# Historical and emerging challenges in enterprise risk management for insurance companies

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## Introduction

The practice of enterprise risk management (ERM) can fall prey to an excessive focus on statistics, formulas, and techniques to the detriment of critical thinking and insight into risks and consequences. The purpose of this paper is to encourage those involved in ERM to take a step back to examine enterprise risk in the context of both human psychology and historical data. In doing so, we will see that the causes of corporate catastrophes are rarely random fluctuations around a mean. Typically, the sources of large-scale enterprise risk are either:

- Unforeseen due to misestimation in the model
- Brought about by factors altogether external to the model

Examples include correlated risk, counterparty risk, the risk of government intervention and the risk of a "run on the bank"—in short, tail risk.

## Overview of ERM

ERM is still an emerging discipline. Its definition is somewhat fluid, but a good basic definition states:

*"Enterprise risk management is the process of systemically and comprehensively identifying critical risks, quantifying their impacts, and implementing integrated strategies to maximize enterprise value."*[1]

At one time, corporate risk management tended to focus more on expected values than on critical risks. This approach was based on the belief that the more severe risks were improbable, unforeseeable, and therefore all right to ignore. If a company priced expected returns at 15%, minor adverse events might result in a performance point drop or two—not the kind of event companies usually invest in preventing.

The historical refusal to plan for improbable but serious risks has had serious consequences and clarifies the need to focus on tail risk. Enterprise risks—those probable and improbable—must be quantifiable in terms of both probability and economic consequences, and subsequently accounted for in allocating assets.

Ideally, such an exercise leads to efficient allocation of capital: Companies hold as much capital as they need to provide a specified return on investment over a specified period. Companies that underestimate their risks are likely to underestimate the capital needed and face potential insolvency. Companies that overestimate their risks will hold too much capital, which reduces the likelihood of insolvency but also reduces the return to investors. Poor returns make going to the capital markets to obtain additional capital more difficult.

For insurance companies, ERM can help measure the value of different tactics. Certain tail risk may

[1] *Enterprise Risk Analysis for Property and Liability Insurance Companies, Brehm et al., 2007.*

be minimized through the utilization of reinsurance, but at a cost: the reinsurance premium is now built into the bottom line regardless of whether that tail risk never comes to be. So the ERM question facing the insurance company amounts to a choice between:

- The economic cost of using reinsurance (i.e., the seeding or outgoing reinsurance premium minus expected reinsured claims)
- The economic cost of not using reinsurance (i.e., potential catastrophic loss and insolvency)
- The economic cost of financing the risk some other way (e.g., holding additional capital).

ERM requires an insurance company to perceive the economic cost of risk and to recognize the potential for ruin in the tail. This risk can take many forms: the Indian Ocean tsunami, Gujarat earthquake, Mumbai floods, upheavals like the collapse of the Russian political system in 1998, or economic events like the current U.S. sub-prime mess, to name a few.

We see evidence of the need for ERM all around us. For example, the emerging Solvency II regulation in the European Union requires insurers that do business there to have explicit corporate functions that address "risk management, risk modeling (for internal model users), compliance, internal audit and actuarial issues," according to the regulatory agency's FAQ of 7 October 2007. Additionally, capital requirements will be modified to match the level of risk associated with each type of asset that an insurance company might hold. Assets with higher volatility indices will require greater reserves of capital—for example, venture capital investments will likely have a higher capital charge associated with them than will municipal bonds. Solvency II is widely seen as a global model for managing risk in the insurance industry. India's insurance market is still young and ERM is an emerging discipline. However, the rapid pace of change in the global economy, in which India is thoroughly entwined, will require insurers to address ERM issues sooner rather than later.

**Divergent interests**

It is human nature to favor the answer that works in one's own interest, especially when that answer can be justified with apparently hard mathematical calculations. That's why different stakeholders are likely to favor different answers to a key ERM question:

*"What level of capital is appropriate to ensure the desired result?"*

Shareholders typically like to see a lower level of required capital, resulting in greater returns per unit of investment. They may be more tolerant of risk in the hope of greater returns; they are also less likely to be skeptical of low capital requirements because those requirements work in their favor.
Regulators, on the other hand, do not profit directly from a company's returns, and are primarily interested in ensuring the company's continued solvency for the benefit of the economy and of policyholders. They are likely to favor higher capital requirements even at the expense of returns.
Policyholders (who do not play as direct a role in determining capital, but who affect the issue indirectly by their selection of policies and their political choices) are somewhere in the middle. Lower required capital may decrease the premium they must pay but increases the risk of future insolvency, which can leave them exposed if a cataclysmic event leaves an insurer unable to pay claims.
Assuming that a life insurance company's pricing methodology uses a return on capital approach then a then an investor wanting a 15% return on investment and expecting to generate USD 3 million worth of income a year would expect to put USD 20 million into that business. A regulator with a conservative approach to capital reserves might require USD 40 million to support the enterprise, to ensure that the business stays solvent in case of catastrophic casualties or property

destruction. That makes the return on investment 7.5% instead of 15%. Policyholders are in the middle; if more capital is required, shareholders may decide to increase premiums to ensure that they receive their expected return on investment. If less capital is required, the premiums may decrease but the chance of insolvency goes up, which might leave policyholders with nothing.
This is not to suggest that stakeholders will falsify ERM results or hide information; most people no doubt act in good faith. However, when a person has a strong interest one way or another and there is a range of results, a person may tend to select the result that is most favorable to the outcome he wants. The lesson is that good ERM requires attention to divergent interests.

