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Dynamic models for human Longevity with Lifestyle Adjustments

CLOSING CONFERENCE

January 15th, 16th & 17th 2018

ISFA Institut de Science Financière et d'Assurances
GRANDE ÉCOLE D'ACTUARIAT & GESTION DES RISQUES

LABORATOIRE SAF SCIENCES ACTUARIELLE & FINANCIÈRE

UPMC SORBONNE UNIVERSITÉS

Université Claude Bernard Lyon 1

PROGRAM

Monday, January 15th 2018

10h15 Welcome coffee

10h30 Welcome address
Stéphane Loisel & Nicole El Karoui

10h40 **Andrew Cairns**
Modelling Socio-Economic Differences in the Mortality of Danish Males Using a New Affluence Index

11h40 **Marine Habart** (Axa) & **Dominique Abgrall** (Allianz) LoLitA
Longevity/mortality risks… from insurers' point of view

12h20 **Yahia Salhi** LoLitA
Surveillance of Biometric Assumptions in Population Dynamics

13h-14h30 Lunch

14h30 **Alexandre Boumezoued** LoLitA
A new inference strategy for general population mortality tables

15h10 **Pierre Thérond** LoLitA
A Credibility Approach of the Makeham Mortality Law

15h50 Coffee break

16h20 **Guillaume Biessy** LoLitA
Role of pathologies in the disablement process

17h00 **Pierrick Piette** LoLitA
Forecasting Mortality Rate Improvements with a High-Dimensional VAR

17h50 End

Tuesday, January 16th 2018

9h00 Welcome coffee

9h30 **Julien Vedani** LoLitA
Economic valuation in life insurance - Market inconsistences of the market-consistency

10h10 **Denys Pommeret** LoLitA
A Class of Random Field Memory Models for Mortality Forecasting

10h50 Coffee break

11h20 **Xavier Milhaud** LoLitA
Lapse tables for lapse risk management in insurance, a competing risks approach

12h00 Lunch

14h00 **Daniel Alai**
Mind the Gap: A Study of Cause-Specific Mortality by Socio-Economic Circumstances

15h00 **Gilles Gaba** LoLitA
Demographic transition and economic structural change: A cross-country cliometric approach

15h40 Coffee break

16h10 **Joël Wagner**
Long-Term Care Prevalence and Actuarial Tables: New Empirical Evidence from Switzerland

17h10 (40+10) **Michaël Schwarzinger & Quentin Guibert** LoLitA
Life Expectancy And Life Expectancy Without major Disability: A Microsimulation Model From French National Data Sources

18h00 End

19h30 Cocktail

Wednesday, January 17th 2018

8h45 Welcome coffee

9h10 **Hippolyte d'Albis**
Age groups and the measure of population aging

10h10 Coffee break

10h40 **Nicole El Karoui** LoLitA
Population dynamics models for longevity I

11h20 **Sarah Kaakaï** LoLitA
How can a cause-of-death reduction be compensated in presence of heterogeneity? A population dynamics approach based on English data by deprivation.

12h00 Lunch

13h30 **Jason Tsai**
Multi-population Mortality Modeling: When the Data is Too Much and Not Enough

14h30 **Frédéric Planchet** LoLitA
Longevity Risk and "Longevity megafunds"

15h10 Coffee break

15h40 **Caroline Hillairet** LoLitA
Pricing of long term derivatives : main challenges and issues

16h20 **Tim Boonen**
Redistribution of longevity risk: The effect of heterogeneous mortality Beliefs

17h20 Closing/Remarks

17h30 End

Membres IA : 18 Points PPC

Conference venue
CAMPUS DES CORDELIERS
Amphithéâtre Pasquier
Salle Marie Curie
15, rue de l'école de médecine
75006 PARIS

Cocktail venue
CAMPUS JUSSIEU
Tour Zamansky, 24ème étage
4, place Jussieu 75005 Paris

