent preventable tragedies, that is, failures in risk management – because, as demonstrated by well-founded retrospective analysis, all three cases reveal failures in foresight and prudent precaution, based on known risk factors, that should not have been tolerated by organizational actors in industry and government in the years leading up to the onset of the crises. For example, in the worst of the three, the financial crisis, decades of systematic deregulation in this sector, particularly in the U.S. and the UK, led to a decade of truly reckless risk-taking involving innovative financial instruments that introduced high levels of instability into the global banking sector.

What is often overlooked in catastrophic loss, in addition to the immediate direct and indirect costs, is the restricting of future options for action in response to the next crisis. Especially in the case of preventable tragedies, the result is to severely constrict the ability of nations to marshal resources for future threats. In the case of the financial crisis, in the single year 2009 governments in the largest Western economies added 20% to their accumulated debt-t0-GDP ratios, and these numbers will continue to rise relentlessly over the coming years. (A well-known paper by Reinhart and Rogoff argues that economic growth is increasingly constrained at debt-t0-GDP ratios exceeding 90%.) The resources that governments have been forced to direct to preventing yet more serious damage to their economies from the financial-sector bailouts were, essentially, wasted (because measures were available that should have and could have prevented the financial collapses from occurring).

I present below a highly-simplified scheme for addressing emerging risks with catastrophic loss potential. (This scheme may be most suited to the case of the reinsurance industry, which would have potential exposure to a very broad set of risks and risk factors.)

> FIRST STEP: Scan the social/natural environment for emerging risks, rank them in terms of potential impacts [losses] only (ignoring likelihood or probability of occurrence), and select a manageable set of potentially high-impact emerging risks for detailed analysis.

NOTE: The need here is only for getting very rough indications of total losses of all kinds under worst-case scenarios.

SECOND STEP: In the set chosen for analysis, look for "key indicator variables" that give evidence of high volatility or problematic trend lines over relatively short periods and assign high priority for ongoing attention where relevant exposures warrant.

EXAMPLE: In the run-up to the financial crisis, the total value of the global derivatives market was in exponential-growth mode. In 2001 the value of credit default swaps was less than $1 billion; by mid-2008, it was $62 trillion. CDSs and other derivatives were novel financial instruments and were unregulated, a result of a specific set of events during the Clinton administration. (Throughout this period these figures were publicly reported quarterly by the Bank of International Settlements.) In my book (Leiss 2010), on p. 49, I show a graphic illustrating the rate of growth in this market between 2001 and 2008; the slope approaches the vertical in the later stages. This is a growth curve that is bound to crash (it is eerily similar to the ecological schemata of predator-prey population dynamics just before the prey population crashes).

THIRD STEP: Set up a watching brief on the on the selected risks and consider mitigating or hedging the firm's potential losses.

Of course much would need to be done to refine this scheme. But where complexity is the order of the day, the analytical scheme needs to have the virtues of simplicity and sharp focus.

Finally, prudent anticipation and pro-active mitigation (hedging one's bets, especially where the stakes are very large) is the indispensable need in risk management. For example, it is already clear that humanity will almost certainly have to entertain geo-engineering the planet's climate, on a vast scale, to counteract the effects of inevitable large future increases in GHG emissions. There are enormous and very poorly characterized risks associated with this option. Those in the business of catastrophic loss mitigation should begin better characterizing those risks, and their exposure to them, sooner rather than later.

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Catastrophic Failures in Risk Management: The Never-Ending Global Financial Crisis

28 June 2011

With increasing frequency comments on the ongoing sovereign debt crisis in Greece and the euro zone include a reference to the need to avoid a repeat of the collapse of the investment bank Lehman Brothers in September 2008. The basis for this otherwise puzzling comparison is the concept of "contagion," that is, cascading failures in the financial sector – the "falling dominos scenario" – which once started with a single "event" cannot be halted, by any means currently at our disposal, until other (perhaps many other) large losses occur. Here is an account from today's *Globe and Mail* (Eric Reguly, "French banks seek support for Greek debt rollover plan, pp. B1, B14):

> "The [debt rollover] plan is voluntary, though euro zone governments are putting enormous pressure on their banks to contribute to the rescue package for fear that Greece's inability to pay its debt charges would trigger a second financial crisis. 'If it wasn't voluntary, it would be viewed as a default, with huge risk of catastrophic results,' [French President Nicolas] Sarkozy said.... Josef Ackermann, chief executive officer of Deutsche Bank AG, said [that the] Greek debt crisis, if not contained, would reverberate through the European and global economies. 'If it's Greece alone, that's already big,' he said. "But if other countries are drawn in through contagion, it could be bigger than [the 2008 collapse] of Lehman,..."

How did we get ourselves into this mess? In my 2010 book, *The Doom Loop in the Financial Sector, and Other Black Holes of Risk*, I sought to show that the 2008 global financial crisis had its roots in three key developments:

(1) a quarter-century of systematic deregulation of the banking sector, primarily in the U. S. and the UK;
(2) a failure to oversee the markets in novel financial instruments (derivatives and securitization) as they exploded in size and global reach during the first decade of this century;
(3) a deeply flawed conception of risk management in the financial sector, which failed to recognize and assess systemic risk.
In addition, I referred to an accompanying serious policy mistake, namely, the erroneous belief (motivated by ideological principles) that "asset bubbles" – in this case, soaring valuations in home values in the U. S., Ireland, and Spain – could not be controlled, a belief shown to be false in the book by George Cooper (2008), *The Origin of Financial Crises.*

As a result of these errors, the countries of the developed world were "blindsided by risk" in 2007-2008, and those countries have suffered immense and, to some extent, immeasurable levels of losses that are still ongoing. They have also added huge new quantities of sovereign debt to their national balance sheets. The major institutional actors in the banking sector maintain that no one could have foreseen these consequences and thus that they could not have been prevented. This is a self-serving lie and has been exposed as such. Those who doubt this should read, among other good sources, Richard Bookstaber's *A Demon of our own Design* (2007) and Gillian Tett's *Fool's Gold* (2009).

The fact of the matter is that these selfsame actors in the banking sector, along with their friends in the political sphere, had colluded in the dismantling of essential regulatory

structures that had been put in place after the experience of the Great Depression. They destroyed the career of a woman who foresaw the disaster of failing to regulate the derivatives markets. The result was to unleash a decade of reckless risk-taking that enriched them enormously and left huge bills to pay for future generations.

The European sovereign debt crisis is Round 2 of the unravelling of this reckless risk-taking. It illustrates a fundamental fact about our newly-globalized economic and financial sectors: namely, that as risks in some sectors (such as environment and health) are more strictly regulated, we continue to simply overlook emerging risks in other sectors, with catastrophic results. What were the brilliant minds at the European Central Bank, and in the finance ministries of the dominant European economies, thinking when they created a monetary union unsupported by a fiscal union? What were they thinking as they watched smaller countries such as Greece, Ireland, and Portugal run up enormous new levels of debt – at the same time as their economies were falling behind in economic productivity terms (on the basis of which the debt has to be repaid at some point)? What were they thinking when, through the new monetary union, they foreclosed the option for single nations in Europe to default on their sovereign debt (as Argentina did in 2002) without threatening a larger cascade?

Others helped, to be sure, especially Goldman Sachs, which made hundreds of millions in fees aiding the Greek government hide the true level of its sovereign debt: see Louise Story and others, "Wall Street helped to mask debt fueling Europe's crisis," *The New York Times*, 13 February 2010: http://www.nytimes.com/2010/02/14/business/global/14debt.html?dbk .

