

# DEEP IMPACT

His comet wasn't Halley's only influential discovery.



BY JOHN ILKIW

Edmond Halley's final career as an astronomer extraordinaire earned him enduring fame. His two earlier lives are less known

but are precursors to three future financial services professions: venture capitalist, actuary and risk manager.

His career in astronomy began in 1705 when he published a prediction that a comet, which had appeared in 1682, would reappear in the early days of December 1758, and was the same comet seen in 1531 and 1607. Halley developed a theory that comets appeared periodically because they followed an elliptical orbit around the sun. Isaac Newton, one of his many high-reputation colleagues, believed comets followed a parabolic orbit—you see them once as they pass the earth and never again as they continue their journey through space. In 1758, fifteen years after his death, Halley's prediction was confirmed. The comet, now known as Halley's Comet, reappeared on December 25, albeit a few days later than he had predicted. Not a bad prediction given the rudimentary nature of scientific thinking, mathematical modelling and technology of the time.

## LIFE BEFORE THE COMET

In an earlier life, Halley sold the rights to a patent for a six-man diving bell that he had designed and tested to a depth of 60 feet in the Thames River. In today's world, this is equivalent to selling the rights to the future income stream from intellectual property—everything from promising scientific discoveries to established music libraries. They are investments that promise high returns with a low correlation with other assets. At that time, numerous joint-stock “diving” companies attracted venture capital in the hope of replicating the William Phipps salvage expedition that had retrieved thirty-two tons of gold, silver and jewels from a sunken Spanish ship off the

island of Hispaniola. After the King, Captain Phipps and crew received their distributions, the remaining partners received a 10,000% dividend.

The company holding the Halley patent was incorporated in September 1691 as The Governor and Company for Raising Wrecks in England and appeared in early stock lists as “Diving Halley.” None of these companies fared well—shares were over sold, over priced and sunk in value. For one company, a one five-hundredth share sold for GBP100, falling subsequently to 12, 10, 9, 8 and at last to nothing.

Halley's second life materialized in 1693 when he published the first set of reliable life tables and a companion life annuity analysis in the Philosophical Transactions of the Royal Society. His mathematically rigorous analysis laid the foundation for two modern-day professional disciplines: actuarial science and risk management. Using monthly data on age, sex, births and deaths for the town of Breslau (then located in Germany, but now in Poland and known as Wroclaw) he estimated the probability of a person of a given age living to a specified future age. His calculations revealed that a male who reached the age of 30 had an even chance of living another 27 to 28 years.

Halley's contingency tables and annuity analysis are early examples of major advances in risk management that could be exploited profitably by institutions with open minds. At the same time, there is a high cost to institutions of not keeping abreast of such advances. How so? While Halley's breakthrough was used on the Continent to price annuities, the English government ignored it. To raise one million pounds, it sold annuities that paid purchasers back over 14 years regardless of their age. Given that Halley's study had shown that even people at the age of 30 had a life expectancy of almost 30 years, this proved to be a very costly source of public financing. The English government continued to sell annuities at the same price to people regardless of their age until 1789. ■

John Ilkiw is senior vice-president, portfolio design and risk management at the Canada Pension Plan Investment Board.