**Stochastic testing: Don't blame the model**

Stochastic testing represents an important advance in risk calculations, since it allows us to deal with randomness in quantitative fashion. To give a classic example, if you flip a fair coin 100 times, the most likely outcome is 50 heads. If you perform 1,000 sets of 100 flips, some sets would contain 49 heads, some 51, and so on, due purely to random variation. There is a chance that, even with a fair coin, one might throw only 20 heads. Or two. Or none.

To extend the example to enterprise risk, if we think that 50 is the mean number of hurricanes in a given year, we want to know the probability that there will be 60 hurricanes (or 70, or 100) due to statistical variation. In some cases, the model may be good, but humans fail to interpret it correctly. If a model predicts that a particular state of affairs will only happen once every 100 years but will result in the destruction of the business, many will dismiss the event as highly improbable. However, a one-in-100-years scenario still happens—maybe tomorrow, or maybe 100 years from now.

One prominent example is the meltdown of a hedge fund known as Long-Term Capital Management. The company used derivatives to bet that the spreads between high- and low-quality bonds would converge over time. It used sophisticated mathematical models. Based on its confidence in its methods, it leveraged its funds to a high degree, increasing the potential risks and returns. It posted returns of 40% in its first year. However, in 1998, a convergence of unlikely historical events—rising interest rates, the Asian financial crisis, and Russia's bond default among them—caused investors to load up on high-quality instruments like U.S. treasuries. As a result, the low-quality bonds were worth less than ever, and the high-quality bonds were worth more than ever—the spread went precisely the opposite direction from what the model predicted, which drove the fund into ruin. The worst-case scenario used by the fund's managers was not actually the worst case. While they drowned in a stream whose average depth was 12 inches, the stream was 12 feet deep where they fell in.

Many other cases exist where insolvencies are caused by occurrences that fall into the far tails of probability distributions. Few of those doing stochastic testing in the late 1990s would have predicted that short-term interest rates would fall to 1% in the United States. Few analysts predicted the fall of interest rates in Japan to zero. What we find is a situation where, because of optimism or failure of imagination, we don't adequately test the tails.

The failure to focus on tail risk is not due to faulty models. The possibilities of historic spreads between bond instruments or historically low interest rates existed in the models, but they were seen as drastically unlikely and therefore all right to ignore. An effective ERM strategy does not ignore these risks.

## Misestimation of the mean

This is all very appealing until you consider that insolvencies are usually not the result of statistical variation. They have historically been the result of misestimation of the mean—the assumption that you are flipping a fair coin when, really, you are not.

One of the most common examples is the liquidity crunch, in which a substantial asset class becomes illiquid all at once, at the least convenient moment.

In the 1980s in the United States, attractive returns on commercial real estate brought over-investment and overbuilding, resulting in high vacancy and low rents in the early 1990s. The value of those assets declined precipitously, but nobody could unload them because anyone who could buy them already had too much on his books. Everyone wanted to sell them and nobody wanted to buy them, creating a spiral in which prices collapsed. Insurance companies were particularly hurt by this crisis, as many of them had substantial amounts of commercial real estate in their portfolios. This crisis actually resulted in U.S. regulators rewriting the rules on the risk profiles of assets held by insurance companies. Commercial real estate of all kinds was reclassified as high risk for insurance company portfolios to invest in—one quantum less risky than junk bonds. An asset that had been seen as extremely safe and stable was found to be volatile and dangerous and subject to a liquidity crisis. In other words, the fair coin was found to be weighted against the flippers. Additionally, a run on the bank occurred—something external to all but the most extreme stochastic calculations.

A similar scenario is unfolding with home mortgages in the United States. Sub-prime mortgages were packaged into various financial instruments. Those instruments were classified by rating agencies as safe investments even though many of the loans thus packaged were, in hindsight, at high risk of default once artificially low introductory interest rates were reset. Sophisticated modeling supported the ratings of many mortgage-backed securities, but the models were based on bad assumptions about default rates. Most investors thought mortgage-backed securities were a good idea, until defaults rose and they found nobody willing to buy the instruments. The coin was, again, weighted the wrong way, and another liquidity crisis has ensued.