Now a grand game is being played out, one which will not have a happy ending. The Europeans cannot allow Greece to default because of the contagion risk. But the Greeks themselves will *never* be able to repay the full value of the debts they have already accumulated, much less those they expect to incur with the second EU bailout later this year and next. The game being played is to pretend that Greece is solvent; it is not solvent and cannot become solvent again with the remedies that are on the table. Even if the Greeks accept the medicine that has now been offered to them (wage cuts, privatization of national assets, etc.), and even if they were to actually able to carry out these measures (a highly dubious proposition), they still will never be able to repay their debts. But the European game is to pretend that the Greeks can and will, so that their national banks, holding great quantities of this paper, can avoid recognizing the huge losses they are sitting on.

The global financial crisis that erupted in 2007/8 may run for a decade or more, piling up catastrophic levels of losses for many nations and peoples. (One part of the economic fallout is the high levels of permanent unemployment of young people in the U. S. and many European countries.) By the time it runs its course most of the world's developed economies will be up against the wall in terms of debt-to-GDP ratios, which will severely constrain both their future economic growth and their ability to fund essential social programs. And the worst part of it is, none of this needed to happen.

This was a preventable tragedy. Any rational assessment of risk in the banking and financial sectors at the end of the last century, using techniques that were well in hand more than a decade ago, would have concluded that imprudent levels of risk-taking were being contemplated. But the powers that be, in the political and economic sectors, decided to roll the dice. They did so without having the faintest notion of the real risks they were running. And so, despite all the sophistication in risk management that we have developed in the past 50 years, once again we were blindsided by risk.

Many citizens around the world are paying a high price for this irresponsibility, and will continue to pay for a very long time. If we go on acting like this, future generations will have plenty of time in which to contemplate the ruination of the economic wealth once possessed by their predecessors, because they will have little else to do.

For ongoing expert commentary on the global financial crisis, two indispensable Internet resources are:

(1) "The Baseline Scenario," by Simon Johnson and James Kwak: http://baselinescenario.com/

(2) Commentaries by Christopher Whalen: http://www.rcwhalen.com/

See also the accompanying PPT: William Leiss, "Blindsided by Risk" (2011): http://leiss.ca/wp-content/uploads/2011/06/Blindsided-by-Risk.pdf

Financial Risk: The World turned Upside Down

5 July 2011

Here's the latest from the Greek debt crisis:

> "Europe is seeking to avoid a default at all cost because it could also initiate payment of credit-default swaps, with unpredictable results. There is little public information on which financial institutions have sold credit-default swaps and might have to absorb losses if Greece defaulted, but it is likely that American banks and insurance companies have taken on the largest share. The shock to the global economy might compare to the collapse of Lehman Brothers in 2008, the European Central Bank has warned." (Jack Ewing & Landon Thomas Jr., "Europe faces tough road on effort to ease Greek debt," *The New York Times*, 4 July 2011)

Wait a minute! In credit default swaps the first party pays a premium to a second party in order to "insure" the value of an amount invested in corporate or government bonds made by the first, and the second party guarantees to make up the shortfall if that investment loses value, for example where the issuers of the bonds default on their debt. Derivatives such as credit default swaps are a risk management strategy for investors, protecting them (for a price) against large losses. So how does this very sensible risk mitigation strategy, used by individual

investors, end up *causing or exacerbating* another broad financial crisis? [All you need to know about credit default swaps: http://tinyurl.com/4wjzdj.]

The problem is *systemic risk* – which is what led to the original global financial crisis starting in 2007/8 – and the failure of national and international regulators to solve this problem during the last three years. Systemic risk arises in the hidden interconnections involved in dealings among powerful financial institutions.* The continuing lack of transparency in these markets is one reason why governments, which provide a backstop of last resort against failures (bankruptcies) in the banking and financial sectors, still cannot estimate the level of systemic risk and take effective steps to limit the damage such risk can do to economic activity and levels of sovereign debt. [*Louise Story and James Kanter, "Europeans regulators investigate banks for credit swaps," *The New York Times [NYT]*, 29 April 2011: http://tinyurl.com/3sce2hn.

We have a never-ending global financial crisis because the core problems that originally caused it have not yet been fixed. And it's not clear that they will be fixed before much more damage has been done. What is the scope of the current crisis?

- European governments and central banks plus the IMF now hold half of all Greek debt (~€ 165 bn);
- As of 2010, commercial banks were exposed to the following totals of debt in Greece, Spain and Portugal (all in euros): French, 229 bn; Germany, 226 bn; British and Dutch, 100 bn each; US, 54 bn; Italy, 31 bn;*
- There appears to be $616 bn (US) in swaps held by investors against debt of PIIGS countries (Portugal, Ireland, Italy, Greece, Spain);**
- Money market funds hold short-term debt issued by European banks, leading to recent large panic withdrawals;***
- If Italy starts to shake, all bets are off.****

*Jack Ewing, "Debtors' prism: Who has Europe's Loans?" *NYT*, 5 June 2010: http://tinyurl.com/3udgwy4
** L. Story, "Derivatives cloud the possible fallout from a Greek default, *NYT*, 22 June 2011: http://tinyurl.com/4xu5ro9
***M. Mackenzie & N. Bullock, "Flight from money market funds exposed to EU banks," *Financial Times*, 24 June 2011: http://tinyurl.com/3qrp8hp
****Simon Johnson, "Could Italy be the next domino to fall?" (5 July 2011): http://tinyurl.com/659gfl9

One of the important subtexts to the story during September 2008, when the prospect of cascading failure in the banking sector threatened to bring down the entire house of cards, was the observation of then U. S. Treasury Secretary Henry Paulson that he did not have the right kind of legal authority to take effective action to stem contagious collapse. Something similar is happening in Europe right now. Most observers would agree that the best solution to the Greek crisis would be an "orderly default" on its sovereign debt, under which holders of Greek bonds would take the usual "haircut," losing something like 50% of their investments. There would be severe pain in Greek society, to be sure; something similar has happened many times before, most recently in Argentina, and eventually nations recover from it.

But the creation of deep interconnecting webs in the global financial sector forestalls this solution. The European Central Bank and the largest Euro-zone societies fear the onset of contagion (first, a collapse in the value of Irish and Portuguese debt, then a spread to Belgium, and perhaps onwards). And if this contagion were to spread to the much larger economies of Spain and Italy, all bets would be off. *The powers that be in Europe simply do not appear to know how to prevent this from happening.* So they have to pretend that the tools they possess will be adequate for the job. Hanging over their heads is the additional uncertainty caused by their lack of control over the derivatives markets and the fear that fallout from this market could help to destroy the viability of whatever solutions they come up with.

Citizens in North America and Europe need to understand clearly the perils they still face from the failure to fix the flaws that caused the 2008 crisis. This ongoing crisis has, quite literally, turned the global financial system on its head – meaning that solutions that worked in the past are no longer viable. The strongest sign of this change is the fact that a perfectly good risk mitigation strategy, namely paying for insurance against the risk of default of a bond held as an investment, threatens to have unintended *and unforeseeable* systemic consequences.

