# XI° Congresso Nazionale Attuari

## *Verso le credenziali della CGA (CERA Global Association): sviluppo del progetto formativo per l'attuario nell'ERM framework*
### *Vincenzo Urciuoli*

## Appendice

**Presentation of CISA AEP CERA qualification**

CISA (Inter-University Centre for Actuarial Sciences and Risk Management) was founded in 1991 by the Universities of Florence, Rome La Sapienza and Trieste, the only Italian ones, at that time, to offer Master Programs in Actuarial Sciences. To-day the Universities members of CISA are ten: Florence, Rome La Sapienza, Milan Cattolica del Sacro Cuore, Milan Bicocca, Trieste, Turin, Sannio (Benevento), Calabria (Cosenza), Sassari, Salento (Lecce). The Administration of CISA is located in Florence. CISA is a non-profit Institution, whose funds (raised through professional courses and research projects) are entirely allocated to support Training and Research Programs in the field of Actuarial Sciences and Risk Management, which, not exhaustively, includes Private Insurance (Life and Non-life), Pension and Welfare Schemes, Enterprise Risk Management, Financial Instruments for Mitigating Catastrophic Risks (floods, earthquakes, climatic changes), Health Insurance, Historic and Artistic Asset Risks etc. In the structure of the Centre a peculiar role is played by the Committees, which organize specific activities of the scientific sectors pertaining to CISA's range of interest. In past years CISA has organized numerous post-graduate and professional Courses, on such topics as: Enterprise Quantitative Methods, Pension Funds, Energy and Environment Risks, Health Insurance etc. These Courses have granted University recognized degrees to those participants who have passed a prescribed sequence of examinations. More

recently, together with the Italian Order and Council of Actuaries, CISA has organized an Actuary School and Laboratory (now at its fifth edition), addressed both to graduate students intending to be admitted to the Order and to professional actuaries wishing to update their knowledge and competence. Finally, the performance of CISA's didactic activities is supported by advanced technological instruments, such as: • an e-learning Moodle platform, allowing teachers to communicate class materials, information on programs, home-works, tests, etc.; • a video platform named "Attuari Channel", which transmits in streaming on-demand public and classified videos; • an informatic room endowed with 16 computers for the students plus one for the teacher with a graphic tablet transmitting the signal on six 42-inch monitors. Therefore, considering CISA's experience, competence and equipment in providing highly qualified Courses in the field of Actuarial Sciences and Risk Management, it appears totally appropriate the appointment of CISA as provider of CERA Course on Enterprise Risk Management (ERM). In particular, the Centre can supply teachers of high international standard, coming both from Italian and other European Universities collaborating with CISA (e.g., prominent scholars in Risk Theory such as Hans Bühlmannand Paul Embrechts are members of CISA's Scientific Board). Structure of the ERM Course What follows is a proposal for the organization of the ERM Course, concerning lectures, teachers and examinations. The Course will consist of seven Sections, according to CERA Syllabus, namely: • Section 1. Enterprise Risk Management and Framework. 8 hours of lectures for three days: total 24 hours. Teachers: Fabio Grasso (University Rome La Sapienza), Susanna Levantesi (University Rome La Sapienza). • Section 2. ERM Process (Structure of the ERM Function and Best Practice). 16 hours of lectures and 8 hours of laboratory in three days: total 24 hours. Teachers: Giampaolo Crenca(CNA President),Salvatore Forte (University Rome Luiss). • Section 3. Risk Categories and Identification. 16 hours of lectures and 8 hours of laboratory in three days: total 24 hours. Teachers: Luigi Vannucci

