

# **De Finetti, Bruno (1906–1985)**

ERMANNNO PITACCO

Volume 1, pp. 421–423

In

Encyclopedia Of Actuarial Science  
(ISBN 0-470-84676-3)

Edited by

Jozef L. Teugels and Bjørn Sundt

© John Wiley & Sons, Ltd, Chichester, 2004

# De Finetti, Bruno (1906–1985)

## Essential Biography

Bruno de Finetti was born on June 13, 1906 in Innsbruck (Austria). His parents were Italian, coming from regions that until 1918 belonged to the Austro-Hungarian Empire. At that time, de Finetti's father, an engineer, was actually engaged in the construction of railways in Tyrol.

Bruno de Finetti entered the Polytechnic of Milan, aiming at a degree in engineering. After two years, since a Faculty of Mathematics was opened in Milan, he moved to mathematical studies and in 1927 he obtained a degree in applied mathematics.

After graduation, de Finetti moved to Rome to join the Istituto Centrale di Statistica, whose president was the Italian statistician Corrado Gini. He stayed with that institute until 1931, when he moved to Trieste to accept a position at Assicurazioni Generali. He was engaged as an actuary and, in particular, he was active in the mechanization process of actuarial services, mainly in the field of **life insurance**. He left Assicurazioni Generali in 1946.

During this period, in spite of the work pressure in the insurance company, de Finetti developed the research work started in Rome in the field of probability theory. Important results in actuarial mathematics also date back to that period. Moreover, de Finetti started teaching: he taught mathematical analysis, financial and actuarial mathematics, and probability at the University of Trieste, and for two years he taught at the University of Padua.

In 1947, Bruno de Finetti obtained a chair as full professor of financial mathematics at the University of Trieste, Faculty of Sciences. In 1951, he moved to the Faculty of Economics, at the same University. In 1954, he moved to the Faculty of Economics at the University of Rome 'La Sapienza'. Finally, in 1961 he moved to the Faculty of Sciences at the same university where he taught the theory of probability until 1976.

Bruno de Finetti died in Rome on July 20, 1985.

## The Scientific Work

The scientific activity of de Finetti pertains to a wide range of research fields. Nevertheless, Bruno de Finetti is a world-renowned scientist mainly because of his outstanding contributions to probability and statistics. Foundations of subjective probability (*see* **Bayesian Statistics**), **stochastic processes** with independent increments, sequences of exchangeable random variables, and statistical inference are the main areas in which we find de Finetti's contributions. Actually, de Finetti must be considered as one of the founders of the modern subjective approach to probability (see, in particular, the well-known treatise, de Finetti [11]).

For a comprehensive description of de Finetti's contribution to probability and statistics, the reader can refer to [1]; see also [13].

Extremely significant contributions can be found also in the fields of mathematical analysis, economics, **decision theory**, risk theory, computer science, financial mathematics, and actuarial mathematics. The reader can refer to [2, 3] for detailed information about de Finetti's scientific work and a complete list of papers, textbooks, and treatises; see also [4].

## Contributions in the Actuarial Field

Bruno de Finetti's contribution to actuarial sciences can be allocated to the following areas:

1. **life insurance mathematics** (**mortality laws**, surrender value (*see* **Surrenders and Alterations**), ancillary benefits, expenses, calculation of mathematical reserves (*see* **Life Insurance Mathematics**), technical bases for impaired lives);
2. non-life insurance (*see* **Non-life Insurance**) mathematics (theory of non-life insurance, **credibility theory**);
3. risk theory and **reinsurance** (optimal retention (*see* **Retention and Reinsurance Programmes**), individual and collective approach to risk theory, **extreme value theory**).

Important contributions to the development of actuarial sciences also arise from de Finetti's scientific work in different research fields, typically in the fields of stochastic processes, statistical inference,

and **utility theory**. In particular, his results concerning exchangeability (see [5]) and partial exchangeability (see [6]) have made a significant impact on the theory of statistical inference and related actuarial applications, whereas his contributions to utility theory (see [9]) underpin a number of results relevant to insurance economics.

A short presentation of some seminal de Finetti's contributions to actuarial sciences follows.