Difficult Risk – Risk Tradeoffs:
Political vs. Financial Risk in the EU

12 August 2011

There was an important article by Jack Ewing and Liz Alderman in the August 10 edition of *The New York Times*, entitled "Some in Germany want Greece to temporarily exit the Euro Zone." This article takes up issues that have been quietly heating up in the background for some time already but which are, inevitably, becoming harder to ignore. Ever since the first EU bailout of Greece in May 2010, and intensifying with the subsequent Portuguese rescue mission and especially the second Greek one, both in 2011, comments emanating from Germany and elsewhere have cast aspersions on the "profligate southerners" who have come to depend on their "frugal" northern compatriots to rescue them from financial disasters of their own making.

The Greek case is odious, because there was a deliberate effort on the part of its officials and politicians, over many years, to deceive their fellow EU members about the size of their budgetary deficits and sovereign debt levels. But everyone in the EU's governing circles shares the blame, since theirs was a collective failure, first, to think carefully about the risks of creating a monetary union without a fiscal union, and second, to put in place rigorous reporting requirements and auditing measures to establish reliable figures on financial data. In the end, to be sure, the greatest burden of responsibility falls on the Greek politicians, interest groups, and public at large, all of whom allowed their nation's sovereign debt to grow from a relatively modest level, thirty years ago, to the unsupportable heights it has now reached (€333 billion and counting, well before the second EU bailout tranche has been delivered).

A number of well-known commentators, such as Nouriel Roubini, are on record as saying that Greece cannot possibly repay this amount of debt in full and that, sooner or later, it must leave the Euro Zone and default. Default means that its sovereign bonds would collapse in value, probably by 50% or more, producing large losses for the bondholders. All of Greece's banks, which hold €30b of this debt, would collapse, and the country would be plunged into a deep and long-lasting recession with massive unemployment. More than half of this debt is now in the hands of public entities outside Greece (IMF, national governments, the ECB and national banks in Europe), and an additional €50b is in the hands of private-sector banks in Europe, mainly German and French; and under current conditions, as Greek bonds mature (€100b by 2014), a higher proportion of the total will be held by public sector entities. [http://www.economist.com/blogs/freeexchange/2011/06/greek-debt]. Since we all know by now that governments will bail out their large banks, this means that European taxpayers could take losses of €100-150b or more.

Default would mean, of course, severing Greece from the Euro Zone and restoring its former national currency, which would undoubtedly be a very painful process. And yet, in such matters, if default is inevitable, sooner is much better than later, since it enables countries to put the difficulty behind them and begin the long path back to recovery. For the Greeks themselves, this could be preferable to enduring years of watching a steady downward spiral in their economy, putting them ever further from being able to start running government surpluses and paying down their debt, before finally defaulting and hitting bottom anyway. And even for the Europeans this could make sense, because they could then apply the €60b already committed to the second bailout against their expected current losses on the bond defaults – and because, if they do not consider this option, almost certainly they will be in for a third bailout after 2014, throwing even more good money after bad, after which – who knows?

Another important reason for thinking through this alternative scenario with respect to the EU's collective financial risk is that it could set a precedent to seal off the prospect of catastrophic levels of increasing collective debt as further bailouts are required, for Portugal or Ireland (again) or, more ominously, for Spain and Italy. In every case this would mean shrinking the Euro Zone and restoring older national currencies. Of course, eventually, one could bring them back into the currency union – but, this time, with a proper fiscal union solidly in place, and with a common debt held in Eurobonds.

Finally, this radical and bitter financial medicine might be what is needed to head off a potentially surging political risk within Europe. This is the risk vs. risk scenario whereby the ongoing bailout sagas gradually give rise to political anger in the northern European countries which are shouldering the burden of responsibility (and which, in the case of France, just this week, are starting to feel the resulting pressures in their own financial markets). These sentiments are already on the rise in smaller nations such as Finland and Denmark, but most importantly, in Germany, the main EU backstop. If the costs of bailouts keep rising, and if both France and Germany feel directly some sustained financial market pressures related to their prominent roles in the European Financial Stability Facility and the European Central Bank, then it is almost inevitable that the taxpayers in these nations would rebel at some point.

Europe paid an enormous price in the twentieth century, twice over, for political antagonism among its member states. It cannot afford to ignore this new political risk, because such trends sometimes suddenly spiral out of control and politicians become unable to stop this type of downward spiral. It was rather ominous to read in the Ewing and Alderman article that some Greeks, stung by the pointed criticism of their financial imprudence originating in

Germany, recalled that Germany had never paid reparations to Greece following the cruel Nazi occupation of their country.

There are of course downsides to every risky scenario, even for the stronger members of the EU. If some of the weaker economies in the southern belt are removed from the Euro Zone, the euro will rise in value. For export-driven Germany this will make its products more expensive on world markets, just when the second round of recession gets under way. Almost certainly the keen awareness of this fact on the part of senior German officials and politicians, including Chancellor Merkel, is moderating their political discourse. But these are the types of trade-offs that are very difficult for citizens to come to terms with: a sophisticated understanding of the determinants of the euro's exchange rate does not have anywhere near the emotional impact of the urge to "punish" the perceived malingerers in the south. Changes in popular attitudes can very quickly eliminate the discretionary room for maneuver available to politicians.

There are huge stakes involved in these issues. But it may be that the riskiest scenario of all is just trying to ignore them in the hope they will fade away of their own accord.

Financial Risk Management: Duping the Rubes

August 23, 2011

Before 2008 financial industry professionals arranged to deceive local government officials around the world about the risks inherent in their "structured" products, costing the citizens those officials worked for huge losses they could ill afford. Much of this sad story has been told in excellent investigative journalism accounts published in *The New York Times*, some of which are referred to in my 2010 book, *The Doom Loop in the Financial Sector and Other Black Holes of Risk* (University of Ottawa Press), pages 38-43. Here I refer to developments occurring after the book was finished, as well as one other newly-reported important episode, involving school districts in the state of Wisconsin. This later story is being told by one of the first-rate financial reporters for *The New York Times*, Gretchen Morgenson; see her latest article, "Finger-Pointing in the Fog," 21 August 2011: http://tinyurl.com/3hqomna. [See also Ben Protess, "Dealbook: S.E.C. Sues Stifel Nicolaus Over Wisconsin School Investments," *NYT*, 10 August 2011: http://tinyurl.com/438ghdx.]

The U. S. Securities and Exchange Commission has sued Stifel Nicolaus & Company, a St. Louis-based brokerage firm, charging it with defrauding five Wisconsin school districts by recommending a complex financial transaction to them in 2006, involving the purchase of three financial securities. These securities only existed because Stifel arranged for them to be created by putting the job out to tender; the contract was won by The Royal Bank of Canada [RBC]. The total value of the securities was $200 million; the school districts invested $37 million of their own funds and borrowed the rest, $163 million, from DEPFA, an Irish bank. The school districts were sold by Stifel on the venture by being told that they would make profits on the investments that exceeded their interest costs by a substantial margin.

Well, the securities were a form of financial derivative called "synthetic CDOs." CDOs (collateralized debt obligations) themselves are essentially "bets" on how well a random assortment of assets – bonds secured by debts which are generating an income stream, such as home mortgages, car loans or credit card balances – will perform over a certain period of time, the key factor being the default rates (failure to pay the debts and interest on them) in the pool of debt as a whole. "Synthetic" CDOs are in effect bets on these other bets; in other words, here the investors in the securities do not have any ownership of the underlying assets [the debt pool]; rather, they simply "reference" those assets, betting on how well they will perform over a period of time. The securities sold to the school boards were synthetic CDOs.