A similar situation has been anticipated by some in India, where the urban housing market may be susceptible to a sudden price adjustment. The Indian housing market shares some characteristics with the pre-meltdown U.S. housing market: the prevalence of speculators looking for a return on investment rather than a place to live who take out floating-rate loans, own many properties, and sell them as their loans adjust to higher interest rates. If many of them are forced to sell simultaneously, the downward pressure on house prices could create a situation similar to the liquidity crisis in sub-prime mortgages in the United States, where investors are caught holding an illiquid asset precisely when they wish to sell it. Because of a robust market for homes in urban areas, this has not yet occurred, but if demand drops, the consequences could be serious.

## Pricing mistakes

Insurance product pricing mistakes offer another example of how risk models are only as good as their assumptions. Term to 100 was a common product in Canada that provides level term coverage until death or age 100, with no cash surrender value. It is a lapse-supported product because there is no surrender value. Consequently, the assumed lapse rate becomes a critical assumption in the determination of the premium rate. In an aggressive market, companies wanted to price these products as low as possible and so assumed high lapse rates of 6% to 7%. Actual lapse rates

turned out to be about 1% to 2%, making the level premiums much too low. Unfortunately for the insurance companies, Canadian law prevented them from shifting the burden to policyholders in the form of higher premiums. They had to bear the cost of their poor assumptions—an enterprise risk if there ever was one. Secondary guarantee universal life policies, currently in vogue in the United States, are also lapse supported. Time will tell if these were priced using appropriate assumptions. Careful examination of experience can be helpful in these cases, but for new products, the experience may not tell the whole story. In the Term to 100 cases, policyholders had a strong incentive to hold on to the policies—stronger than anticipated by the historical data. There is abundant potential for future misestimation of prices based on assumed experience. Economies have become interdependent and markets throughout the world have become quite volatile. Old age mortality has been, as a whole, declining around the world for a century, not always in stepwise fashion, and our understanding of it continues to evolve. In India, many demographers comment on the overall "youthfulness" of the population. However, population aging here is taking place in asymmetrical fashion, with the north staying relatively young and the south graying at a faster pace. How might this demographic trend affect India's economy in the long-term?

Worldwide, the rapid pace of change in healthcare technology always holds the promise of breakthrough technologies that could instantly extend the lives of large numbers of people. The lesson is that, in a caveat dear to mutual funds, "past performance is no guarantee of future results."

**Growing risks on the horizon**

In addition to aggressive assumption setting (wishful thinking), enterprises face risks that are growing in severity to an unknown but potentially serious degree. First among these is correlation risk, the manner in which risks amplify one another. With fluid and thoroughly globalized securities, credit, and currency markets, correlation risk is more difficult than ever to quantify. With the advent of increasingly complex synthetic financial products, correlation risk may be impossible to quantify.

Correlation risk is one of the factors underlying the nerve-wracking credit problems facing banks around the world. Insurance companies invested in sub-prime mortgages through MBS or CDO. The first level of risk was default on those mortgages. Additionally, many homes are being sold in foreclosures, flooding the market and driving down prices. That depresses the sale of new houses. Any residential real estate in a company's portfolio is now valued lower. If fewer houses are being sold, fewer of the products homebuyers typically buy (washing machines, refrigerators, etc.) will be sold. Then there is the effect on consumer spending. Even those who do not plan to sell their home feel less wealthy if its value drops significantly. They become more conservative; consumer confidence drops. That can cause a recession—less real business activity, falling securities prices, and lower credit ratings for companies whose public valuation is lower. Commercial real estate loses value as organizations become more wary of real estate in general and as businesses fail, leaving offices vacant.

In India, there is a correlated risk between the stock market and unit-linked life insurance (ULIP). With no guarantees in these policies, policyholders must accept any losses due to market volatility. If the markets ever took a downturn, future sales would be affected and insurers would reduce their investments in equity markets.

Another emerging risk, known as counterparty risk, has its origins in the sharing of risk through reinsurance and hedge instruments. These instruments are traded easily, leaving it unclear who is responsible for the bill when adverse events occur. According to the Reserve Bank of India, "Over

the last 10 years or so, several other types of derivatives have begun trading in India ... efforts are on for introduction of credit derivatives in India. Feasibility probes for foreign exchange futures have begun. Efforts are also on for an appropriate design for interest rate futures." Clearly, India is throwing in its lot with the liquid, securitized, and complex global financial system.

**Conclusion**

All of these issues—the divergent interests of stakeholders, mis-estimation, risks external to models, correlation, counterparty risk, and government intervention—deserve consideration in the ERM process. Because none of them fits neatly into an equation, to give them proper attention requires taking a step back from the textbook approach and looking at the broader picture. The benefit of ERM is in thinking critically about and planning for enterprise risks—even those that do not submit themselves to quantification. It is a process that should produce insight, not just more data.

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