(University of Florence), Lorenzo Quirini (MPS Executive). • Section 4. Risk Modelling and Aggregation of Risks. 16 hours of lectures and 8 hours of laboratory in three days: total 24 hours. Teachers: Paul Embrechts (ETH, Zurich), Francesca Zucchi (Université de Lausanne). • Section 5. Risk Measures. 8 hours of lectures for two days: total 16 hours. Teachers: Marcello Galeotti (University of Florence), Emanuele Vannucci (University of Pisa). • Section 6. Risk Management Tools and Techniques. 16 hours of lectures and 8 hours of laboratory in three days: total 24 hours. Teachers: Francesco Cuzzucrea (PwC | Actuarial Services | Associate Partner),Angelo Troiani (PwC | Actuarial Services | Manager). • Section 7. Economic Capital. 16 hours of lectures and 8 hours of laboratory in three days: total 24 hours. Teachers: Fabio Baione (University of Florence),Mauro Piccinini (THE BOSTON CONSULTING GROUP). It's also included a seminar on professionalism and especially on professional standards. The direction of the entire course (or school of higher education ) ERM, under the CISA, is entrusted to Marcello Galeotti (University of Florence) and Vincenzo Urciuoli (University Rome La Sapienza).

**Section 1**

**Enterprise Risk Management Concept and Framework**

Abstract

The goal of this course is to provide the candidates with the enterprise risk management definition and framework. The concept of enterprise risk management is fully described as well as the specific principal terms. Furthermore, the course deals with the appropriate framework and the acceptable governance structure for an organization's enterprise risk management. The meaning and the framework of risk culture are also examined. Finally, the governance issues, the perspectives of regulators, rating agencies, stock analysts, and company stakeholders as well as the value creation obtained through enterprise risk management are deepened.

| **Course Programme** | Target Bloom's Rating | Bibliography |
|---|---|---|
| **1. What is the Enterprise Risk Management (ERM)** | | (1), (2), (4) |
| 1.1 Definition, framework and drivers, <br> 1.2 The resulting value to organizations. | 2-3 | |
| **2. The principal terms in ERM** | 2-3 | (4) |
| **3. The appropriate framework for an organization's enterprise risk management and the features of an acceptable ERM governance structure.** | 4-5 | (2), (4), (6) |
| **4. Creating a a risk culture in an organization** | 4-5 | |
| 4.1 The meaning of risk culture, <br> 4.2 Risk consciousness, accountabilities, discipline, collaboration, incentive, compensation, and communication, <br> 4.3 The risk culture framework. | | (4), (7) |
| **5. The governance issues: market conduct, internal audit, legal risk, operational and technical risks.** | 3-4 | (2), (4) |
| **6. The risk frameworks in regulatory and other environments and their underlying principles.** | 3-4 | (3), (5) |
| **7. The perspectives of regulators, rating agencies, stock analysts, and company stakeholders and how they evaluate the risks and the risk management of an organization.** | 3-4 | (6) |
| **8. Value creation through ERM: processes, assessment of the organization's risk profile, optimal economic capital allocation for rating improvement.** | 5 | (4), (6) |
| **9. The changes in the organization's risk profile: risk and return trade-offs.** | 3-4 | (2) |

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(4) International ActuarialAssociation (IAA), 2009. **Note on Enterprise Risk Management for Capital and SolvencyPurposes in the InsuranceIndustry.**

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**Section 2**

**Erm Process – Structure of the Erm Function and Best Practices**

**Abstract**

The goal of this section is to provide the student with knowledge on the Structure of the ERM Function and Best Practices.

The Course Programme is in compliance with the CERA Syllabus, i.e.:

- Demonstrate how to articulate an organization's risk appetite, quantified risk tolerances, risk philosophy and risk objectives.
- Demonstrate how to articulate a desired risk profile and appropriate risk filters.
- Assess the overall corporate risk exposure arising from financial and non-financial risks.
- Compare the relevance of risk measurement and management to various stakeholders including customers, regulators, government, company directors, professional advisors, shareholders and the general public.
- Demonstrate an understanding of contagion and how it affects different stakeholders.
- Evaluate the elements of a successful risk management function and a structure for an organization's risk management function.
- Determine how financial and other risks and opportunities influence the selection of strategy and how ERM can be appropriately embedded in an entity's strategic planning.
- Demonstrate the application of a risk control process such as the Risk Management Control Cycle or other similar approach.
- Propose ERM solutions or strategies to address real (case study) and hypothetical situations.