INVITED SPEAKERS

Daniel **ALAI** *University of Kent*

Daniel Alai is a Lecturer in the Centre for Actuarial Science, Risk and Investment at the University of Kent. He is also an Associate Investigator in the Centre of Excellence in Population Ageing Research, funded by the Australian Research Council. Prior to his appointment at Kent in early 2014, Daniel was a Senior Research Associate in the Australian Institute for Population Ageing Research at the UNSW Business School. Daniel joined UNSW in June 2010 following the completion of his PhD degree from the Department of Mathematics at ETH Zürich. He has also worked for insurance companies such as Sun Life (Waterloo, Canada) and Manulife (Waterloo, Canada), as well as for consulting companies KPMG (Toronto, Canada) and Tillinghast-Towers Perrin (New York City, US). He has expertise in actuarial risk management and loss modelling, development and assessment of models for longevity risk and application to product design, risk management and regulatory requirements.

Hippolyte d'**ALBIS** *Paris School of Economics*

Hippolyte d'Albis is senior researcher at CNRS and Professor at the Paris School of Economics. He is specialized in the economics of demographic issues, and most notably in population ageing and migration. He serves as an associate editor of the Journal of Demographic Economics, the Journal of the Economics of Ageing and Public Finance Review.

Tim **BOONEN** *University of Amsterdam*

Tim Boonen is an assistant professor in actuarial science at the University of Amsterdam. Before joining the University of Amsterdam, Tim obtained his Ph.D. in 2014 at Tilburg University. His research addresses longevity risk modelling, risk sharing, capital allocation, and applications of game theory in insurance.

Andrew **CAIRNS** *Heriot-Watt University*

Andrew Cairns is Professor of Financial Mathematics at Heriot-Watt University, Edinburgh, and Director of the Actuarial Research Centre (ARC) of the Institute and Faculty of Actuaries. He is well known internationally for his research in financial risk management for pension plans and life insurers. In recent years he has been working on the modelling of longevity risk: how this can be modelled, measured and priced, and how it can be transferred to the financial markets. Amongst his work in this field, he has developed a number of new and innovative stochastic mortality models.
He leads a major research programme sponsored by the ARC on "Modelling Measurement and Management of Longevity and Morbidity Risk".
He qualified as an actuary in 1993, was elected as a corresponding member of the Swiss Association of Actuaries in 2005 and, in 2016, was elected as a Fellow of the Royal Society of Edinburgh - Scotland's national academy of science and letters.

Michaël **SCHWARZINGER**
Translational Health Economics Network

Jason **TSAI** *National Chengchi University*

Jason Chenghsien Tsai is a professor of the Risk Management and Insurance Department and the director of Research Center on the Sustainable Development of Insurance Industries at National Chengchi University. Jason's research interests lie at the intersection of insurance and finance. He has published in the Journal of Risk and Insurance, Insurance: Mathematics and Economics, European Journal of Operational Research, among others. Jason has led and participated in many projects for insurance supervisors, organizations, and companies in Taiwan. He was a Fulbright Scholar visiting Santa Clara University. Jason's doctoral degree is in Risk Management and Insurance from Georgia State University. He got his Master's and Bachelor's of Business Administration from Carnegie Mellon University and National Taiwan University, respectively.

Joël **WAGNER** *UNIL, Swiss Financial Institute*

Joël Wagner is Full Professor of Actuarial Science at HEC Lausanne and Faculty Member of the Swiss Finance Institute. His research focuses on current topics in risk management and insurance. Recent and ongoing work studies challenges in financing life, pension, health and long term-care insurance, in actuarial pricing and insurance management (strategy, distribution, claims), and from developments in regulatory frameworks. Joël regularly collaborates in projects with insurance companies, conducts field studies, teaches in executive education and presents findings at academic conferences as well as in talks to practitioners.
Before joining HEC Lausanne, he was Assistant Professor of Risk Management and Insurance at the University of St. Gallen (HSG) and Member of the Executive Board of the Institute of Insurance Economics. His industry experience includes working as a consultant in the Financial Services and Insurance practice of The Boston Consulting Group. Joël holds a venia legendi in Business Administration with special emphasis on Risk Management from HSG and has been awarded the degree of Privatdozent. He holds a Ph.D. in Mathematics and an engineering degree in Physics from the Swiss Federal Institute of Technology in Lausanne (EPFL).