In the case of CDOs investment banks create a corporate entity known as a "special-purpose vehicle" [SPV] to manage the collection and distribution of income flows generated by the debt. Then they would divide the pool into sections, known as "tranches," of varying riskiness: The "safest" tranches have first call on all the income generated from the pool and are assigned the lowest interest rate, since the risk to the investor (the risk that the value of the tranche would collapse by higher-than-expected default rates on the debt) was thought to be low; and so on down the line, usually through ten tranches, where the tranche bearing the highest risk would get the highest income. In the case of synthetic CDOs, the investment banking arm of RBC advertised a "special purpose entity" program which "issued credit linked notes referencing CDO tranches." Synthetic CDOs generate income to pay investors by selling insurance against default in the referenced CDOs and are issued in tranches similar to CDOs.

[There are incredible complexities buried in these so-called "structured financial products." For an easily-accessible but technical explanation see the Wikipedia entry on CDOs: http://en.wikipedia.org/wiki/Collateralized_debt_obligation.]

The key step is to get an investment-grade "rating" on the tranches. In order to attract investors the investment bank doing the deal went to the rating agencies, in this case Standard & Poor's, for this service. The reason one can accurately refer to investing in CDOs as making a "bet" on the underlying debt pool is that the ratings agencies use complex mathematical models to rate the various tranches in the series from highest (AAA) to lowest (BBB). [See *The Doom Loop*, pages 80-83, for an account of the kinds of "games" that were played in the securities ratings business.] The investment deal that was offered by Stifel to the five Wisconsin school boards was rated AA- by S.&P; according to the board representatives, Stifel told them that these securities were as good as U. S. Treasury Bonds and that there would have to be "fifteen" Enron-type corporate collapses before anything could go wrong with their investment (this account is disputed in ongoing litigation, of course).

The value of the securities created for the Stifel/RBC deal started to collapse only a year later, and ultimately the school boards were left with tens of millions of dollars in losses on their investment. DEPFA seized the collateral for the loan from the school boards; the boards are suing Stifel (separately from the S. E. C. lawsuit against Stifel); and Stifel is suing RBC. Stifel has filed in court what is called an "amended cross claim" [hereafter Stifel ACC], a legal document filed with a court after the various sides have interrogated each other in a process called "discovery." The entire document is in the public domain, and the PDF file may be accessed at: http://tinyurl.com/456x76y.

The Stifel ACC document shows that RBC required Stifel to confirm that its client had read and understood their risk calculation. Section 41 of the claim notes that "DEPFA bank ... took no action [to seize the collateral] until after the [synthetic CDO] investments had lost nearly their

entire value." Does anyone think that the school board officials clearly understood that they could lose their entire investment? I doubt it very much! The public record in other such cases shows that the local officials who were persuaded to do these kinds of deals really had no idea what complex derivatives actually are, and had no way of checking the evaluation of the risks they carried that were given to them by their own longstanding financial advisors.

A pertinent twist in this case is Stifel's claim (not yet proven in court, as they say) that RBC exploited the mathematical models, used by S.& P. to generate its ratings for the tranches of the synthetic CDOs, in order to hide the true risks in the portfolio: "In fact, the CDOs manufactured by RBC acted as a Trojan Horse, wrapped in an "AA" rating by Standard & Poor's, which carried material undisclosed profits, were riddled with conflicts, and hid risks which ultimately led to the losses suffered by the OPEB trusts" (Stifel ACC, Exhibit 1, #8). [OPEB trusts are legal entities established in Wisconsin to manage post-retirement benefits for former public-sector employees.]

The use of the word "manufactured" just above is especially interesting. We think of manufacturing, say, a widget or other device that we can see and take into our hands. Something manufactured is constructed out of materials in factories or workshops. CDOs too are indeed constructed, but out of whole cloth, as it were, and it is important to realize just how different these products are from those that we ordinarily think of as manufactured products. Financial derivatives such as CDOs, like other financial instruments of a more familiar nature, such as bonds, must be given an investment grade in order to be marketed and sold to investors. CDOs are rated through the use of complex mathematical models; but synthetic CDOs – which reference pure CDOs – need a second round of mathematical modeling; in other words, a modeling of another model. This gives them a rather ethereal character. It would be difficult to say, in ordinary language, just what kind of widget they really are. Which is why the kinds of people who make up local school boards probably shouldn't be touching them.

So far no one in this particular case is suing S.&P., although last week it was revealed that the U.S. justice department has been quietly investigating the ratings agency practices (Louise Story, "U.S. inquiry said to focus on S.&P. ratings," *NYT*, 17 August 2011: http://tinyurl.com/3br4xoo). But as yet no government is suing the investment banks who – some would say – are the real authors of the wicked little games involving derivatives that played a big role in triggering the global financial crisis, resulting in staggering losses to individuals and governments and the accumulation of the massive amounts of public debt that are once again, right now, shaking the global economy.

This may be about to change: On the day this piece was first drafted, *The New York Times* carried a late-breaking story by Susanne Craig and Peter Lattman, "Goldman's shares tumble as Blankfein hires top lawyer," 22 August 2011 [referring to Lloyd Blankfein, CEO of Goldman, Sachs]: http://tinyurl.com/43ftg3t. Apparently there are moves afoot by agencies of the U.S. government that may lead to charges being filed against Goldman and perhaps other major investment banks for fraudulently misleading clients about the derivatives securities they packaged and sold to clients.

Note on subsequent developments in Jefferson County, Alabama:

See Campbell Robertson and Mary Williams Walsh, "Debt Crisis? Bankruptcy Fears? See Jefferson County, Ala." *NYT*, 29 July 2011: http://tinyurl.com/3vwtenp. They write: "The complicated bond-and-derivative structures failed during the financial turmoil of 2008, leaving the county with a $3.2 billion debt to pay, faster than planned. Sewer revenues that

were pledged to pay the debt cannot keep up." The county is facing a law that says that the interest on the bonds they issued must be paid even if the county declares bankruptcy. See also Joe Nocera, "Sewers, Swaps and Bachus," *NYT*, 22 April 2011: http://tinyurl.com/3wecuek.

Local officials across the USA and in Europe from Norway to Italy are involved in lawsuits and recriminations after being cajoled into entering the dark and treacherous waters where complex financial derivatives swim freely and seek to feed on the unsuspecting. Only strong and intelligent regulation of financial markets can protect the rest of us from these kinds of entirely legal depredations. But as Joe Nocera shows in his column cited above, in the U.S. at least financial industry lobbyists and their Congressional enablers are still fighting tooth and nail against such regulation (and, if the past is any guide, they will succeed). *Caveat emptor*.

Author's Note: The use of the word "rube" (referring to an unsophisticated person from a small rural town) in this piece is meant affectionately, since I am one of them and, in a modest way, I too got caught up in the mess discussed here.

Catastrophic Failures in Risk Management: The 2011 Nuclear Crisis in Japan

27 June 2011

I: PPT presentation by Dr. Atsuo Kishimoto.