**Proportional reinsurance** policies are analyzed in [7], referring to both a one-year period and an infinite time horizon. The approach adopted to find optimal retention levels can be considered an ante-litteram example of the mean-variance methodology, followed by Markowitz 10 years later for solving portfolio selection problems (see **Portfolio Theory**). de Finetti's approach starts from considering that any reinsurance policy reduces the insurer's risk (in terms of the variance of the random profit and the related ruin probability (see **Ruin Theory**)) as well as the expected profit. Then, a two-step method is proposed. The first step consists in minimizing the variance under the constraint of a given expected profit, whereas the second one, assuming the expected profit as a parameter, leads to the choice, based on a preference system, of a particular solution.

In the framework of risk theory, starting from the collective scheme defined by **Filip Lundberg** and **Harald Cramér**, de Finetti proposed a 'barrier' model (see [10]), in which an upper bound  $L$  is introduced for the accumulated portfolio surplus. The approach adopted is based on a **random walk** model. The problem consists in the choice of the level  $L$ , which optimizes a given objective function, for example, maximizes the expected present value of future dividends, or maximizes the expected residual life of the portfolio.

In the field of life insurance mathematics, an important contribution by de Finetti concerns the surrender values (see [12]). The paper aims at finding 'coherent' rules for surrender values, which do not allow the policyholder to obtain an advantage by withdrawing immediately after the payment of a premium. Then, the paper extends the concept of coherence to the whole tariff system of a life office, aiming at singling out '**arbitrage**' possibilities for the insured, arising from the combination of several insurance covers.

Although the assessment of risk for a life insurance portfolio dates back to the second half of the 19th century (Hattendorff's theorem (see **Life Insurance Mathematics**)) is among the earliest contributions in this field), the formal expression of the randomness of life insurance contracts must be attributed to de Finetti. The concept of random present value of benefits as a function of the random residual lifetime has been actually introduced in [8].

As far as research in the actuarial field is concerned, it is worth noting that de Finetti was awarded in 1931 the Toja prize, in 1964 the International INA prize by the Accademia dei Lincei, and in 1978 by the **Swiss Actuarial Association**. Bruno de Finetti belonged to the pioneering generation of **ASTIN**, the first section of the **International Actuarial Association**, founded in 1957 to promote actuarial studies in the field of non-life insurance.

## References

- [1] Cifarelli, D.M. & Regazzini, E. (1996). de Finetti's contribution to probability and statistics, *Statistical Science* **11**(4), 253–282.
- [2] Daboni, L. (1987). Ricordo di Bruno de Finetti, *Rivista di Matematica per le Scienze Economiche e Sociali* **10**(1–2), 91–127.
- [3] DMA (Dipartimento di Matematica Applicata alle Scienze Economiche, Statistiche e Attuariali) (1986). *Atti del Convegno "Ricordo di Bruno de Finetti professore nell'ateneo triestino"*, Università di Trieste, Italy.
- [4] Ferrara, G. (1986). Bruno de Finetti, In Memoriam, *ASTIN Bulletin* **16**(1), 11–12.
- [5] de Finetti, B. (1937). La prévision: ses lois logiques, ses sources subjectives, *Annales de l'Institut Henri Poincaré* **7**(1), 1–68.
- [6] de Finetti, B. (1937). Sur la condition de "équivalence partielle", *Colloque consacré à la théorie des probabilités*, Vol. VI, Université de Genève, Hermann et C.ie, Paris.
- [7] de Finetti, B. (1940). Il problema dei "pieni", *Giornale dell'Istituto Italiano degli Attuari* **9**, 1–88.
- [8] de Finetti, B. (1950). Matematica attuariale, *Quaderni dell'Istituto per gli Studi Assicurativi di Trieste* **5**, 53–103.
- [9] de Finetti, B. (1952). Sulla preferibilità, *Giornale degli Economisti e Annali di Economia* **11**, 685–709.
- [10] de Finetti, B. (1957). Su un'impostazione alternativa della teoria collettiva del rischio, *Transactions of the 15th International Congress of Actuaries*, Vol. 2, pp. 433–443.

- [11] de Finetti, B. (1975). *Theory of Probability* (English translation), Wiley, New York.
- [12] de Finetti, B. & Obry, S. (1932). L'optimum nella misura del riscatto, *Atti del II Congresso Nazionale di Scienza delle Assicurazioni*, Vol. 2, Bardi, Trieste, Rome, pp. 99–123.
- [13] Lindley, D.V. (1989). de Finetti Bruno, *Encyclopedia of Statistical Sciences* (Supplement), Wiley, New York, pp. 46–47.

ERMANNNO PITACCO