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## Actuarial non-life insurance

PROF. GIAN PAOLO CLEMENTE

### Course aims and intended learning outcomes

The course is aimed at supplying the rigorous and organized study of the most important decision problems regarding property and casualty insurance. The goal of this course is to provide students with quantitative skills relevant for pricing and reserving in the non-life insurance business. Focus is on both theory and practice.

The following topics will be tackled: premium rates valuation for motor third-party liability; deterministic methods for claims reserve (Chain-Ladder Paid, Chain-Ladder Incurred, BF Paid and Incurred, Fisher-Lange and Frequency Severity); stochastic methods for claims reserve, both run-off (Mack formula, Bootstrapping and Collective Risk Models) and one-year (Merz-Wuthrich formula and Re-reserving approaches) approaches, technical liabilities evaluation and solvency capital requirement for reserve risk under Solvency II framework, optimal reinsurance policies.

The course will mainly be taught through lectures on theory, with some classes dedicated to exercises.

At the end of the course, the students should be able to define rate premiums, and to evaluate loss reserves in accordance with various deterministic and stochastic methods, with the consequent estimation of volatility. Furthermore, the students should be able to compute the solvency capital requirement for reserve risk by means of both the market-wide and undertaking specific standard formula and a partial internal model. Throughout the course a special focus will be placed on the analysis of practical applications and empirical data with respect to the topics studied.

### Course content

#### INSTRUCTIONAL OBJECTIVES OF THE COURSE

- Main deterministic statistical-actuarial methods for claims reserve.
- Paid and Incurred Chain-Ladder methods, Bornhuetter-Ferguson method.
- Average cost methods: Fisher-Lange and Frequency-Severity
- Solvency II: the new criteria for the evaluation of technical liabilities
- Best estimate and risk margin.
- Discounting
- Premium reserve and claims reserve under Solvency II framework
- Stochastic methods for claims reserve.
- Distribution-Free Chain-Ladder (Mack formula).
- Predictive distribution of claims reserve: Bootstrapping, Over-Dispersed Poisson methods, Collective risk model.
- The variability of the estimation of the run-off and one-year loss reserves and comparisons between the various approaches used.
- The Merz-Wuthrich formula
- A Re-reserving approach
- Solvency II: the estimation of non-life underwriting risk, with particular reference to reserve risk (standard formula and internal model).
- Analysis of several case studies for studying the variability of the loss reserve.
- Reinsurance: an in-depth look at several aspects of reinsurance.
- Premium rating for motor third-party liabilities: some practical aspects.



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## Reading list

Given the particular structure of the course and the analysis of certain topics over a long term horizon, it is not possible to identify specific textbooks that cover all course topics.

Instructional material will be made available on the Blackboard platform throughout the course.

Series of readings and supplemental instructional materials will be made available on the course site of the Blackboard platform.

Reading materials for further study (optional)

CASUALTY ACTUARIAL SOCIETY, Estimating Unpaid Claims using basic techniques, 2009.

P.D. ENGLAND-R.J. VERRALL, Stochastic claims reserving in general insurance, British Actuarial Journal 8/3, 443-518, 2002.

S.A. KLUGMAN-H.H. PANJER-G.E. WILLMOT, Loss Models: From Data to Decisions, 4th Edition, Wiley, 2012.

T. MACK, Distribution-free calculation of the standard error of chain ladder reserves estimates, ASTIN Bulletin 23/2, 213-225, 1993.

M. MERZ-M.V. WÜTHRICH, Modelling the claims development result for solvency purposes, CAS E-Forum, Fall 2008, 542-568, 2008.

G. TAYLOR, Loss Reserving: An Actuarial Perspective, Kluwer, 2000, Boston.

M.V. WÜTHRICH-M. MERZ, Stochastic Claims Reserving Methods in Insurance, Wiley Finance, 2008.

## Teaching method

Lectures integrated with examples from actuarial case studies.

Tutoring hours (computer laboratory).

Seminars.

## Assessment method and criteria

The exam is based on both a written and an oral examination.

The written examination includes four questions lasting 2 hours and an half.

The written examination is based on both open-ended questions and exercises.

Calculator is allowed during the written examination.

The compulsory oral exam can be taken only if the written exam has been passed (i.e. with a mark greater or equal than 18).

The final mark is the simple average of grades of written and oral exam.

In case the exam has been failed, both written and oral examination must be taken again.

The examination regards the entire course syllabus. The examination is aimed at assessing reasoning, analytical rigour with regard to course topics.

## Notes and prerequisites

### *Prerequisites*

In order to understand the topics dealt with in the course, the concepts of basic mathematics, probability, statistics, financial mathematics and basic non-life insurance are necessary.

At the beginning of this course the student should have an active knowledge of a basic course in probability theory and statistics (at bachelor level).



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In particular, before taking the course, the student should have an understanding of:

- the concepts of discrete and continuous random variables;
- the concepts of the probability function, density function and generating functions;
- the concepts of mean, variance and skewness;
- main distributions of discrete and continuous random variables used in insurance field;
- the basic elements of the criteria for setting rates in property-casualty lines;
- the definition of risk premium, pure premium and rate premium;
- the definition of premium and loss reserve in non-life insurance;
- characteristics of main reinsurance treaties;
- the criteria for assessing minimum capital requirements for non-life Insurers under Solvency I framework

*Other information*

Further information can be found on the [lecturer's webpage](#) or on the Faculty notice board