Dr. Atsuo Kishimoto is a member of the Research Institute of Science for Safety and Sustainability (RISS), National Institute of Advanced Industrial Science and Technology (AIST) , Onogawa 16-1, Tsukuba 305-8569, Japan. This presentation was delivered at the iNTeg-Risk Annual Conference, 7-8 June 2011, in Stuttgart, Germany and is made available here with the kind permission of Dr. Kishimoto:

Atsuo Kishimoto, "Risk governance deficits in the multiple risk situation: The Great East Japan Earthquake, Tsunami, and Fukushima nuclear accident" [PPT]: http://leiss.ca/wp-content/uploads/2011/06/IR_JP-1-4_Kishimoto.pdf

II: Reporting in *The New York Times.*

The essential mission of risk management is to "anticipate and prevent or mitigate harms that may be avoidable." The detailed, retrospective analysis of risk management failures is a crucial aspect of learning from mistakes and making the requisite changes to avoid or mitigate future failures. This type of analysis seeks to provide a precise accounting of the situation as it existed *before* the catastrophic failure occurred, included what was known, or reasonably should have been known, by the main actors in the events, about relevant information and alternative strategies for risk reduction. (Thus it is not a case of adding blame after the fact for mistakes that could not have been foreseen by anyone.)

A series of articles published in *The New York Times* since March 2011 is indispensable for understanding what when wrong, and why. For a full list of all articles, go to: *The New York Times*, "Times Topics":
EARTHQUAKE, TSUNAMI AND NUCLEAR CRISIS
http://topics.nytimes.com/top/news/international/countriesandterritories/japan/index.html

The following *Times* articles are of particular interest:

1. "Japanese Rules for Nuclear Plants relied on Old Science," by Norimitsu Onishi and James Glanz, 26 March 2011:
   The offshore breakwaters protecting Japan's nuclear plants – all of which face the sea – were designed to protect against the risk of typhoons, but not the risk of tsunamis. In general, this article's review of Japan's approach to nuclear safety concludes: "Japan is known for its technical expertise. For decades, though, Japanese officialdom and even parts of its engineering establishment clung to older scientific precepts for protecting nuclear plants,... failing to make use of advances in seismology and risk assessment since the 1970s."

2. "Culture of Complicity tied to stricken Nuclear Plant," by Norimitsu Onishi and Ken Belson, 26 April 2011:
   This article details the long-term web of complicity among industry officials, politicians, and government regulators which ensured that dissenting views on risk management were systematically excluded from consideration. "Influential bureaucrats tend to side with the

nuclear industry – and the promotion of it – because of a practice known as amakudari, or descent from heaven. Widely practiced in Japan's main industries, amakudari allows senior bureaucrats, usually in their 50s, to land cushy jobs at the companies they once oversaw."

3. "Japanese Officials ignored or concealed Dangers," by Norimitsu Onishi and Martin Fackler, 16 May 2011:
   During decades of successfully battling against lawsuits filed by civilians against the nuclear industry in Japan, industry officials and academics regarded as friendly to the industry systematically covered up deficiencies in the siting of the plants, seismological records, the existence of fault lines, and the viability of the safety measures at the plants.

4. "'Safety Myth' left Japan ripe for Nuclear Crisis," by Norimitsu Onishi, 24 June 2011:
   The use of robots for emergency measures at nuclear plants – especially when radiation levels are very high – is standard in the industry around the world, but not in Japan, despite the fact that it is the world's leader in robotic technologies. Why not? Hiroyuki Yoshikawa, a robotics expert, explained: "The [nuclear] plant operators said that robots, which would premise an accident, were not needed. Instead, introducing them would inspire fear [among the public], they said. That's why they said that robots couldn't be introduced."

Catastrophic Failures in Risk Management: Blood Donation Risk and Gay Men

29 June 2011

As we are now seeing in the long-running global financial crisis, the initial stages of catastrophic failures in risk management can have follow-on consequences over long periods of time. In the case of blood donation risk, the infection of blood recipients by the HIV and Hepatitis C viruses in many countries around the world, including Canada, in the 1980s was such a catastrophic failure. This risk is known as "transfusion-transmitted infection" (TTI). [Those unfamiliar with these events and their causes should consult the 3-volume report by Mr. Justice Horace Krever, *Final Report of the Commission of Inquiry on the Blood System in Canada* (1997): http://www.hc-sc.gc.ca/ahc-asc/activit/com/krever-eng.php.]

Because male homosexual activity was a key vector in the transmission of these viruses, leading to the contamination of donated blood, blood agencies around the world introduced, in the late 1980s, a policy of "deferral" – a curious euphemism for what amounts to a ban – on blood donations by "men who have had sex with men [MSM], even one time, since 1977." This is the language of the lifetime ban that is in effect today in most countries of the world, including Canada, the U. S., and much (but not all) of Europe. Other countries have 5-year or 1-year deferrals, which means that blood donation will be accepted from gay men who have been sexually abstinent for specific periods of time prior to the donation. (See the useful Wikipedia entry: http://en.wikipedia.org/wiki/MSM_blood_donor_controversy.)

Much has changed in the blood donation system since that time, including new forms of screening tests that are able to detect the presence of harmful viruses, capable of causing TTIs, at very low levels. The good news is that those who receive blood for reasons of medical necessity can be assured that the blood they are getting has never been as safe as it is now. But this is a risk scenario, where "very low risk" never means "zero risk." There are many reasons for this, including limits to detection technologies at very low levels, operational errors, and the constant possibility that a novel pathogen, for which no detection procedure exists, may appear at any time.

In general it may be said that the current blood donor system is very precautionary and will remain so. Blood agencies constantly monitor their pathogen-detection systems under quality control regimes, conduct rigorous surveillance for early detection of novel pathogens, and regularly re-assess their risk estimations for what is known as "residual risk," which is the risk that a harmful agent present in blood may escape detection prior to infusion in a patient. For Canada the most recent risk estimation for residual risk of HIV in donated blood is 1 in 8 million cases, which represents 1 case in about 10 years of blood donations.

Given the uncertainties that are inevitably present when we estimate very low risks, in this case the risk could be as low as 1 in 20 million donations. This illustrates a very important ethical principle that comes into play with the application of a precautionary approach to very low risks, namely, that we should not try to be more precautionary than our evidence allows us to be. Why is this so? Because these are risk estimations, and there is the possibility that what we fear – in this case, a harmful pathogen in donated blood – may not be there at all (see References: Hrudey & Leiss 2003).

One reason for applying this principle to blood donation risk is that protecting the blood supply from harmful pathogens is by no means a cost-free exercise. The activities of screening and treating donated blood have very specific costs associated with them, and those costs have risen sharply over the last decade. In Canada provinces pay for the costs of the blood supplied for medical uses, and these charges become part of the overall health care budgets for provincial governments. Demanding more and more stringent safety standards for blood increases its cost and this competes against other demands on those budgets. At some point a judgment has to be made that residual risks in blood are "as low as reasonably achievable" and that, based on current residual risk estimates, blood is "safe enough." (Of course, new information, such as the discovery of a novel pathogen, changes this calculus.)

The ethical principle that we should not try to be more precautionary than our evidence allows us to be also applies to policy choices. The policy that imposes a lifetime ban on blood donations by gay men in Canada is such a choice. It is made despite the fact that what was once a ten-year ban (the 1987 ban on men who have had sex with men since 1977) has become, with the mere passage of time, a 34-year ban. It is made despite all the subsequent changes in the specificity and sensitivity of screening and treating technologies for harmful pathogens in blood. It should not be allowed to stand or to go unchallenged. (For a technical review of these issues see References: Leiss et al. 2008.)