A number of case studies will be presented and be object of class and home works.

| Course Programme | Target | Bibliography |
|---|---|---|
| **1. Components of Risk Identification** | | |
| *1.1 Risk Categorization and Identification* | | |
| 1.1.1 Financial Risk<br>1.1.2 Strategic Risk<br>1.1.3 Operational Risk | 3-4 | (1),(2),(3),(4),(5) |
| *1.2 Qualitative Risk Assessment* | | |
| 1.2.1 Partecipant Identification<br>1.2.2 Advance Communication<br>1.2.3 Qualitative Risk Assessment Surveys<br>1.2.4 Consensus Meeting | 3-4 | (1),(2),(3),(4),(5) |
| *1.3 Emerging Risk Identification* | | |
| 1.3.1 Monitoring Known Risks<br>1.3.2 Environmental Scanning for Unknown risks | 3-4 | (1),(2),(3),(4),(5) |
| *1.4 Killer Risks* | | |
| 1.4.1 Politically Difficult to Introduce<br>1.4.2 Easily Identifiable<br>1.4.3 A Leading Indicator of High-Severity Risk Events | 3-4 | (1),(2),(3),(4),(5) |
| Case Study | 4-5 | |
| **2. Risk Quantification** | | |
| *2.1 Components of Risk Quantification* | | |
| 2.1.1 Calculate Baseline Company Value<br>2.1.2 Quantify Individual Risk Explosure<br>2.1.3 Quantify Enterprice Risk Explosure | 3-4 | (1),(2),(3),(4),(5) |
| Case Study | 4-5 | |
| **3. Risk Decision Making** | | |
| *3.1 Defining Risk Appetite and Risk Limits* | | |
| 3.1.1 Defining Risk Appetite<br>3.1.2 Defining Risk Limits<br>3.1.3 How To Define Risk Limits | 3-4 | (1),(2),(3),(4),(5) |
| *3.2 Integrating ERM Into Decision Making* | | |
| 3.2.1 Decision Making With ERM<br>3.2.2 Risk-Priority Decision Making<br>3.2.3 Return-Priority Decision Making | 3-4 | (1),(2),(3),(4),(5) |
| Case Study | 4-5 | |
| **4. Risk Messaging** | | |
| *4.1 Internal Risk Messaging* | | |
| 4.1.1 Integrating ERM Into Business Performance Analysis<br>4.1.2 Integrating ERM Into Incentive compensation | 3-4 | (1),(2),(3),(4),(5) |
| *4.2 External Risk Messaging* | | |
| 4.2.1 Shareholders<br>4.2.2 Stock Analysts<br>4.2.3 Rating Agencies<br>4.2.4 Regulators | 3-4 | (1),(2),(3),(4),(5) |
| Case Study | 4-5 | |

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Retrieved from http://www.casact.org/research/erm/overview.pdf
(2) COSO. (2004**). Enterprice Risk Management - Integrated Framework Executive Summary.**
Retrieved from http://www.coso.org/pubblications/ERM/COSO_ERM_ExecutiveSummary.pdf
(3) International Actuarial Association - **Practice Note on Enterprise Risk Management for Capital and Solvency Purposes in the Insurance Industry**
(4) Sim Segal (2011), **Corporate Value of Enterprise Risk Management,Wiley Corporate F&A, New Jersey, Canada**
(5) Sim Segal, **Risk Management, Society of Actuaries, New York 2008**

**Section 3**


**Risk Categories and Identification**


Abstract


The goals of the course are in compliance with the CERA Syllabus, i.e.:

- Explain what is meant by risk and uncertainty.
- Describe different definitions and concepts of risk.
- Discuss risk taxonomy.
- Investigate and interpret financial and non-financial risks faced by an entity, including but not limited to: currency risk, credit risk, spread risk, liquidity risk, interest rate risk, equity risk, hazard/insurance risk, pricing risk, reserving risk, other product risk, operational risk, project risk and strategic risk.


| Course Programme | Target Bloom's Rating | Bibliography |
|---|---|---|
| **1.  Risk and Uncertainty** | | |
| 1.1  Uncertainty vs. Determinism. | 2 | (1) |
| 1.2  How to Measure Uncertainty. | 3-4 | (1) |
| 1.3  Choice under Uncertainty:  Decisions and  Strategies | 2 | (2) |
| **2.  Definitions and Concepts of Risk** | | |
| 2.1  Definition of Risk in Several Contexts. | 2 | |
| 2.2  Evaluation of Risk Impacts: Patrimonial, Economic, Financial, Social, Psychological etc. | 2-3 | (3),(4),(10) |
| **3.  Risk Taxonomy** | | |
| 3.1  Collection of Empirical Data and Model Selection. | 3-4 | |
| 3.2  Synthetic Indexes of Risk Levels. | | (3),(4),(10) |
| 3.3  Ordering through Effectiveness of Available Choices | 5 | |
| **4.  Financial and Non-financial Risks** | | |
| 4.1  Several Typologies of Credit Risk: Sovereign Debt, Corporate Bonds, Credit Retail. | 3-4 | (6),(7),(9),(12) |
| 4.2  Insurance Risk: Life and Non-life, Reserving. | 4-5 | (4),(8),(10) |
| 4.3  Other Risks: Currency and Interest Rate Risk,  Product Risk, Operational Risk, Extreme Events… | 3-4 | (5),(11),(13) |

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(4)    L. Vannucci, **Statistica assicurativa e valutazioni attuariali**. (Capitoli 1, 2, 4 e 5, il capitolo 3 è di E. Vannucci), Ed. Pitagora, Bologna, 2000.
(5)    L. Vannucci, **On estimation of automobile insurance fraudolence degree**. Giornale dell'Istituto Italiano degli Attuari, Anno LXVI, vol. unico, pp. 83-99, 2003.
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(13)   L. Vannucci, **Assicurazione e riassicurazione delle catastrofi ambientali**. Sta in E-book "Cambiamenti climatici, catastrofi ambientali e assicurazione (titolo in italiano) Climate change, environmental catastrophic events and insurance (titolo in inglese)", pp. 27-44, a cura di S. Landini e G. Maracchi, Cesifin on line, ISBN 9788898742028, 2015.

**Section 4**


**Risk modelling and aggregation of risks**


Abstract

In this section classic and recent approaches to risk modelling and dependence uncertainty will be discussed. At the end of the course the student should get familiar with the basic elements of these approaches and capable to choose the most convenient ones in practical cases. A particular emphasis will be set on numerical (in some cases also geometrical) algorithms designed to calculate risk measure bounds in case of dependent risks portfolios.

| Course Programme | Target Bloom's Rating | Bibliography |
|---|---|---|
| **1. Basic concepts in Quantitative Risk Management** | | |
| 1.1 A definition of economic risk: examples from insurance and | 2 | |
| 1.2 Expected utility and definition of risk aversion. Risk premium | | (1),(4) |
| 1.3 Risk management for a financial firm. | 4 | |
| **2. An introduction to the Extreme Value Theory** | | |
| 2.1 Light and heavy tail distributions. Rate of hazard. Sub-exponential distributions. | | |
| 2.2 Ruin probability for heavy tail distributions. Fluctuations of sums and maxima. | 2-3 | (3) |
| 2.3 The extreme value distributions and the mean excess | | |
| **3. Aggregation of dependent risks** | | |
| 3.1 Definition of copulas. Sklar's theorem. Archimedean copulas. | 2-3 | (2),(4) |
| 3.2 Copulas and dependence. Kendall's tau and Spearman's rho. | | |
| **4. Dependence uncertainty for aggregate risk** | | |
| 4.1 How to calculate regulatory risk measures under dependence uncertainty: Monte-Carlo and geometric methods | 3-4 | |
| 4.2 Upper and lower bounds for VaR and ES. | | (5),(6),(7),(8) |
| 4.3 The Rearrangement Algorithm. Numerical examples for homogeneous and inhomogeneous portfolios | 4-5 | |