ABSTRACTS

Monday, January 15th 2018 | 10h40

Modelling Socio-Economic Differences in the Mortality of Danish Males Using a New Affluence Index

Andrew CAIRNS

We investigate and model how the mortality of Danish males aged 55-94 has changed over the period 1985-2012. We divide the population into ten socio-economic subgroups using a new affluence index using data from the Statistics Denmark national register database. This is shown to provide consistent subgroup rankings based on age specific death rates across all ages and over all years. The gap between the most and least affluent is confirmed to be widest at younger ages and has widened over time. We introduce a new multi-population mortality model that fits the historical mortality data well and captures the essential character of the raw data. The model generates smoothed death rates that allow us to work with a larger number of smaller subgroups than might be considered feasible when working with raw data. The model produces plausible projections of age-specific death rates that preserve the subgroup rankings at all ages. It also satisfies reasonableness criteria related to the term structure of correlations across ages and over time through consideration of future death and survival rates.

Monday, January 15th 2018 | 11h40

Longevity/mortality risks… from insurers' point of view

Marine Habart (Axa) & **Dominique Abgrall** (Allianz)

Life Expectancy has been steadily increasing over time, and these gains raise new challenges for insurers. This presentation aims at describing how insurers tackle the mortality/longevity topics, and gives some concrete business examples. More precisely, two examples of mortality monitoring will be developed: a first case where the average mortality rate is assumed constant (e.g. stable insurance portfolio) and a second case where the mortality rate is proportionally decreasing at a steady rate. For both cases, we illustrate how we can detect a persistent change, even small, and how we measure it at the same time. Mortality/longevity topics are complex and it is key for an insurance company to work in close collaboration with academics to better understand and model it.

Monday, January 15th 2018 | 12h20

Surveillance of Biometric Assumptions in Population Dynamics

Yahia SALHI

In this paper we consider the quickest detection of a change on the death intensity of an individual-based stochastic population dynamics that have been extended to the study of human population dynamics, see Bensusan (2010), Boumezoued (2016a) and Kaakai (2017). The intensity process is assumed to be a deterministic function of age and time. Using this formulation, we investigate the optimal time to raise an alarm for a multiplicative change of the intensity. We consider a robust framework to characterize the quickest detection problem and use the results on the optimality of the so-called CUSUM strategy in El Karoui et al. (2017). Applications to real-world data-sets are investigated.

Monday, January 15th 2018 | 14h30

A new inference strategy for general population mortality tables

Alexandre BOUMEZOUED
Milliman R&D

We propose a new inference strategy for general population mortality tables based on annual population and death estimates, completed by monthly birth counts. We establish formulas in the Lexis diagram based on population dynamics in a deterministic setting that links the death rates to be estimated with the observables at hand. The inference algorithm takes the form of a recursive and implicit scheme for computing death rate estimates. This paper demonstrates both theoretically and numerically the efficiency of using additional monthly birth counts for computing annual mortality tables. As a collateral gain, the new mortality tables show better features, including the fact that previous anomalies in the form of isolated cohort effects disappear, which confirms from a mathematical perspective the previous contributions by Richards (2008), Cairns et al. (2016) and Boumezoued (2016).
This is joint work with Marc Hoffmann and Paulien Jeunesse (Paris Dauphine University).

Monday, January 15th 2018 | 15h10

A Credibility Approach of the Makeham Mortality Law

Pierre THEROND

The present article illustrates a credibility approach to mortality. Interest from life insurers to assess their portfolios' mortality risk has considerably increased. The new regulation and norms, Solvency II, shed light on the need of life tables that best reect the experience of insured portfolios in order to quantify reliably the underlying mortality risk. In this context and following the work of Bühlmann and Gisler (2005) and Hardy and Panjer (1998), we propose a credibility approach which consists on reviewing, as new observations arrive, the assumption on the mortality curve. Unlike the methodology considered in Hardy and Panjer (1998) that consists on updating the aggregate deaths we have chosen to add an age structure on these deaths. Formally, we use a Makeham graduation model. Such an adjustment allows to add a structure in the mortality pattern which is useful when portfolios are of limited size so as to ensure a good representation over the entire age bands considered. We investigate the divergences in the mortality forecasts generated by the classical credibility approaches of mortality including Hardy and Panjer (1998) and the Poisson-Gamma model on portfolios originating from various French insurance companies.

