

PRESIDENTIAL ADDRESS—NOVEMBER 14, 2005

ON BECOMING AN ACTUARY OF THE FOURTH KIND

STEPHEN P. D'ARCY

A presidential address is an opportunity for outgoing presidents to thank the many people who have helped them over the course of the year, to wax philosophical about things actuarial, and to enlighten the membership about relevant issues facing our profession. As a teacher, though, I cannot pass up the opportunity of a few minutes in front of an audience to try to provide a useful learning experience for the class, I mean the membership. Thus, today's lecture is, "On Becoming an Actuary of the Fourth Kind."

Hans Bühlmann first offered this classification of actuaries in an *ASTIN Bulletin* editorial (1987) entitled, "Actuaries of the Third Kind?" Actuaries of the first kind, who emerged in the 17th century, focused on life insurance issues and tended to use deterministic methods. In the early 20th century, actuaries of the second kind developed—casualty actuaries who used probabilistic approaches in dealing with workers compensation, automobile insurance, property insurance and similar risks. The actuaries of the third kind, who were the object of Bühlmann's editorial, were the investment actuaries applying stochastic processes, contingent claims and derivatives to assets and liabilities. This specialty developed in the 1980s as financial risk became more important and tools to manage financial risk were created. For advice on learning the tools and techniques of this type of actuary, your assignment is to read, "On Becoming an Actuary of the Third Kind," which I presented at the 75th anniversary of the CAS and is published in the 1989 *Proceedings of the Casualty Actuarial Society*.

At a recent ASTIN meeting in Zurich, Professor Paul Embrechts of the Swiss Federal Institute of Technology (ETH) referred to those actuaries working in enterprise risk management

(ERM) as actuaries of the fourth kind. Change has certainly sped up in the actuarial profession, as it took 250 years for the actuaries of the second kind to emerge, 70 more years for actuaries of the third kind to develop, but less than three decades for the newest type of actuary to arise. I would like to provide some guidance on becoming an actuary of the fourth kind.

Risk is present whenever the outcome is uncertain, whether favorable or unfavorable. Risk exists whenever there is uncertainty. ERM is the systematic evaluation of all the significant risks facing an organization and how they affect the organization in aggregate. A variety of classifications of risk have been proposed, but I find that categorizing risks as hazard, financial, operational, or strategic to be most useful. Hazard risks are the risks actuaries have most commonly considered. These are the pure risks, the loss/no loss situations that may injure people, damage property, or create a liability. Traditional actuarial mathematics work best on hazard risks, as they are generally independent and discontinuous. Actuaries and other risk professionals have generally done a remarkably good job assessing and evaluating hazard risks. Organizations rarely become insolvent due to failure to manage hazard risks, and insurers can generally withstand major losses of this type, even when they exceed all prior incidences of such losses by a significant amount. If only this were true for similar occurrences of the other types of risk. Daily we learn of companies going into bankruptcy because of mismanaging other risks.

Financial risks are those that affect assets, including interest rates, inflation, equity values, and foreign exchange rates. These risks are correlated, continuous, and require an understanding of stochastic calculus to be measured appropriately. Unlike hazard risks, financial risks provide the possibility of a gain, not just a loss. The techniques for managing financial risks—financial derivatives such as forwards, futures, options, and swaps—are relatively new, developed only over the last several decades. Mis-

use of these techniques and the resulting financial debacles they caused have actually led to the need for ERM.

Operating risks represent the failure of people, processes, or systems. One recent example of operating risk is the announcement (*The Wall Street Journal*, November 9, 2005) by Freddie Mac, the large mortgage finance company, that it discovered a computer error that, since 2001, has been overvaluing accrued interest on variable rate home equity loans. The effect of this error is estimated to be at least \$220 million. The next day General Motors announced that it had incorrectly booked credits from suppliers in 2001 (*WSJ*, November 10, 2005). The overstated earnings are estimated to be as high as \$400 million, or 50 percent of its reported profit during that year. To clarify the distinction between hazard and operational risk, if an employee steals from an employer, that is a hazard risk and can be covered by typical insurance policies. However, if that employee inflates earnings in order to “qualify” for a bonus, that is not considered hazard risk and is not covered by insurance. This would be operational risk.

Strategic risk reflects the business decisions of an organization or the impact of competition or regulation. An organization that adapts (or fails to adapt) to new markets, whose activities lead to new forms of regulation that either help or hinder future operation, or whose business plan proves either successful or unsuccessful—all are examples of strategic risk. Examples of strategic risk for insurance are the benefits produced for those first to use credit scoring as a rating variable, and the market share losses of those companies that were slow to adopt this approach.

