

Preface to the Third Edition

Since the first lecture in 2004/2005 at ETH Zurich, market-consistent actuarial valuation has become the standard framework in insurance valuation, risk management and statistical modelling. It is the basis of a consistent economic balance sheet, and it is also the basis of risk-based solvency considerations such as the Swiss Solvency Test and Solvency II. These legal and regulatory developments have also led to changes in our perception of the field. The main improvement of the third edition compared to the previous editions is that we have given an update on recent developments and changes.

In Chap. 4, we elaborate more on different risk measures. Our original solvency definition was rather restrictive. In the light of the Swiss Solvency Test and Solvency II, we relax our restrictive definition to more practical risk measures which are used in the industry. We also provide a comparison between our initial definition and industry practice.

The biggest changes concern Chap. 5 on non-life insurance modelling. Over the last ten years, the viewpoint of non-life insurance reserving risk has fundamentally changed from a static view towards a dynamic view. This change required a rewrite of big parts of this chapter in order to adapt the valuation framework to this dynamic view.

Most importantly, I want to express my most sincere gratitude to my former co-authors of these notes Hans Bühlmann and Hansjörg Furrer. The foundations of these lecture notes go back to Hans and Hansjörg, and their ideas and our conversations have always been a great source of inspiration. I very much regret that they did not have a sufficient amount of time to contribute to this latest edition.

Finally, I would like to kindly thank Philippe Deprez for his very beneficial support in preparing this new edition. His mathematical comments have substantially enhanced this manuscript and his graphical skills have improved the illustrations. My final thanks go to the many students who have attended this lecture.

Zürich
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Preface to the Second Edition

The financial crisis of 2007–2010 has shown that the topic of market-consistent valuation and solvency has nothing lost of its topicality. On the contrary, it has shown that we need a much deeper understanding of the models used, their limitations, etc., in order to model real world problems. In this spirit, the first edition of these lecture notes has initiated a very active discussion among academics and practitioners about actuarial modelling and the use of models.

Since the first edition of these notes this course was again held at ETH Zurich in 2008 and 2010. Moreover, we have also presented part of these notes in various European countries, such as Germany, the UK, France, The Netherlands and Sweden. These presentations have stimulated several interesting discussions which we have implemented into the new version. The main new features are:

In Chapter 2, we elaborate on the separation of financial deflators and probability distortions. For the financial deflator, we then give a simple explicit example in terms of the discrete time Vasiček model. Probability distortions on the other hand can be understood in various ways. We give different examples that lead to the Esscher premium, to the cost-of-capital loading for expected shortfall and to first order life tables (in Chapter 3).

In Chapter 3, we introduce the approximate valuation portfolio which is useful in the case where we are not able to construct an exact valuation portfolio. This is done using selected scenarios evaluated with the help of an appropriate distance function. This is in line with the state-of-the-art concepts used in life insurance practice.

Finally, in Chapter 6, we add two sections that discuss losses and gains from insurance technical risks. This is closely related to the actual discussion of the claims development result in non-life insurance, but of course also applies to life insurance problems.

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Preface to the First Edition

The balance sheet of an insurance company is often difficult to interpret. This derives from the fact that assets and liabilities are measured by different yardsticks. Assets are mostly valued at market prices; liabilities—as far as they relate to contractual obligations to the insured—are measured by established actuarial methods. Since, in general, there does not exist a market for trading insurance policies, the question arises how these actuarial methods need to be changed to give values—as if these markets existed. The answer to this question is “Market-Consistent Actuarial Valuation”. These lecture notes explain the logical mathematical framework that leads to market-consistent values for insurance liabilities.

In Chapter 1, we motivate the use of market-consistent values. Solvency requirements by regulators are one major reason for it.

Chapter 2 introduces stochastic discounting, which in a market-consistent actuarial valuation framework replaces discounting with the classical technical interest rate. In this chapter, we introduce the notion of “Financial Variables” (which follow the laws of financial markets) and the notion of “Technical Variables” (which are purely dependent on insurance events).

In Chapter 3, the concept of the “Valuation Portfolio” (VaPo) is introduced and explained in the life insurance context. The basic idea is not to consider liabilities in monetary values but in units, which are appropriately chosen financial instruments. For life insurance products, this choice is quite natural. The risk due to technical variables is included in the protected (against technical risk) VaPo, denoted by VaPo^{prot} .

Financial risk is treated in Chapter 4. It derives from the fact that the actual investment portfolio of the insurance company differs from the VaPo^{prot} . Ways to control the financial risk are—among others—derivative securities such as Margrabe Options and/or (additional) Risk Bearing Capital.

In Chapter 5, the notion of the Valuation Portfolio (VaPo) and the protected (against technical risk) Valuation Portfolio (VaPo^{prot}) is extended to the non-life insurance sector. The basic difference to life insurance derives from the fact that in property and casualty insurance the technical risk is much more important. The

discussion of appropriate risk measures (in particular the mean square error of prediction) is therefore a central issue.

The final Chapter 6 contains selected topics. We mention only the treatment of the “Legal Quote” in life insurance.

These lecture notes stem from a course on market-consistent actuarial valuation, so far given twice at ETH Zürich, namely in 2004/2005 by HB and HJF and in 2006 by MW and HJF. MW has greatly improved on the first version of these notes. But obviously this version is not to be considered as final. For this reason, we are grateful that Springer’s newly created EAA Lecture Notes series has given us the opportunity to share these notes with many friends and colleagues, whom we invite to participate in the process of discussion and further improvement of the present text, and to help clarify our way of understanding and modelling.

The authors wish to thank Professor Paul Embrechts for his interest and constant encouragement while they were working on this project. His support has been a great stimulus for us.

It is also a great honour for us that our text appears as the first volume of Springer’s newly founded EAA Lecture Notes series. We are grateful to Peter Diethelm, who as Managing Director has been the driving force in getting this series started.

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