In the last few years good arguments have been made in the medical literature in support of a drastic shortening of the lifetime ban (see the References section at the end). In Australia, where the practice is a 1-year deferral, a policy that has been in effect for over a decade, there is now some evidence to support the conclusion that a 1-year ban represents no "increased recipient risk for HIV" (References: Seed et al. 2010). HIV is of course a known pathogen. But the greatly enhanced global surveillance for novel pathogens that has been introduced in

the past 30 years ought to be regarded as providing substantial protection against the risk that a novel pathogen, using male homosexual activity as a vector, could re-infect donated blood before it was detected. Adding some extra precaution for novel pathogens strongly suggests that a 5-year deferral could be implemented without increasing residual risk. Once further evidence had been accumulated as a result of that policy change, one could be in a position to move more confidently to a 1-year deferral period or to some other appropriate policy choice.

This argument suggests, in effect, that the level of protection against the residual risk of TTI in blood donated by gay men that is mandated in the current lifetime ban is an ethical and legal violation of the right of gay men to be protected against an unreasonable form of discrimination based on sexual orientation.

This is, in fact, a case illustrating the theory of tragedy developed by the philosopher Hegel (1770-1831: see the Wikipedia entry, "Tragedy"). Hegel argued that tragedy originates not in the struggle between right against wrong, but between two competing and equally compelling rights. In the blood case, one of the unassailable rights is the right of blood recipients to be protected by all reasonable means against the threat of transfusion-transmitted infection. No one would argue against such a right. But, on the other side, the current policy of a lifetime ban against blood donations by gay men represents – in my view, unarguably – an unreasonable form of discrimination based on sexual orientation.

Why does this representation of the issue seem to depend on the contrast between "reasonable" and "unreasonable" forms of discrimination? This is because of the underlying argument that the policy choices we make in such matters ought to be firmly grounded on the evidence we possess – in this case, the risk assessment for residual risk in donated blood. The evidence we now possess is that donated blood is not safer, in any measurable sense, in choosing a lifetime ban against a 5-year (or perhaps even 1-year) deferral. Therefore the longer ban is unreasonable and should not be allowed to stand.

In a democratic society public policy choices are, and should be, ultimately political choices. And it is very clear that in Canada and elsewhere, there is no broad political appetite for taking up this issue.

But recently in Canada it also became a matter of legal dispute, in a case decided by Justice Aitken in the Superior Court of Ontario in September 2010 (Canadian Blood Services v. Freeman: See References for the complete text). The defendant claimed that the lifetime ban on gay men donating blood violates his Charter rights. In such cases Canadian courts will apply the so-called "Oakes test" (see the Wikipedia entry, *R. v. Oakes*), based on a 1986 decision at the Supreme Court of Canada written by then-Chief Justice Brian Dickson. The key issue is on what basis the courts will permit certain limitations on the rights and freedoms of individuals listed in Section 1 of the Charter. The Oakes test sets three hurdles that must be surmounted for a limitation on a fundamental right to be permitted:

1. The limitation must be "rationally connected" to the objective sought by the policy in question [the "rational connection" principle];
2. The means by which the limitation is implemented must impair the right "as little as possible" [the "minimal impairment" principle];
3. The effects of any limitation must be "proportional" to the achievement of the objective [in this case, the safety of the blood supply].

Much of the substance of the case became effectively moot when Justice Aitken ruled that Canadian Blood Services [CBS] was not subject to the Charter. However, in a remarkable extension in what became a 177-page decision, Justice Aitken went on to ask how she might have ruled on the substantive Charter issues *if* she had found that CBS was indeed subject to the authority of the Charter – or, in legal terms, if a Section 1 analysis had been necessary in deciding the case. In the last paragraph of her decision she wrote (p. 177): "In conclusion, had a s. 1 analysis been required in this case, I would have found that CBS and Canada would not have met the test for minimal impairment with the MSM deferral period now being 33 years and increasing by an additional year annually."

Justice Aitken further commented (p. 175) that, had she found that a s. 1 analysis was required in order to resolve the case, she would have, in effect, required both CBS and Health Canada, as the two cooperating regulators of blood safety in Canada, to return to the court with submissions, based on evidence, justifying their choice of a period of time shorter than 33 years (as it was in 2010) for a deferral period.

Thus, to sum up, the original catastrophic failure in the risk management of donated blood, in Canada and elsewhere during the 1980s, gave rise to a second failure, which continues down to the present day. This second failure, attributable to the blood regulatory agencies, is the unwillingness to adjust the deferral period for blood donations by gay men in accordance with evidence-based reasoning. It amounts to a clearly unreasonable form of discrimination based on sexual orientation, and it is a public policy scandal, a blemish on our devotion to the rights and freedoms of individuals that will persist until it is changed, as it must be.

Additional Notes on CBS v. Freeman:
I am not qualified to comment on the legal argument under which Justice Aitken ruled that CBS is not subject to the Charter and that therefore the appeal to the protection of Section 1 of the Charter must fail, even though the Government of Canada was also named as a defendant in Freeman's counter-claim. Thus this may be good law; but it is certainly also bad public policy. All of the screening tests devised by CBS (including the lifetime ban on gay men) are subject to approval by Health Canada, which holds the relevant legal authority under the *Food and Drugs Act* (s. 12 and Schedule D), where blood is regulated as a drug. And CBS could not change the current policy on donations by gay men without approval by the superior authority of Health Canada. (As a federal department Health Canada is subject to the Charter.)

The CBS website contains the following statement:
"We are, and always have been open to changing the policy as long as safety can be maintained and the evidence supports it. Both patient groups and Canadian Blood Services agree that the current lifetime ban needs to be reconsidered, as was stated in a recent Ontario Superior Court decision."

(http://www.blood.ca/centreapps/internet/uw_v502_mainengine.nsf/web/A4B9BA180CA282E085257826000F146B?OpenDocument)

References:
Note: Unfortunately, the text of these materials (except for the first two) is not available free of charge to those using private computers, but can be downloaded as PDF files by those who have access to a university computer account.

Steve Hrudey and William Leiss, "Risk Management and Precaution," *Environmental Health Perspectives*, vol. 111, no. 13 (October 2003), 1577-1581: http://leiss.ca/wp-content/uploads/2009/12/risk_management_and_precaution_insights_on_the_cautious_use_of_evidence.pdf

Canadian Blood Services/Société Canadienne du Sang v. Freeman, 2010 ONSC 4885: http://www.blood.ca/CentreApps/Internet/UW_V502_MainEngine.nsf/page/CanadianBloodServicesCEOGivesInitialReaction?OpenDocument&CloseMenu [statement by CBS and link to the complete text of the court decision, Part I (pp. 1-112) and II (pp. 113-end)].

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William Leiss, Michael Tyshenko, and Daniel Krewski, "Men Having Sex With Men Donor Deferral Risk Assessment: An Analysis Using Risk Management Principles," *Transfusion Medicine Reviews*, Vol 22, No 1 (January), 2008: pp 35-57.

Note: And earlier and substantially similar version of this article is available at: http://leiss.ca/wp-content/uploads/2009/12/donor_deferral_risk_assessment.pdf

Eleftherios C. Vamvakas, "Scientific Background on the Risk Engendered by Reducing the Lifetime Blood Donation Deferral Period for Men Who Have Sex With Men," *Transfusion Medicine Reviews*, Vol 23, No 2 (April), 2009: pp 85-102.

Mark Wainberg et al., "Reconsidering the lifetime deferral of blood donation by men who have sex with men," *CMAJ*.2010; 182: 1321-1324.

