Operational Risk Under Basel II: A Model for Extreme Risk Evaluation

By James Franklin

"Banking compliance in world historical perspective" perhaps sounds overly ambitious. Bankers are not used to thinking of themselves as at the forefront of historical movements or major conceptual developments. But the Basel II compliance regime is a leading example of the international special-purpose regimes that are gradually taking on the role of world government, and its methods mark an important advance in the handling of risk. In particular, its approach to operational risk is a sound model for the evaluation of extreme risks, an essential but inherently difficult task in areas as diverse as biosecurity and anti-terrorism.

Although there is no international government and no prospect of one any time soon, there are powerful and stable regimes of international cooperation on many particular matters. They are motivated in large part by risk, which prompts co-operative action more effectively than most drivers. If the prospect of hanging concentrates the mind wonderfully, the threat of an avertable hanging channels the concentration into planning in concert with others facing the same risk. The risk of invasion and the threat of terrorism are high-profile examples that have seen the creation of international alliances and cooperative efforts by police and intelligence services that would never have come into being in more peaceful times. In contrast to international problems that do not seem to pose an urgent threat to powerful international actors, the refugee and African poverty problems, for example, risk that could strike at home produces concerted action in distant parts.

The current international regimes on less military threats descend from 19th century efforts at cooperation like maritime safety regulations and the International Postal Union. They now include the Basel II regime in banking, IFRS in accountancy, the FIRST computer incident response system, the World Health Organization's system for containing global epidemics, and many others. They form in effect a very powerful international public sector based on technical expertise. They are part of a wide international process whereby urgent globalized risks are taken in hand by global agencies whose directives based on technical expertise have wide applicability via a network of national affiliates and hence have a status as *de facto* global law. [1]

The highly technical nature of these developments has caused them to be somewhat overlooked by humanities-oriented legal and political theorists. It has, however, also meant that concerns about loss of national sovereignty have not much hindered the development of these regimes. The apparently non-legal and semi-voluntary nature of the standards has contributed to their ease of acceptance by those concerned about threats to sovereignty, while their being based on technical expertise gives them credibility as relevant solutions to the problems that they address.[2] The role of committees of experts means that the setters of the standards are to some degree accountable to the body of relevant experts (though not to other stakeholders such as the general public or national governments).[3]

History of International Finance and Global Risks

The financial system does not have the same urgency in its risks as, for example, health and terrorism, since the risks in question are rarely life threatening. On the other hand, commerce is naturally international. International trade has always been a large part of all trade, and diversity of regulations is a major impediment to it. The "liquid" nature of money means that financial crises easily spread and that capital can fly from one country to another. Commerce and finance have therefore had very long experience in international cooperation in dispute resolution, standardization, and regulation going back the medieval Law Merchant. Run by merchants for merchants, it could consider technical

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commercial matters, the "customs of merchants," possibly beyond the understanding of mere lawyers (such as bills of exchange, implied warranties, and patents). Some of its discussions are preserved in the ethical-legal compliance system imposed on medieval commerce by the Church, the ecclesiastical law of usury; it contains, for example, the first extended analyses of risk in insurance, annuities, and forward contracts. [4] The achievements of these laws in regulating commercial practice were eventually incorporated into the commercial law of modern individual states.

Risk also drove national regulation of certain industries, beginning with the actuarial profession, which has now had a century and a half of national legal regulation. That is made necessary by the time structure of the risks involved in life insurance. The insurer takes in money many years in advance of paying out claims, so there is a temptation to live off the money received in the early years and offer competitive but unsustainable rates, undercutting more responsible competitors to the ultimate disadvantage of customers. The unregulated situation of the early 19th century, satirized by Dickens in his invention of the fraudulent Anglo-Bengalee Disinterested Loan and Life Assurance Company, made it impossible for life insurers to gain the trust of customers without heavy regulation of the industry.[5] Despite widespread doubts in the period of *laissez faire* economics on the wisdom of regulating any form of commerce, the actuarial profession became highly regulated, but the supervision was outsourced to the actuarial profession itself, which was entrusted with ensuring its own expertise in difficult mathematics and its professional integrity through a rigorous system of examinations. The profession has remained highly regulated but has not been to the fore in the internationalization of its standards. It has been overtaken in that regard by accountancy and especially by banking.