ERM originally focused on loss prevention, controlling negative surprises, and reducing downside risk. That was the initial reaction of both regulators and boards to the failures at Barings Bank, Enron, WorldCom, Arthur Andersen, and other corporations. ERM evolved into accepting risk, but measuring the risk associated with the expected returns from different business

strategies. When organizations began to use ERM approaches for capital allocation and tied compensation to the resulting risk adjusted returns, it became serious for many managers. Cases are now told of dueling modelers, each with their own capital allocation process favoring their sponsoring area, who vie to have their model adopted by the organization. ERM is now evolving into risk optimization and the efficient deployment of capital. When an organization accepts risks where it has a comparative advantage, and transfers or avoids risks where it does not, the system is adding value by efficient risk treatment. ERM deals with the entire range of potential outcomes, not just downside risk.

So, how to become an ERM actuary? Step one in ERM, as in traditional risk management, is risk identification—to identify all significant risks an organization faces. Although actuaries are good at quantifying risks, other specialties, such as traditional risk managers, have greater expertise in the identification of risk, particularly hazard risks. Traditional risk managers, just as most actuaries, also tended to ignore financial risks. A first step in becoming an actuary of the fourth kind is to master the skills of the risk managers in the identification of risk and then to expand this identification process to financial, operational, and strategic risks, as well as hazard risks. The risks an organization faces, though, are myriad. The advice of one ERM pioneer, James Lam, is instructive. His admonition is, “Don’t boil the ocean.” Instead focus on the most significant risks an organization faces. Deal with those first, then in future iterations expand the focus to the next level of risk elements.

Step two in ERM, as in traditional risk management, is to quantify the risks. Actuaries are well skilled in this area, at least for hazard risks, but ERM also requires the quantification of the correlations among different risks. ERM is concerned with risk in aggregate and to the extent that one risk offsets other risks, then the organization benefits. To the extent that different risks combine to increase the negative impact, the organization is at risk. Measuring the correlations is also more complicated than

just looking at the correlation coefficient, or how two variables tend to move in relation to each other. Two risks can be generally uncorrelated, but, if an extreme event were to occur, then they could be highly correlated. Techniques for evaluating these forms of correlations, filters, tail dependency, copulas, and other numerical techniques must be incorporated.

Much needs to be done to be able to quantify operational and strategic risk to the standards common in hazard and financial risk, but progress is being made. The Basel Accord proposes several methods for determining capital charges for operational risk. These methods were devised to be applicable to banks, but regulatory consolidation is expanding the application to insurers and other financial institutions. Other techniques include measuring change in the market value of publicly traded companies when operational risks are revealed, such as accounting problems, product recalls, or the legal troubles of closely identified executives. Much more needs to be done in this area. Actuaries have the skill set that can improve the quantification process, but other specialties are moving into this area as well, such as the former financial engineers (yes, the same ones responsible for Long Term Capital Management, Enron, and others), accountants, and risk managers. If we want this done correctly, we need to step up to the plate now or other groups will claim this area. Our unique advantages—the combination of math skills, practice in explaining complex mathematics to nonmathematical managers, and a professional code of conduct—make actuaries the ideal professionals to assume a leadership role in ERM. The opportunity for staking a claim will not exist for long, however. If you are interested in becoming an actuary of the fourth kind, start now.

Step three of the risk management process involves evaluating the different methods for handling risk. Risks can be assumed, transferred, or reduced. A variety of methods exist for transferring or reducing risk. Risk can be transferred by subcontracting, by insurance, or by securitization. Risk can be reduced by loss

control, contract, or reinsurance. These techniques range from engineering to legal to financial to actuarial, requiring the actuary of the fourth kind to be conversant in each area.

Step four is to select the best method for handling the risk, which in most cases will involve a combination of different techniques. ERM aims to establish a consistent approach to dealing with risk. This means that the organization wants to make consistent choices about all of the risks it faces, how much risk it will accept, and what return it would require for accepting a particular level of risk.

Step five is to monitor the risk management approach selected. ERM is an ongoing process that must be monitored, adjusted, and revised as new information and new techniques become available. Thus, as soon as one round of an ERM process is completed, the next round begins. It is an iterative process that entails identifying additional significant risks, quantifying those risks, and improving the quantification of previously identified risks based on additional information and improved mathematical techniques. It also entails reevaluating the different approaches to handle risk, implementing an improved strategy, and then, once more, monitoring the results. It sounds like rate filings or loss reserve analysis—do it and then do it again. This is full employment for actuaries, perhaps?