Monday, January 15th 2018 | 16h20

Role of pathologies in the disablement process

Guillaume BIESSY

Most Long-Term Care (LTC) Insurance products rely on definitions for functional disability based on the Activities of Daily Living (ADL). While functional disability may reflect the level of care required by the insured life, it is not on its own a good predictor of lifespan in LTC, which strongly depends on the underlying pathology responsible for disability. Indeed, cancer and respiratory diseases are associated with extremely short lifespan while dementia and neurological diseases make for much longer claims. Pathologies are therefore responsible for heterogeneity in the data, which makes estimation of mortality in LTC a difficult issue. As a consequence the associated literature is still scarce. In this presentation, we study the mortality in LTC associated with 4 different groups of pathologies: cancer, dementia, neurological diseases and other causes based on data from a French LTC portfolio. We consider a semi-Markov framework, where mortality in LTC depends on both age at claim inception and time already spent in LTC. We first derive the incidence rate in LTC and mortality rate associated with each group of pathologies and for both males and females. To do so, we rely on local likelihood methods that we apply directly to transition intensities of the model. We then combine those transition intensities to get a second-step estimator of the overall mortality in LTC, which proves more accurate than a direct estimate regardless of the pathology. Finally our results indicates that the peak of mortality following entry in LTC observed in the data is mostly due to the cancer group, and derive a parametric mixture model that better explain mortality in LTC, even when no data about pathologies is available.

Monday, January 15th 2018 | 17h00

Forecasting Mortality Rate Improvements with a High-Dimensional VAR

Pierrick PIETTE

Forecasting mortality rates is a problem which involves the analysis of high-dimensional time series, especially in multi-populations modeling. Most of usual mortality models propose to decompose the mortality rates into several latent factors to reduce this complexity. These approaches, in particular those using cohort factors, have a good fit, but they are less reliable for forecasting purposes. One of the major challenges is to determine the spatial-temporal dependence structure between mortality rates given a relatively moderate sample size. This paper proposes a large vector autoregressive (VAR) model fitted on the differences in the log-mortality rates, ensuring the existence of long-run relationships between mortality rate improvements. Our contribution is threefold. First, sparsity, when fitting the model, is ensured by using high-dimensional variable selection techniques without imposing arbitrary constraints on the dependence structure. The main interest is that the structure of the model is directly driven by the data, in contrast to the main mortality forecasting models. Hence, this approach is more versatile and would provide good forecasting performance for any considered population. Additionally, our estimation allows a one-step procedure, as we do not need to estimate hyper-parameters. The variance-covariance matrix of residuals is then estimated through a parametric form. Secondly, our approach can be used to detect nonintuitive age dependence in the data, beyond the cohort effect which is captured by our model. Third, our approach is natural to model the several populations in long run perspectives. Finally, in an out-of-sample forecasting study for mortality rates, we obtain rather good performances and more relevant forecasts compared to classical mortality models using the French, US and UK data. We also show that our results enlighten the so-called cohort effect for these populations.

Tuesday, January 16th 2018 | 9h30

Economic valuation in life insurance - Market inconsistences of the market-consistency

Julien VEDANI

The Solvency II directive has introduced a specific so-called risk-neutral framework to valuate economic accounting quantities throughout European life insurance companies. The adaptation of this theoretical notion for regulatory purposes requires the addition of a specific criterion, namely the market-consistency, in order to objectify the choice of the valuation probability measure. This work aims at pointing out and fixing some of the major risk sources embedded in the current regulatory life insurance valuation scheme. We compare actuarial and financial valuation schemes. We then address first operational issues and potential market manipulation sources in life insurance, induced by both theoretical and regulatory pitfalls. For example, we show that calibrating the interest rate model in October 2014 instead of December 31st 2014 generates a 140% increase in the economic own funds of a representative French life insurance company. We propose various adaptations of the current implementations, including product-specific valuation scheme, to limit the impact of these market-inconsistencies.