Clive R. Seed et al.**, "**No evidence of a significantly increased risk of transfusion transmitted human immunodeficiency virus infection in Australia subsequent to implementing a 12-month deferral for men who have had sex with men (CME), *Transfusion*, Volume 50, Issue 12, pages 2722-2730 (December 2010):

"We found no evidence that the implementation of the 12-month deferral for male-to-male sex resulted in an increased recipient risk for HIV in Australia. The risk of noncompliance to the revised deferral rather than its duration appears to be the most important modifier of overall risk."

Eleftherios C. Vamvakas, "Relative Risk of Reducing the Lifetime Blood Donation Deferral for Men Who Have Had Sex With Men Versus Currently Tolerated Transfusion Risks," *Transfusion Medicine Reviews*, Vol 25, No 1 (January), 2011: pp 47-60.

Catastrophic Failures in Risk Management: The Terrorist Attack on Air-India Flight 182

30 June 2011

The month of June 2011 marks the first anniversary of the release of *Air India Flight 182: A Canadian Tragedy*, the final report of the Commission of Inquiry into the Investigation of the Bombing of Air India Flight 182, headed by Mr. Justice John Major.

The mid-flight destruction of Flight 182 off the Irish coast on 23 June 1985 killed all 329 passengers and crew; an explosion at Narita Airport in Japan, which was part of the same terrorist plot, killed two baggage handlers there. The resulting toll represents, still today, the second-largest loss of life (second only to the September 11, 2001 events in the United States) in a single terrorist plot ever to occur anywhere in the world.

The work of the Commission of Inquiry took place over a period of four years and included an exhaustive review of documentary evidence, lengthy hearings at which witnesses were heard and examined, and the compilation of a large collection of research papers containing expert analysis. Relatives and friends of the murdered victims had waited more than a quarter-century for a full accounting of what was, in the Commission's considered view, a preventable tragedy.

The Wikipedia entry, "Air India Flight 182," provides a useful overview of the events and the reactions to them over the entire period. The entire five-volume Final Report of the Commission of Inquiry is available on a CD-ROM at a cost of $29.95: http://publications.gc.ca/site/eng/370979/publication.html.

Following are two excerpts from Chapter V of Volume 1 (The Overview).

Page 166:

"The bombing of Air India Flight 182 was preventable but was made possible because of an unintentionally coordinated series of aviation security failures on the part of a number of stakeholders:

- CP Air failed to follow its own baggage security procedures;
- Both Air India and Transport Canada failed to appreciate the threat posed by unaccompanied, interlined bags;
- Air India was inexcusably careless in deploying checked baggage screening devices and procedures which it ought to have known were inadequate for the purpose, and failed to prevent unauthorized bags from being placed on its flights;
- Transport Canada, on behalf of the Government of Canada, failed in its role as regulator by neglecting to adapt the existing aviation security regime to confront the known terrorist threat of sabotage;
- Transport Canada also failed in its regulatory role by denying Air India the security support it required and by permitting Air India to rely on security procedures and plans that were inadequate to respond to the known threat of sabotage;
- Due to a climate of excessive secrecy nurtured by uncritical

adherence to the "need-to-know" principle, crucially important intelligence was not shared, nor was it collected and analyzed in a coordinated manner; and

- Each of Air India, Transport Canada and the Royal Canadian Mounted Police (RCMP) failed to appropriately assess threat and intelligence information and to adequately communicate such information to relevant stakeholders."

Page 168:

"In fact, security measures that could have prevented the suitcase containing the bomb from being placed on the flight were available, but were simply not implemented."

Disclosure:
I assisted the Commission of Inquiry as an expert on risk management and risk communication.

Risk Management Cases:
Drilling for Shale Gas: Hydraulic Fracturing ("Fracking")

20 July 2011

The environmental risks associated with drilling for shale gas, and the extraction process known as "hydraulic fracturing" ["fracking"], are receiving a good deal of attention in Canada, the United States, and elsewhere.

The state of New York has had a moratorium on shale gas development for the past year, but Governor Mario Cuomo has recommended that it be lifted in favour of permitting activity in selected areas. The Province of Quebec now has a two-year moratorium in place and has indicated that further research will be required before it is known whether the environmental risks can be limited to acceptable levels.

Readers who are interested in this issue, especially those who live in or near areas where underground shale deposits may attract this activity, will be interested in the following current resources.

1. Scientific Article:

   "Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing," *Proceedings of the National Academy of Sciences* (May 2011): open access PDF file available at: http://bit.ly/mW2QZO

2. Report by Quebec Ministry of the Environment:

"Développement durable de l'industrie des gaz de schiste au Québec" (complete report, 323 pp., February 2011, PDF file): http://bit.ly/rkP6dl

English translation of excerpts: "Sustainable Development of the Shale Gas Industry in Québec (PDF file)": http://bit.ly/psW3cm

3. New York State report:

New York State, Department of Environmental Conservation, "Horizontal Drilling and High-Volume Hydraulic Fracturing in the Marcellus Shale and Other Low-Permeability Gas Reservoirs," Preliminary Revised Draft environmental impact statement (July 2011):

http://www.dec.ny.gov/energy/75370.html [full report available in a 29MB-PDF file, can be downloaded also chapter-by-chapter]

4. Environmental group:

Natural Resources Defense Council [http://www.nrdc.org/], search under "shale gas" http://bit.ly/q7DzyV and "hydraulic fracking" http://bit.ly/nmQuVa

5. Newspaper coverage of issue:

The New York Times, search under "hydraulic fracking" and "shale gas"

6. Wikipedia:

Hydraulic fracturing: http://en.wikipedia.org/wiki/Hydraulic_fracturing

7. National Ground Water Association brief:

The National Ground Water Association's brief on "Water Wells in Proximity to Natural Gas or Oil Development" is aimed at well owners. It's well written, in plain language, and provides sound practical information and advice that can be quite useful for well owners living in areas of oil and gas exploration, including shale gas. It can help well owners living in areas where exploration is planned (i.e. list of things to do before exploration has started). The document is available at:

http://www.ngwa.org/Documents/Water_Wells_in_proximity__info_brief_2011.FINAL.pdf

[Thanks to my colleague René Therrien at Université Laval for this.]

Fat Tails and Climate Change: Catastrophic Failures in Risk Management

July 20, 2011

The phrase "fat tails" became familiar to some people after the storm broke in 2008's global financial crisis. A fat tail refers to the probability and consequences of a possible event that is outside the bounds of our normal expectations, as defined either by our prior experience or by accepted theories – for example, theories of the behaviour of financial markets.[1] More specifically, it refers to the probability of an adverse event (such as a financial crisis) that is both *more likely* to occur than is "normally" expected, and that if it should occur could have *catastrophic dimensions*. [See www.fattails.ca and the lovely 2010 animated graphics in *The Economist*: http://econ.st/n9xYZq.]

Fat tails are very important for risk estimates dealing with the likelihood and outcomes of adverse events of all kinds. Some of the controversy about the global financial crisis that began in 2007/8 has to do with what our "normal" expectations are for the collapse of banks and other financial institutions that are "too big to fail." (This is now referred to as "systemic risk" or "systemically important financial institutions, markets, and instruments."[2]) Some of the major banking players claimed, after the event, that what happened in late 2008 was so remotely improbable that no rational person could have forecast it. What they forget to mention is that since their risk models completely ignored systemic risk, where hidden correlations among asset classes lurked, they had no idea they even had to manage this risk.[3]

Climate change risk poses a somewhat different form of this same problem. The key risk here is represented by the process known as "radiative forcing," whereby higher levels of atmospheric CO_2 and other greenhouse gases, such as methane, trap more of the sun's energy as it strikes the earth. The current "best estimate" of temperature increase in response to a doubling of atmospheric CO_2 since 1750 is somewhere in the range between +2.0°C and +4.5°C (or 3°C ± 1.5°C). This is, obviously, a fairly substantial range, and if the increase were to be in the upper part of the range (the "extreme tail"), the effects on the environment that now sustains human productivity on the planet could be severe.[4] What one would like to do under

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[1] See the discussion in my book, *The Doom Loop in the Financial Sector, and Other Black Holes of Risk* (University of Ottawa Press, 2010), pp. 90-93, and the PPT presentation, "Blindsided by Risk" (June 2011): http://leiss.ca/wp-content/uploads/2011/06/Blindsided-by-Risk.pdf.