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**Section 5**


**Risk Measures**


Abstract


The goal of this section is to provide the student with knowledge and practice of techniques and models aimed to quantify risk exposures within the context of several risk management processes. So, first of all, static and dynamic credit risk models will be introduced. Next, the use of financial derivatives in mitigating the interest rate risk will be discussed. The core of the course will be devoted to analysis and computation of the main and most adopted risk measures, i.e. VaR and Expected Shortfall. Finally, financial time series will be examined in the context of ARCH and GARCH models. A number of case studies will be presented and be object of class and home works.


| Course Programme | Target Bloom's Rating | Bibliography |
|---|---|---|
| **1. Credit Risk Measurement** | | |
| 1.1 Measurement of credit risk for fixed income securities from<br>1.2 Dynamic credit risk models and credit derivatives. | 3-<br>2- | (1),(3) |
| **2. Asset-liability Immunization** | | |
| 2.1 Analysing the use of financial derivatives in order to mitigate<br>2.2 Asset-liability immunization with fixed income securities | 3-<br>4-5 | (1),(2) |
| **3. Risk Measures** | | |
| 3.1 Coherence and sub-additivity.<br>3.2 The Value-at-Risk and the Expected Shortfall: advantages and<br>3.3 The best and worst VaR: computation algorithms and | 2-3 | (4),(5),(6) |
| **4. Financial time series** | | |
| 4.1 Volatility models and risk estimation.<br>4.2 ARMA processes. ARCH and GARCH models.<br>4.3 Multivariate GARCH processes. | 3- | (3) |

## Bibliography

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(3)     McNeil A.J., Frey R., Embrechts P. (2005) - **Quantitative Risk Management: Concepts, Techniques, and Tools.** Princeton  Series in Finance.

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**Section 6**

**Risk Management Tools and Techniques**

Abstract

The aim of the course is to instil in successful candidates the key principles underlying application of tools and techniques of ERM within an organisation, focusing on quantitative methods of risk measurement and modelling.

This section deals with risk optimization and mitigation through hedging, transfer and reduction tecniques of the main risk categories within financial and insurance industries.

Additionally other key risks (e.g. operational, strategic, legal) will be analyzed aiming at their management and mitigation.

The students should gain the ability to apply ERM tools and techniques to any type of organisation.

**Course Programme**

| | Target Bloom's Rating | Bibliography |
|---|---|---|
| **1.  Risk Management: Overview on Tools and Techniques** | | |
| *1.1 Basic risk management concepts*<br>  1.1.1.Determination of appropriate hedging<br>  1.1.2.Overview on the possibilities for risk mitigation and risk | 2 | (9) Cap 1 e 5, (11) |
| *1.2 Risk optimization and the utility for the undertaking*<br>  1.2.1 Discussion of the possibilities and boundaries of risk<br>  1.2.2 Benefits and costs of risk management for the undertaking | 2 - 3 | |
| *1.3 Risk management and Solvency II framework* | 3 | (7), (11) |
| **2.  Financial Portfolio Management** | | |
| *2.1 Asset side relatedrisks*<br>  2.1.1 Classification of risks according to asset classes<br>   • Debtinstruments<br>   • Equity<br>   • Other asset classes (property, currency, etc.)<br>   • Derivatives<br>  2.1.2 Overall economic risk and correlation<br>   • Diversification | 3 - 4 | (5) Cap 5, (8) Cap 3-7 e 22, (9) Cap 5 |
| *2.2 Asset-liability portfolio management risk*<br>  2.2.1 Hedgingportfolios | 3 - 4 | (5) Cap 4, (8) Cap |