Tuesday, January 16th 2018 | 10h10

A Class of Random Field Memory Models for Mortality Forecasting

Denys POMMERET

We consider a dynamic model for mortality rates based on a random field with dependencies among adjacent cohorts aiming at capturing, among others, the cohort effects and cross generations correlations. It also describes the conditional heteroskedasticity of mortality. The proposed model is a generalization of the AR-ARCH models for random processes. For such class of models, we compare moments and quasi-maximum likelihood estimation (QML) procedures for the parameters. It is shown that the QMLE gives better results. Its statistical consistency and the asymptotic normality of the estimated parameters are obtained. The framework being general, we investigate and illustrate a simple variant, called the three-level memory model, in order to fully understand and assess the effectiveness of the approach for modeling mortality dynamics.

Tuesday, January 16th 2018 | 11h20

Lapse tables for lapse risk management in insurance, a competing risks approach

Xavier MILHAUD

This paper deals with the crucial problem of modelling policyholders' behaviours in life insurance. We focus here on the surrender behaviours and model the contract lifetime through the use of survival regression models. Standard models fail at giving acceptable forecasts for the timing of surrenders because of too much heterogeneity, whereas the competing risk framework provides interesting insights and more accurate predictions. Numerical results follow from using F&G model (Fine & Gray (1999)) on an insurance portfolio embedding Whole Life contracts: through backtests, this framework reveals to be quite efficient and recovers the empirical lapse rate trajectory by aggregating individual predicted lifetimes. These results could be particularly useful to design future insurance product. Moreover, this setting allows to calibrate experimental lapse tables, simplifying the lapse risk management for operational teams.

Tuesday, January 16th 2018 | 14h00

Mind the Gap: A Study of Cause-Specific Mortality by Socio-Economic Circumstances

Daniel ALAI

Socio-economic groups may be exposed to varying levels of mortality; this is certainly the case in the UK, where the gaps in life expectancy, differentiated by socio-economic circumstances, are widening. The reasons for such diverging trends are yet unclear, but a study of cause-specific mortality may provide rich insight into this phenomenon. Therefore, we investigate the relationship between socio-economic circumstances and cause-specific mortality using a unique dataset obtained from the UK Office for National Statistics. We apply a multinomial logistic framework; the reason is twofold. First, covariates such as socio-economic circumstances are readily incorporated. And second, the framework is able to handle the intrinsic dependence amongst the competing causes. As a consequence of the dataset and modelling framework, we are able to investigate the impact of improvements in cause-specific

mortality by socio-economic circumstances. We assess the impact using (residual) life expectancy, a measure of aggregate mortality. Of main interest are the gaps in life expectancy amongst socio-economic groups, the trends in these gaps over time, and the ability to identify the causes most influential in reducing these gaps. This analysis is performed through the investigation of different scenarios. First, by eliminating one cause-of-death at a time; second, by meeting a target set by the World Health Organization (WHO), called WHO 25x25; third, by developing an optimal strategy to increase life expectancy and reduce inequalities. Joint work with Séverine Arnold (-Gaille), Madhavi Bajekal and Andrés M. Villegas.

Tuesday, January 16th 2018 | 15h00

Demographic transition and economic structural change: A cross-country cliometric approach

Gilles GABA

Clustering and Life cycle approachs are used for stages' identification, and Fisher exact test is combined with Cramer's V for stages' associations study.

Tuesday, January 16th 2018 | 16h10

Long-Term Care Prevalence and Actuarial Tables: New Empirical Evidence from Switzerland

