
Lyon PhD Course Actuarial Science

Chapter 1 Context, motivations, and basics

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1 Actuarial Science

1.1 Encyclopedia of Actuarial Science

"Actuarial science provides a structured and rigid" (or rigorous) "approach to modeling and analyzing the uncertain outcomes of events that may impose or imply financial losses or liabilities upon individuals or organizations. Different events with which actuarial science is concerned – in the following called actuarial events – are typically described and classified according to specific actuarial practice fields."

"Given that uncertainty is the main characteristic of actuarial events, it follows that probability must be the cornerstone in the structure of actuarial science. Probability in turn rests on pure mathematics."

"In order to enable probabilistic modeling of actuarial events to be a realistic and representative description of real life phenomena, understanding of the 'physical nature' of the events under consideration is a basic prerequisite. Pure mathematics and pure probability must therefore, be supplemented with and supported by the sciences that deal with such 'physical nature' understanding of the actuarial events.

"It follows that actuarial science is not a self-contained scientific field. It builds on and is the synthesis of several other mathematically related scientific fields such as pure mathematics, probability, mathematical statistics, computer science, economics, finance, and investments. Where these disciplines come together in a synthesis geared directly towards actuarial applications, terms like actuarial mathematics and insurance mathematics are often adopted."

"To many actuaries, both in academia and in the business world, this synthesis of several other disciplines is 'the jewel in the crown', which they find particularly interesting, challenging, and rewarding." (see EAS (2005)).

1.2 Wikipedia

"Actuarial science is the discipline that applies mathematical and statistical methods to assess risk in insurance, finance and other industries and professions. Actuaries are professionals who are qualified in this field through intense education and experience. In many countries, actuaries must demonstrate their competence by passing a series of thorough professional examinations."

1.3 International Actuarial Association / Association Internationale des Actuaires

Actuaries fulfill many roles in a broad range of environments, including insurance companies, health organizations, pension plans, risk management, government, regulatory regimes, and in other fields.

They have a detailed understanding of economic, financial, demographic and insurance risks and expertise in:

- developing and using statistical and financial models to inform financial decisions;

- pricing, establishing the amount of liabilities, and setting capital requirements for uncertain future events.

Actuaries also provide advice on the adequacy of risk assessment, reinsurance arrangements, investment policies, capital levels and stress testing of the future financial condition of a financial institution.

Note: “financial institution” is used broadly to include pension plans and governmental systems, such as social insurance plans, as well as retail and investment banks.

A qualified actuary is a professional trained in evaluating the current financial implications of future contingent events.

It is the actuary’s job to assist in the scientific analysis and quantification of risks.

Expertise in understanding the underlying business dynamics, backed by training in economics, finance, demographics, statistics, and risk management, helps to ensure that actuaries build models which make best use of the available information.

In general, actuaries excel in problem solving.

2 Actuarial Science

Actuarial Science = mixture of quantitative disciplines:

- Propobability and Applied Probability
- Statistics and Applied Statistics
- Finance Mathematics
- Economics
- Quantitative Risk Management
- Computer Science and Data Processing
- Demography
- Applied Mathematics
- Numerical Methods and Monte-Carlo Methods
- Etc.

Sometime called "Actuarial Mathematics".

3 Research Topics in Actuarial Science

Here is a (non-exhaustive) list of research topics in actuarial science

- Risk Theory
- Life Actuarial Mathematics
- Non Life Actuarial Mathematics
- Pensions
- Reinsurance
- Risk measures and premiums
- Financial Mathematics
- Economy of insurance and Risk Management
- Demography
- Statistical Models

- Data Analytics
- Computational Methods
- Catastrophic Risk
- Longevity Risk
- Operational Risk
- Entreprise Risk Management
- Etc.

4 Academic Actuarial Journals

Here are the main academic actuarial journals.

4.1 Insurance: Mathematics & Economics

"Insurance: Mathematics and Economics is an international journal that intends to strengthen communication between individuals and groups who produce and apply research results in insurance and finance, aiming to integrate the currently fragmented research in both fields."