The International Banking Compliance Regime

In banking, a history similar to that in life insurance has resulted in a more powerful international body than any found in the actuarial world—the Committee on Banking Supervision of the Bank for International Settlements in Basel, which enforces the Basel II standards.[6]

As in the case of the long-time scale on which actuaries work, there are special reasons why banking should be regarded as a prime candidate for regulation, reasons that do not apply to business in general. Quite apart from the centrality of banking to the economy and demands by socialists and Keynesians for its regulation, there are problems with risk that motivate regulation from outside the industry and from within. There is a problem with information asymmetry, in that customers have little ability to evaluate the risks that banks face, and for the same reason a failure of a bank affects the whole industry since customers cannot easily distinguish one bank from another. The global reach of banks means that any regulation needs to be international to be fully effective, as otherwise banks can evade regulation through offshore operations.[7]

Banks are regulated in various ways, but from the point of view of risk, the most important target of regulation is banks' reserves against risk. The nature of a bank is to take in funds, then lend most of them out for profit, while reserving some against risks. The risks are varied: of default by creditors, of movements in exchange rates, of the disappearance or devaluation of assets, and "operational risk," a heterogeneous category that will be discussed later.[8] A prudent bank must quantify all those risks to reasonable accuracy and reserve sufficient funds against them (or against all but the most huge and uncontrollable of them). A cartel of prudent banks has an interest in regulating the banking industry so that would-be imprudent fly-by-night banks do not grab market share by offering favorable rates of interest at the expense of under-reserving. Needless to say, quantifying the risks and their interactions is not easy, while alternatives to quantifying such as a rule of thumb like reserving some fixed percentage of deposits is far from adequate (though common in the past). There are further subtleties over what is to count as reserved funds (gold in the vault should count, but what about likely future tax breaks?). The industry has an interest in international as well as national comparisons, not only because banking is now international but also in order to discover if the banking conditions in some countries are more stable than in others.

Nineteenth century banks were often unstable, and it came to be generally accepted that some sort of regulation of risky investments by banks was necessary. The Bank of England, followed by other central banks, gradually took on a supervisory role in ensuring the

stability of the banking system as a whole.[9] Mid-20th century banking was highly regulated in such matters as interest rates, exchange rates, and entry to the industry. A period of deregulation in the 1980s removed many of those restrictions, but reserving against risk did not go through the same process and was generally thought to be in need of stricter regulation, ideally on an international scale. This was the background to the Basel initiatives undertaken by the Committee on Banking Supervision of the Bank for International Settlements, the original Basel Capital Accord of 1988 (Basel I), replaced by the more elaborate but flexible Basel II (final version released in 2004, with implementation in many countries by 2006). Formally, the Committee represents only the central banks of the G10 countries and has no legal standing or legal backing of its own (nor is it subject to the control of any elected body that might influence it to take account of desiderata other then banking stability[10]). The Basel Committee operates on the premises of the Bank for International Settlements, an international organization, but is not an organ of the BIS, nor do its decisions need to be ratified by the BIS or by any national governments (though in 2005 directives that in effect implemented Basel II were approved by the European Parliament). Nevertheless, compliance with its standards by major banks in the major banking nations is almost total. In 2002, 90 percent of countries claimed to be following the Basel I capital adequacy standard.[11]

The essential difference between Basel I and Basel II with regard to risk is that the latter permits banks to evaluate their risks using any internal models and sophisticated statistical technology that they wish, provided that they disclose them to the (national) regulator (such as the Federal Reserve Board and the Bank of England) and the regulator approves. That naturally allows free rein for statistical expertise, both on the side of banks and on the side of the regulator. It promises to bring evaluation of risks much more in line with true risk.

Operational Risk as a Model for Extreme Risk Evaluation

Basel II has also forced banks to give more direct attention to risks that outsiders might first think of under the term "risk" but which have traditionally been thought of as too hard to quantify. It is agreed that, while credit, market, and insurance risks are relatively tractable as to methodology and the availability of necessary data, that is not the case for operational risk. Operational risk or oprisk ("the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events") is a grab bag of many kinds of risk, mostly of a rare and/or extreme nature.[12] They include the risks that may cause complete collapse of a bank. Merely classifying the kinds and establishing who has expertise in those various areas are substantial intellectual exercises. Table 1 shows a number of kinds of operational risk along with some examples of where those risks have been realized and some applicable methodologies. (The table includes a few risks that are not classified as oprisk under Basel II.)

It is widely agreed that there are unusual difficulties in the way of a bank's quantifying its operational risks adequately, or even of getting a ballpark figure for many of them. Availability of data is a major challenge. Individual banks rarely report internal frauds, for example, unless they are catastrophic. Therefore, an individual bank has very little data on past events of the sort that it fears may impact it severely in the future. It is not usual for individual banks to hold data on public events like tsunamis; banks are not in the business of environmental modelling. Therefore, there are opportunities for bank regulators to encourage a public center to warehouse shared and if necessary anonymized data and to broker the expertise of environmental and economic modelers on risks from external sources that can be studied with publicly available data.