Joël WAGNER

Long-term care (LTC) delivered to elderly persons in need of assistance in activities of daily living is a topic of increasing importance. The financing of LTC, the needs for specialized infrastructure and the limited number of caregivers will pose a systemic threat in many developed countries in the future. In the first part of this presentation, we analyze the factors influencing the old-age care prevalence rates in Switzerland through a log-linear regression model. Based on a cross-sectional dataset covering the LTC needs from 1995 to 2014, we statistically support the effect of key drivers such as the age, the gender and the region of residence. We distinguish the prevalence by the mild, moderate and severe frailty levels and by care received either at home or in an institution. Our regression results evidence that prevalence rates exponentially increase with the age yielding significantly higher values for women. These effects are emphasized for moderate and severe dependence and for institutional care. Finally, we forecast the number of dependent persons until 2045. While we observe that the dependent population more than doubles over the considered 30-year horizon, we report significant cantonal differences.
The second part of this presentation adresses LTC transition probabilities. In fact, the scarcity of knowledge about the probability of an elderly person needing help with activities of daily living has hindered the development of insurance solutions that complement existing social systems. We consider two models: a frailty level model that studies the evolution of a dependent person through mild, moderate and severe dependency states to death and a type of care model that distinguishes between care received at home and care received in an institution. We develop and interpret the expressions for the state- and time-dependent transition probabilities in a semi-Markov framework. Then, we empirically assess these probabilities using a novel longitudinal dataset covering all LTC needs in Switzerland over a 20-year period. As a key result, we are the first to derive dependence probability tables by acuity level, gender and age for the Swiss population. Our results are relevant to governments, practitioners and academics alike and help to better understand the factors affecting the demand of LTC, predicting future needs and developing adapted insurance solutions.

Tuesday, January 16th 2018 | 17h10

Life Expectancy And Life Expectancy Without major Disability: A Microsimulation Model From French National Data Sources

Michaël SCHWARZINGER & Quentin GUIBERT

The main objective of this study is to assess the effects of lifestyle factors (heavy alcohol drinking, tobacco smoking, and/or obesity) on the life expectancy and life expectancy without major disability of healthy 50+ adults in France. We developed a microsimulation model from 3 main National data sources in the years 2008 to 2013: a) population census (Insee); b) death records at the individual level (Insee); and c) the Hospital Discharge (PMSI) database that contains all public or private hospital stays in France and detailed medical information at the individual level.
In the first part of this presentation, we will describe the PMSI database as well as its benefits and possible biases. A trivial benefit is the exhaustive identification of adults affected by major diseases that do require hospital care, with possible assessment of the risks for major disability (severe dementia or bedridden state) and/or in-hospital death. An unexpected benefit is related to the high (73.5%) proportion of 50+ adults hospitalized over 6 years in France, at an increasing rate with age (≥90% after 80 years old). Therefore, the PMSI database also provides a large and representative sample on lifestyle factors, with possible assessment of the risks for major diseases.
In the second part of this presentation, we will describe the simulations techniques used to forecast the residual lifetime of an individual taking into account his health deterioration over time. This approach requires measuring the impact of lifestyle factors on the incidence rates of major diseases, and then on the survival probabilities, depending on the current heath state. We also build estimators of the lifespan (overall, with or without disability) conditionally on the characteristics of healthy 50+ adults (considering gender, age, residency, and lifestyle factors). We used regression approaches considering competing risks data with right censoring and left truncation. Finally, possible use of the study results in different fields will be presented.

Wednesday, January 17th 2018 | 9h10

Age groups and the measure of population aging

Hippolyte d'ALBIS

This paper proposes the use of optimal grouping methods for determining the various age groups within a population. The cutoff ages for these groups, such as the age from which an individual is considered to be an older person, are then endogenous variables that depend on the entire population age distribution at any given moment. This method is first applied to the age distribution of the United States and subsequently to a group of 12 industrialized countries. The cutoff ages as well as the main indicators of aging are calculated.

Wednesday, January 17th 2018 | 10h40

Population dynamics models for longevity I

Nicole EL KAROUI

In this talk, we present the motivations and the framework of population dynamics modelling for human longevity. After an interdisciplinary introduction, we introduce the mathematical way to model populations and underpin the importance of age pyramids evolution for longevity risk management.