[2] IMF and others, "Guidance to Assess the Systemic Importance of Financial Institutions, Markets and Instruments: Initial Considerations" (October 2009): http://bit.ly/roLSRQ.

[3] Joe Nocera, "Risk Mismanagement," *The New York Times Magazine*, 2 January 2009: http://nyti.ms/nkeBtJ and especially Andrew Haldane, Bank of England, "Why banks failed the stress test" (February 2009): http://bit.ly/qIJBva.

[4] Some current policy positions, for example in the European Union, seek to limit the temperature increase to no more than 2.0°C. Andrew Weaver et al., "Long term climate implications of 2050 emission reduction targets," *Geophysical Review Letters*, vol. 34, L19703 (2007, 1-4), seek to show just how difficult that minimum target (at the *bottom* of the range) will be to achieve, arguing that "even if emissions are eventually stabilized at 90% less than 2006 levels globally (1.1 GtC/year), the 2.0C threshold warming limit advocated by the European Commission is eventually broken well before the year 2500" (p. 3).

these circumstances is to reduce the degree of uncertainty that is represented in the wide distribution between the lower and upper levels of the range. But at least one main obstacle is the nature of what is known as "climate sensitivity."

Climate sensitivity is the interaction between changes in radiative forcing and changes in the climate response to it (http://en.wikipedia.org/wiki/Climate_sensitivity), e. g., in global average temperature. But the nature of climate sensitivity makes it unlikely to expect that we will be able to reduce this degree of uncertainty, no matter how much more climate science knowledge we accumulate. Roe and Baker note:[5]

[T]he data that we have on extreme climates [for example, the Eocene warmth and Proterozoic "snowball Earth"] suggest that the climate system may have been acutely sensitive to radiative forcing during some intervals of Earth's history. Our results imply that dramatic changes in physical processes are not necessary for dramatic changes in climate sensitivity, provided that those changes in processes can all align in the same direction toward increased sensitivity [i.e., are correlated].
They conclude that "the climate system is [now] operating in a regime in which small uncertainties in feedbacks are highly amplified in the resulting climate sensitivity."[6] These feedbacks are what produce the "fat [extreme] tail" on the high side of the estimates for the likely impacts from rising GHG concentrations. *This is the "kicker" in their analysis: If we are now in the "regime" described just above, then even small changes in radiative forcing from GHG emissions could have very large future impacts.*

Current CO_2 global average concentrations are about 390ppm.[7] The *Climate Change 2007* report from IPCC notes: "The atmospheric concentration of carbon dioxide ... now exceeds by far the natural range over the last 650,000 years (180 to 300ppm) as determined from ice cores."[8]

One sensible reaction to large uncertainties in the estimation of future adverse impacts of any kind would be to increase the margin of safety or margin for error – a precautionary approach in case the extreme tail of the range comes to pass. Toward this end we would now be reducing global greenhouse gas emissions [GHGs], or at least trying to keep them at the same level as they are; or, if we cannot do that (and obviously we cannot), it would mean at least starting to slow the *rate of increase* in GHGs. But taking the globe as a whole, we humans are doing the *exact* opposite:[9]

> The increase of all GHG gasses has been particularly rapid since 1950.
> The first 50 ppm increase above the pre-industrial value of carbon

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[5] Gerard H. Roe and Marcia B. Baker, "Why is climate sensitivity so unpredictable?" *Science*, vol. 318 (26 October 2007), pp. 629-632.

[6] For an explanation of these feedbacks see: http://www.epa.gov/climatechange/science/futuretc.html.

[7] Ppm = parts per million; ppmv = parts per million volume.
[8] Intergovernmental Panel on Climate Change: Volume I, p. 2. See also: http://en.wikipedia.org/wiki/Carbon_dioxide_in_Earth's_atmosphere

[9] European Environment Agency, "Atmospheric Greenhouse Gas Concentrations" (November 2010): http://bit.ly/pMz6Qf . For a comprehensive study, see: U. S., National Research Council, *Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades and Millennia* (2011): http://www.nap.edu/catalog.php?record_id=12877 [free PDF].

> dioxide (CO_2) for example, was reached in the 1970s after more than 200 years, whereas the second 50 ppm was achieved in about 30 years. In the recent 10 years the highest average growth rate has been recorded for any decade since atmospheric CO_2 measurements began (IPCC, 2007). This increase was nearly entirely caused by human activities....

Levels of carbon dioxide in earth's atmosphere at the beginning of the industrial era around 1750 are estimated to have been 260-280ppm. Based on realistic current projections of steady or accelerating growth in such emissions, it is likely that we will hit 450ppm by 2015 and twice the preindustrial levels (550ppm) a decade later, if not sooner. Given the time it will take to reverse the massive, still-growing infrastructure in fossil-fuel energy production, it is not entirely out of the question that unless drastic changes are made we will reach 3 or 4 times preindustrial levels before the end of this century.

One academic specialist concludes the abstract of his recent technical paper with this decidedly droll comment: "Effectively, civilization is in a double-bind. If civilization does not collapse quickly this century, then CO_2 will likely end up exceeding 1000 ppmv; but, if CO_2 levels rise by this much, then the danger is that civilization will gradually tend towards collapse."[10]

In the face of intractable uncertainties, we have decided to continue rolling the dice, in the hope that maybe such a disaster won't happen after all. Is this indifference to climate change risk in some perverse way a rational response? The climate models predict that the most serious impacts from continued radiative forcing will occur after 2100. Does our indifference perhaps reflect some quirk in the deep evolutionary structure of the human brain, which makes it impossible for us to take seriously a threat to the well-being of future generations? One should admit that it is difficult to ask people to spend real money now for *possible* benefits they will never see in their own lifetimes, and maybe not even in their children's lifetimes.

These are properly labeled "possible benefits" either because what we spend now may be too late to do any good, or because the problem may disappear of its own accord through some means we are unable to identify at the moment, or because the threat of human-induced major global warming may be a "hoax" perpetrated by climate scientists. The last-mentioned reason at least provides some ironic humour and might be regarded as entertaining, if the stakes weren't quite so high.[11]

Our indifference to the risk of climate change and its possible "fat tail" amounts to a massive wager we have made in nature's casino. We might want to remember that we don't make the rules there.

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[10] T. J. Garrett, "Earth System Dynamics Discussion," 2, 315-354 (2011): http://tinyurl.com/3ecsf89

[11] For a fine commentary on this silliness see Gary Gutting, "On experts and global warming," *The New York Times*, 13 July 2011: http://nyti.ms/qTJP04 , and the quotes on climate science in Paul Krugman, "Republicans against science," *The New York Times*, 29 August 2011: http://tinyurl.com/3e7uzm5