It is generally agreed also that the diversity of operational risks creates methodological difficulties both in quantifying the individual risks and in estimating their interactions. Given that the (downside) tails of the distribution of events are crucial and that there is little data on tail events, it is necessary to avoid assuming that the events follow a standard distribution (such as the normal distribution) even if that fits the middle range of events well. Basel II mandates the use of Extreme Value Theory, the statistical methodology for extrapolation of the tails of distributions beyond the range of existing data.[13] The paucity of data on operational risks also means that it is essential to combine what data there is with expert opinion. The elicitation and calibration of expert opinion by small data sets is itself a difficult theoretical area.[14]

Table 1 Operational Risks		
Type of risk	**Example**	**Methodology**
Acute physical hazards	Tsunami, hail	Reinsurers' data + extreme value theory
Long-term physical hazards	Climate change	Climate modelling + work on effects on banking system
Biorisks	SARS, animal plague	Biomedical research + quarantine expertise
Terrorism	Bombing, Internet attack	Intelligence analysis
Financial markets risk	1997 Asian crisis, depression	Macroeconomic modelling, stock market analysis + extreme value theory
Real estate market risk	Home loan book loss of value	Real estate market modelling
Collapse of individual major partner	Enron	Data mining on company data
Regulatory risk	"Basel III", nationalization, government forces banks to pay universities for graduates	Political analysis
Legal risk	Compensation payouts for misinformed customers	Compensation law and likely changes
Managerial and strategic risk	Payout of unwanted CEO, dangerous management decision	
Internal fraud and human error	Barings rogue trader	Model pooled anonymised data, fraud detection
Robbery	Electronic access by thieves	Model pooled data, IT security expertise
Reputational risk	Run on bank, spam deceives customers	Goodwill pricing theory + marketing expertise
New technology risk	Technology allows small players to take bank market share	"Futurology"
Reserve risk	Reserved funds change value	
Interactions of all the above	Depression devalues real estate and reserves	Causal modeling of system interactions

Basel II's "Advocacy Model" of Oprisk Evaluation

The Basel II regime has implemented a style of combining quantitative data with expert opinion that is a sound model for the same problem in any field where risks need to be assessed beyond the range of available data. Its essential idea is to use the conflict between different perspectives on the data to keep the extrapolation honest.

There is a fundamental conflict between the perspective of the bank and that of the regulator. The bank wishes to minimize its calculated risks so as to be able to reserve less funds against them, allowing the bank to lend and make profit on as much money as possible. The regulator wishes to ensure that the bank fully states its risks and reserves against them so that the bank and the whole banking system remain stable. In operational risk in particular, where unusual "one-off" major events have occurred or may occur, there is potential for the results of arguments about particular cases to make a large difference to the amount of funds that a bank is required to hold in reserve and thus make no profit from. It is that conflict of perspectives and inherent

disputability of individual data points that has led the banking industry to develop a package of mathematical and legally inspired methods from which other areas such as biosecurity can learn.

Extreme risk analysis under Basel II is inspired by the familiar "adversary" model of reaching decisions in (Anglo-American) legal cases but has adaptations to suit the more quantitative nature of the data and the more cooperative relation that exists between the regulator and regulated than exists between opposing counsel in a court of law. The name "advocacy model" is appropriate.

It is mandated that larger banks at least should quantitatively model the probability of losses of various sizes in each of 56 cells: 8 "loss types" (such as external fraud, damage to physical assets) in 7 "business lines" (such as retail banking, asset management). An individual bank may have no or very few data points (over say the past five years) in some cells but hundreds in others. It is also mandated that the loss models should take into account four types of evidence: internal data, relevant external data (that is, aggregated data on other banks, possibly in other countries), scenario analysis (that is, what-if analyses conducted by teams of experts on situations of financial stress), and "factors reflecting the business environment and internal control systems." The models are expected to use state-of-the-art statistical methods such as Extreme Value Theory, with justifications of the distributional assumptions used. Correlations between the losses in different cells should also be modeled.

That provides a rigid and demanding framework for the format in which loss probabilities must be reported, but it is recognized that there are many points at which informed human judgment must come into play. They include borderline cases as to which losses should be classified into which cells (or divided among cells), the time to which a loss should be attributed, the likelihood of a previously experienced large loss recurring now that precautions against it have been taken, the relevance of external industry-wide data to the individual bank's case, and the judgments reached about the correlations between extreme losses in different cells (for example, estimating the impact of an IT meltdown on the bank's various lines of business). The bank's internal modelers and the regulator both understand that the outcome of the process—the figure that the regulator requires the bank to hold in reserve—is very sensitive to both individual large-loss data points and to assumptions about distributions and scenarios. Thus, the quantitative models are regarded as an essential first cut but are also taken with a grain of salt; they form the starting point for negotiations between modelers and regulators, often mediated by consultants. The consultants, specialists in operational risk from an independent firm, look at the modelers' attempts and advise on changes needed to meet the regulator's standards, while assuring the regulator that the modelers are reasonable in their assumptions and conclusions (or soon will be). Feedback proceeds up and down the line in a generally cooperative atmosphere.