Actuaries need to become the ERM specialists of the insurance industry. For one reason, no one else understands the mathematics underlying this industry as well as actuaries do, so no one else can do as good a job. For another reason, if actuaries fail to grow into insurers' ERM positions, someone else will. After they master that position, they will feel qualified, and perhaps even be qualified, to assume the roles actuaries now fill in the hazard risk area. Move up or move out. That is only fair. Academics have long lived with the publish or perish dictum. Now the actuarial profession has its equivalent challenge: master ERM or face extinction. It doesn't have quite the right flow, but the consequences are just as dire.

The quantification of risks in an ERM process involves combining the actuarial tools and techniques with those of financial economists. Become an actuary of the third kind on your way to becoming an actuary of the fourth kind. This path is already well laid out. Start with “On Becoming an Actuary of the Third Kind,” add readings from Cairns (2004), Hull (2003), Jorion (2001), and Das (1997). Then expand into ERM by reading Lam (2003), Samad-Kahn (2005), and Standard and Poor’s (2005).

Not all actuaries need to become actuaries of the fourth kind, although I hope that many of you will. There will likely be plenty of work for actuaries of the first, second, and third kinds. But the actuary of the fourth kind represents a new frontier, one that we are well suited for by training and temperament, and one that I think we can fulfill better than any other group.

For an example of ERM in action applied to the insurance industry, let’s look to Hurricane Katrina, which hit the coast of Louisiana the end of August 2005. This hurricane caused an estimated \$125 billion in economic losses, of which the insurance industry is expected to pay approximately \$35 billion. This would make Katrina twice as costly as the previous largest natural disaster, Hurricane Andrew in 1992. Simultaneously, oil prices surged to record levels as a significant portion of the oil producing capacity of the United States was damaged by this storm. It is clear, in retrospect, that a perfect natural hedge existed for insurers exposed to property losses on the Louisiana coastline—derivatives on oil prices. An insurer would purchase oil futures if it were willing to incur losses as energy prices declined, or options if it only wanted protection against oil price increases. Any storm wreaking havoc on the coastline had to affect the oil wells situated in the Gulf and therefore the price of oil, at least temporarily. Rather than reducing exposure to property damage in Louisiana, as at least one major insurer has already announced it would do, insurers could hedge their property exposure with financial derivatives. Now, if we could only ring the coast of Florida with

a valuable natural resource, the industry might be able to cope with hurricane losses there as well.

There is another hedge for property insurers that is related to the spike in oil prices caused by Hurricane Katrina. High gas prices led to a reduction in driving, which reduced the number of automobile accidents, and lowered collision and liability losses for insurers. On the other hand, drivers encumbered with gas guzzling SUVs could be tempted to generate additional comprehensive claims as these vehicles are “stolen” or “burned.” Moral hazard also affects ERM. Start thinking in this manner and you are on your way to becoming an actuary of the fourth kind. Welcome aboard!

Despite my proclivity to turn this into a teaching opportunity, I do not want to miss the chance to thank those many people who helped me during my term in office. To you, the members of the CAS who elected me, thank you for putting your confidence in me. I hope I have met your expectations. To all the volunteers, the committee and task force chairs, and especially the vice presidents and board members who worked so closely with me over the year, thanks for helping me achieve what we did accomplish. Progress would not have been possible without you. Thank you to the wonderful CAS staff members, here and back at the office, and to Cynthia Ziegler for motivating and leading them, for you truly do the essential work of our organization. To the leaders of the other actuarial organizations, some of whom are with us today, others unable to be here, thank you for your openness and cooperation as we worked together to enhance the actuarial profession throughout the world.

Thanks to my family for supporting me during my term. My daughter, Meriden, who is not here, accompanied me to a North American Actuarial Council meeting in Hawaii and helped out at the Spring Meeting in Phoenix. My son, Grant, who was here until this morning, helped me explore Norway and Zurich during ASTIN and AFIR meetings. Most of all, I want to thank my best friend, my wife, Cleo, whose leadership experience helped

me keep my equilibrium during this sometimes hectic year and whose love of teaching has inspired mine.

Now it is with mixed emotions—some sadness and some relief—that I pass on the presidential responsibilities to Paul Braithwaite. It has been a wonderful year, thanks to all of you. Good luck, Paul!

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