"The subject matter of the journal includes the theory, models and computational methods of life insurance (including pensions systems, social insurance, and health insurance), of non-life insurance, of reinsurance and other risk-sharing arrangements, as well as of risk management. Of special interest are also its interactions with financial modeling. It also includes innovative insurance applications of results from other fields, such as probability and statistics, computer science and numerical analysis, economics, operations research and management science. "

Link: <https://www.journals.elsevier.com/insurance-mathematics-and-economics/>

4.2 **ASTIN Bulletin**

"ASTIN Bulletin publishes papers that are relevant to any branch of actuarial science and insurance mathematics. Its papers are quantitative and scientific in nature, and draw on theory and methods developed in any branch of the mathematical sciences including actuarial mathematics, statistics, probability, financial mathematics and econometrics."

Link: <https://www.cambridge.org/core/journals/astin-bulletin-journal-of-the-iaa>

4.3 Scandinavian Actuarial Journal

"Scandinavian Actuarial Journal is a journal for actuarial sciences that deals, in theory and application, with mathematical methods for insurance and related matters. "

"The bounds of actuarial mathematics are determined by the area of application rather than by uniformity of methods and techniques. Therefore, a paper of interest to Scandinavian Actuarial Journal may have its theoretical basis in probability theory, statistics, operations research, numerical analysis, computer science, demography, mathematical economics, or any other area of applied mathematics; the main criterion is that the paper should be of specific relevance to actuarial applications."

"It is the hope of the editors that the journal can promote progress in the development of actuarial methodology and the proliferation of established methods in practical actuarial work."

Link: <http://www.tandfonline.com/toc/sact20/current>

4.4 **European Actuarial Journal**

"The European Actuarial Journal (EAJ) publishes research articles and survey articles as well as papers engaging the mutual transfer between research and practical applications."

"Coverage includes such topics in classical actuarial mathematics as life and non-life insurance, pension funds and reinsurance, along with more recent areas of interest such as risk management, asset-and-liability management, solvency, catastrophe modeling, systematic changes in risk parameters, longevity, and more."

"The successor to six national actuarial journals, EAJ focuses on theory and methods for applications in insurance and finance."

Link: <http://link.springer.com/journal/13385>

4.5 North American Actuarial Journal

"The North American Actuarial Journal scientifically addresses the domestic and international problems, interests and concerns of actuaries, their customers and public policy decision-makers. The NAAJ publishes papers from traditional fields of actuarial practice, such as life and health insurance, pensions, employee benefits, property and casualty insurance, and finance and investments. Papers from new or developing areas of actuarial practice are especially welcome. We seek to stimulate research on emerging public policy debates, technology improvements, demographic trends, multidisciplinary topics, globalization issues, and the like."

Link: <http://www.tandfonline.com/toc/uaaj20/current>

4.6 Journal of Risk and Insurance

"The JRI publishes rigorous, original research in risk management and insurance economics. This includes the following areas of specialization:

- Industrial organization of insurance markets;
- Management of risks in the private and public sectors;
- Insurance finance, financial pricing, financial management;
- Economics of employee benefits, pension plans, and social insurance;
- Utility theory and demand for insurance;
- Asymmetric information, moral hazard, and adverse selection;
- Insurance regulation;
- Econometric, actuarial, and statistical methodology;
- Economics of insurance institutions;

- Insurance cycles and economic cycles of insurance markets;

Both theoretical and empirical submissions are encouraged.

Link: [http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1539-6975](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1539-6975)

4.7 Other academic actuarial journals

- Annals of Actuarial Science
- Dependence Modelling
- Risks
- Variance
- Etc.

4.8 Other academic journals

Academics in actuarial science also published in academic journals which have closed connections with actuarial science.

List of selected journals:

- Annals of Applied Probability
- Geneva Risk and Insurance Review
- Geneva Papers on Risk and Insurance: Issues and Practice
- Journal of Applied Probability
- Journal of Multivariate Analysis
- Journal of Pension Economics and Finance
- Methodology and Computing in Applied Probability
- Etc. Etc.

5 References

1. AAI/IAA (2013). The Role of the Actuary. Association Actuarielle Internationale / International Actuarial Association.
Available online at : <http://www.actuaries.org/>
2. Actuarial science. (2017, April 25). In Wikipedia, The Free Encyclopedia. Retrieved 10:56, May 15, 2017, from
https://en.wikipedia.org/w/index.php?title=Actuarial_science&oldid=777202739
3. EAS (2005). "Actuary" in the "Encyclopedia of Actuarial Science " (Ed. Teugels and Sundt). Wiley.