The essential lesson that can be learned from the advocacy model as practiced in bank operational risk assessment is that the normally cooperative but potentially adversarial relationship between quantitatively astute parties on either side encourages the utmost use of sophisticated quantitative methods like Extreme Value Theory to make the most of data, but at the same time permits honesty in allowing all parties to understand and admit exactly where expert judgment goes beyond the data.

Extreme Risk Evaluation by the "Advocacy Model"

The Basel II methodology for operational risk is an excellent model for the evaluation of extreme risks in other high-consequence areas such as terrorism, biosecurity, and rare natural disasters.[15]

A risk is called "extreme" when it concerns an event that may happen very rarely or never. Such events are at the edge of or outside the range of what has occurred, possibly far outside. Any data are unlikely to be reliably representative. The problem of evaluating extreme risks is therefore fundamentally different from the standard statistical approach of choosing a model to describe a quantitative problem, fitting the parameters of the model to the data available, then using the resulting tuned model for prediction.

So probabilities of extreme events must be evaluated by combining disparate sources of evidence, none of which are reliable in isolation. Sources include whatever data there are, how far the event of interest

is from the data, the opinion of experts (possibly in diverse disciplines), arguments from analogy (that is, from events whose similarity to the event in question is debatable), specialist scientific causal knowledge relevant to the case, and commonsense knowledge. There is no established methodology either for computing or eliciting the probabilities arising from these sources of knowledge or for combining them once discovered. But the reasons for the difficulty of reaching a correct answer are the same as the reasons why it is important to succeed: Because when data are scarce, neglecting any source of evidence or any method of interpretation may lead to the misevaluation of extreme risks and to substantial, avoidable costs.

The advocacy model of Basel II's operational risk regime can be generalized to any case of extreme risk evaluation. In particular it allows these essential features of extreme risk to be taken into account:

- Debate can proceed as to the reliability and relevance of individual extreme data points; predictions tend to be sensitive to the few most extreme values, so it is worth devoting resources to studying whether those values may be "outliers" (mistakes or from another distribution) or no longer relevant (because of measures taken to prevent their recurrence).
- The technicalities of Extreme Value Theory can be applied to allow what data there is to speak, but the limitations of that method will be acknowledged; in general, advocacy methods, being run by experts under conditions of accountability, encourage the use of cutting-edge statistical and other technical methods.
- Scenario analysis can proceed in which teams of experts work through the likelihood of various what-if possibilities, but the team's conclusions are moderated by knowledge that there will be oversight by other experts such as regulators or consultants, who may challenge the assumptions.
- Imprecise probabilities can be used, but there will be some precision demanded as to the numerical range of probabilities covered by such terms as "quite likely" or "negligible."
- It will be possible to use the strengths but largely avoid the weaknesses of human intuitive judgment under uncertainty. For example "groupthink," the overconfidence of experts and their inability to know where their expertise ends, is moderated by the oversight of other, potentially hostile, experts, while the superiority of intuitive methods in making use of large bodies of contextual and commonsense background knowledge is incorporated.
- The availability of results and reasoning for scrutiny (perhaps only within an organization) avoids hasty misestimates and motivates the original estimators to devote effort to making their estimates defensible.

Methods not unlike those described have in fact been used in some other fields. For example, Australia, an island continent free of many pests that are endemic elsewhere, has a very stringent biosecurity regime. It operates in a highly politically charged atmosphere, with powerful Australian farming interests that are against imports facing would-be agricultural exporters from other countries supported by World Trade Organization free trade agreements. The risks of importing, for example, New Zealand apples are extreme risks in the sense that the risk of disease spread in an individual case is below the level observable by experiment but the consequences for Australian growers of the spread of a pest would be catastrophic. Biosecurity Australia has a public process where stakeholders put their case and there are several rounds of comment before a determination is reached, in a report that must be able to survive political and WTO scrutiny. The process is essentially similar to Basel II's oprisk regime.

The structure of extreme risk evaluation means that the advocacy method, so far best instantiated in bank operational risk evaluation, has the potential to be exported to all fields involving extreme risks.

Notes

1. J. Franklin, "Risk-driven global compliance regimes in banking and accounting: the new Law Merchant," *Law, Probability and Risk* 4 (4), 237-250 (2005) (from which the earlier part of this article is largely taken).
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15. J. Franklin, S.A. Sisson, M.A. Burgman, and J.K. Martin (2008). "Evaluating extreme risks in invasion ecology: learning from banking compliance," *Diversity and Distributions* 14, 581-591 (2008) from which this section is largely taken.