Wednesday, January 17th 2018 | 11h20

How can a cause-of-death reduction be compensated in presence of heterogeneity? A population dynamics approach based on English data by deprivation

Sarah KAAKAI

A number of studies have demonstrated how the socioeconomic status of an individual significantly affects its mortality patterns, as well as cause-specific mortality, with increasing evidence indicating a widening of socioeconomic inequalities. It has therefore become crucially important to understand and model the mortality of a heterogeneous population. Recent developments on multi-population modelling have improved the assessment and trends of subpopulations mortality inside a national population. But this new class of models have raised a a number of questions, among which the issue of consistency between subnational and national forecasts. Hence, modelling population dynamics provide complementary insights on subpopulations evolution as well as on aggregated quantities. This paper combines population dynamics and cause-of-death mortality theories to study the interplay between population dynamics and mortality in a heterogeneous population. We show how changes in the population composition act on aggregate mortality quantities, for instance by taking into account interactions between mortality and past fertility. In particular, we are interested in quantifying the impacts of cause-specific mortality changes in comparison with changes of composition in a heterogeneous population composition. In particular, we demonstrate how a cause of death reduction could be compensated in presence of heterogeneity, and which could lead to misinterpretations when assessing public policies impacts and/or for the forecasting of future trends. These findings are illustrated using a unique database obtained from the UK Office for National Statistics that contains information on cause-specific death rates by age, gender and deprivation level. Joint work with Héloïse Labit Hardy, Séverine Arnold and Nicole El Karoui.

Wednesday, January 17th 2018 | 13h30

Multi-population Mortality Modeling: When the Data is Too Much and Not Enough

Jason TSAI

Since Lee and Carter (1992) applied a one-factor model to mortality rates, many researchers have added more factors to capture more complicated demographic features and/or to improve better goodness of fit. How many factors are adequate? In this paper we find that all 45 male populations in HMD are governed by only one factor according to the model selection criterions of Bai and Ng (2002). To secure the robustness of this surprising finding, we take into account the cross-section and time-series heteroscedasticity as well as correlated idiosyncratic errors when determining the number of factors and estimating the factors. Such a result is new to the literature.

Wednesday, January 17th 2018 | 14h30

Longevity Risk and "Longevity megafunds"

Frédéric PLANCHET

Les assureurs «retraite» et les fonds de pension sont soumis à un risque de longévité dont la mesure est délicate (cf. Debonneuil et al. (2016)).
La couverture de ce risque peut être envisagée de différentes manières : souscription de couvertures de réassurance, titrisation, diversification avec le risque de décès, etc.
Le développement de fonds mutualisant des recherches médicales constitue une nouvelle approche, initialement développée pour le financement de la recherche sur le cancer et qui connaît maintenant des variantes spécifiques pour les recherches sur la longévité, au travers des «longevity megafunds».
La capacité de ce nouvel outil de financement à fournir un instrument de couverture efficace du risque de longévité est étudiée dans Debonneuil et al. (2017) : la conclusion est assez prometteuse, il reste à voir comment intégrer ces outils dans le calcul du besoin en capital pour le risque de souscription dans Solvabilité 2.

Wednesday, January 17th 2018 | 15h40

Pricing of long term derivatives : main challenges and issues

Caroline HILLAIRET

We study the utility indifference pricing for long term derivatives (such as longevity derivatives). For such a long term modeling, the possibility of calibrating the utility to a learning set and adjusting the preferences to new economic information is crucial. This can be achieved by means of consistent progressive utility. We then provide a correction term to the marginal utility price (also called Davis' price). Applications to the long term discount rate and the link with the Ramsey rule are given.

Wednesday, January 17th 2018 | 16h20

Redistribution of longevity risk: The effect of heterogeneous mortality Beliefs

Tim BOONEN

Existing literature regarding the natural hedge potential that arises from combining different longevity-linked liabilities typically does not address the question how changes in the liability mix can be obtained. We consider firms who aim to exploit the benefits of natural hedge potential by redistributing their risks, and characterize the risk redistributions that will arise when the parties bargain for a redistribution of risk that weakly benefits them all. We analyze the effects of heterogeneity in the beliefs regarding the probability distribution of future mortality rates on the properties of these risk redistributions, and provide a numerical illustration for a case where an insurer with a portfolio of term assurance contracts and a pension fund with a portfolio of life annuities redistribute their risks. This talk is based on joint work with Anja De Waegenaere and Henk Norde.

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