| | | |
|---|---|---|
| • Dynamichedging | | 9, (9) Cap 7 |
| • Frictionalcosts | | |
| • TrackingError | | |
| 2.2.1 Buy and hold | | |
| 2.2.2 ConstantProportional Portfolio Insurance | | |
| 2.2.3 VariableProportional Portfolio Insurance | | |
| **2.3 Case Study: Enterprise Portfolio Management** | 4 - 5 | |
| **3.    Insurance Portfolio** | | |
| **3.1 Liability side relatedrisks**<br>3.1.1 Classification of risks according to type of business<br> • Lifeinsurance<br>   - Discretionaryparticipationfeatures<br>   - Unit Linked, Index Linked<br>   - TermInsurance<br>   - Annuity<br> • Non-life insurance<br> • Pension funds<br>3.1.2 Overall technical risk and correlation<br> • Diversification | 3 - 4 | (12) Cap 7 |
| **3.2 Asset-liability portfolio management risk**<br>3.2.1 Hedgingportfolios<br> • Italiansegregated funds<br> • Unit Linked with minimum guarantee<br>3.2.2 Riskmitigation<br>3.2.3 Risk transfer | 3 - 4 | (6) |
| **3.3 Case Study** | 4 - 5 | |
| **4.    Reinsurance** | | |
| **4.1 Notion and aim**<br>4.1.1 Life major reinsurance treaties<br>4.1.2 Non-life major reinsurance treaties | 3 - 4 | (2) |
| **4.2 Reinsurance impact in the Solvency II framework**<br>4.2.1 Balance sheets<br>4.2.1 Riskprofile<br> • Internal Model view<br> • Standard Formula view | 3 - 4 | (1), (11) |
| **4.3 Case study** | 4 - 5 | |
| **5.    Securitisation** | | |
| **5.1 Structures and mechanics of securitizations** | 2 - 3 | (8) Cap 27, (9) Cap 6 |
| **5.2 Financial securitization**<br>5.2.1 Collateraliseddebtobligations<br>5.2.2 Mortgage/Assets backed securities | 3 - 4 | |
| **5.3 Insurancesecuritization**<br>5.3.1 Longevity bond<br>5.3.2 Cat bond<br>5.3.3 Sidecars | 3 - 4 | (9) Cap 3, (14), (15) |

| | | |
|---|---|---|
| *5.4 Pros and Cons compared to classical reinsurance* | 4 - 5 | (14), (15) |
| *5.5 Case Study* | 4 - 5 | |
| **6. OtherKeyRisks Evaluation** | | |
| *6.1 Operationalrisk management* | 4 - 5 | (3) Cap 17, (9) |
| *6.2 Liquidityrisk management* | 4 - 5 | (3) Cap 16, (9) |
| *6.3 Strategic and Legal risk management* | 4 - 5 | (3) Cap 21 |
| *6.4 Case Study: Quali-Quantitative Framework for the valuation of Operational Risk in a medium-sized enterpise* | 4 - 5 | |

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(15)  Swiss Re - **The role of indices in transferring insurance risks to the capital markets** - Sigma no. 4/2009

(16)  J. Vadiveloo - **Enterprise Risk Management for Small and Medium-sized Enterprises - Society of Actuaries,** Schaumburg, Illinois

**Section 7**

**Economic Capital**

Abstract

The course is aimed to provide students with :

- Concepts and tools to understand how economic capital is defined and linked with firms' strategic planning and risk appetite,
- Technical knowledge on how to measure the risk adjusted performance of a firm,
- Skills to use an economic capital framework to generate value for an enterprise.

Notwithstanding the focus on the insurance industry, the course will provide tools and examples on how economic capital has been/ can be used also in the banking and in the non-financial sector.

| **Course Programme** | **Target Bloom's rating** | **Bibliography** |
|---|---|---|
| **1. Definition of Economic Capital** | | |
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