



**U N I V E R S I T Y   O F   P I R A E U S**  
**SCHOOL OF FINANCE AND STATISTICS**  
**DEPARTMENT OF STATISTICS AND INSURANCE SCIENCE**  
**MSc INSURANCE SCIENCE AND RISK MANAGEMENT**

**Actuarial and Risk Measures Workshop**  
**on**  
**Pension Plans and Related Topics**

Entrance: University of Piraeus Conference Room  
Date: Friday 3 of October 2014  
Opening: 13:30

**Program**

**Modelling Critical Illness Insurance Data**  
**Howard Waters**  
**University of Heriot -Watt**  
**Time 14:00-14:50**

**Actuarial challenges around pension reforms in Europe**  
**Pierre Devolder**  
**University of Louvain**  
**Time 14:50-15:40**

**Break 15:40-16:10**

**Variable Annuities as Options Packages: A Dynamic Valuation Approach**  
**Anna Rita Bacinello**  
**University of Trieste**  
**Time 16:10-17:00**

**Modelling long term interest rates for pension funds**  
**Vellekoop, Michel**  
**University of Amsterdam**  
**Time 17:00-17:50**

## **Free Admission**

# Abstracts

### **Modelling Critical Illness Insurance Data**

**Howard Waters**  
**University of Herriot Watt, UK**

Critical Illness insurance is a form of long term insurance which pays a sum insured on the diagnosis, within the term of the policy, of one of a specified list of illnesses, for example, a heart attack or cancer. It is a very popular type of insurance in the UK. At its peak, in 2002, over 1 million new policies were sold. In this talk I will give an overview of a recent project which used data from 1999 - 2005 covering nearly one half of the UK market to model Critical Illness insurance, the objective being to develop probabilistic models which can be used to price policies and to monitor future claims experience. The talk will cover technical aspects - Markov models, parameter estimation, Gibbs Variable Selection - and the practical difficulties which inevitably arise with any project involving a large data set, in particular problems caused by missing data. Results will also be presented.

### **Actuarial Challenges around Pension Reforms in Europe**

**Pierre DEVOLDER**  
**Université Catholique de Louvain ( UCL), ISBA, Belgium**

Ageing is for sure one of the major issues for our economies in the next decades. The age structure of our population will deeply change under the influence of 3 demographic factors: the continuous improvement of the life expectancy, a limited fertility rate and the effects of the baby boom (becoming a “papy boom”). Our pension systems designed in Europe in a context of welfare state will be deeply affected by these evolutions in a general atmosphere of increasing risks (financial risk, longevity risk...). The purpose of the presentation is to present some interesting actuarial research questions and applied problems about these future challenges of sustainability of the public and private pension schemes in Europe. Aspects such as point systems, NDC pension schemes, diversification between funding and pay as you go or long term guarantees will be presented.

## **Variable Annuities as Options Packages: A Dynamic Valuation Approach**

**Anna Rita BACINELLO**  
**University of Trieste, Italy**

Life annuities and pension products usually involve a number of guarantees, such as minimum accumulation rates, minimum annual payments or a minimum total payout. Packaging different types of guarantees is the feature of the so-called variable annuities. Basically, these products are unit-linked investment policies providing a post-retirement income. The guarantees, commonly referred to as GMxBs (namely, Guaranteed Minimum Benefits of type 'x'), include minimum benefits both in case of death and survival. In this talk, after providing a detailed description of the most common guarantees offered by variable annuities, we introduce the alternative assumptions underlying the policyholder behavior (*static*, *mixed* and *dynamic* approach) as defined in Bacinello *et al.* (2011), that propose a unifying framework for treatment and valuation of variable annuities under quite general model assumptions. Then we concentrate on the valuation of Guaranteed Minimum Withdrawal Benefits with the dynamic approach, and present the results of a joint work by Bacinello *et al.* (2014), where the valuation model is formulated as a discrete stochastic control problem and solved with a dynamic programming algorithm.

## **Modelling Long Term Interest Rates for Pension Funds**

**Michel VELLEKOOP**  
**University of Amsterdam, Nederland**

The choice of a discount curve that can be used for the valuation of long-term liabilities of pension funds has become a topic of intensified debate in some countries. The market consistent valuation principle is not straightforward to implement for such liabilities, since interest rate instruments such as bonds and swaps are not always liquidly traded for maturities beyond 30 years. Interpolation and extrapolation methods must therefore be specified before a term structure can be estimated based on available market data. We will discuss some popular choices to do this and propose a new method which is linked to the so-called “ultimate forward rate” that has originally been proposed for insurance regulation and has been used for pension funds in some countries as well.