

AFIR-ERM - Articles

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Threshold Portfolio Return for Swiss pension funds based on nested stochastic modelling

Author(s): Ljudmila Bertschi (Member of Swiss Chamber of pension fund experts), Urs Barmettler (Member of Swiss Chamber of pension fund experts (SKPE)/ Dr. math ETHZ), Mauro Triulzi (Dr. math ETHZ), Lionel Candaux (University of Lausanne / Swiss Chamber of pension fund experts (SKPE))

Abstract: According to the FRP5 Guidelines of the Swiss Chamber of pension fund experts (SKPE) the threshold portfolio return corresponds to the annual portfolio return which the pension fund requires to keep the funding ratio constant. The difference between the expected return on assets and the threshold portfolio return plays a key role in determining whether the current benefits can be financed and in establishing and assessing recovery measures in cases of underfunding. The future threshold portfolio return depends mostly on interest credits, reserving and benefit policies and does not depend on the investment strategy. In our forecasting approach, the future threshold portfolio return over different periods is determined based on the nested stochastic modelling for pension fund liabilities whereas the future discount rate is directly linked to the stochastic 10-year-yield of Swiss government bonds (based on the revised FRP4 SKPE-Guidelines). This approach allows a realistic modelling of the pension fund development as well as its benefit and reserving policies. The distribution of the future threshold portfolio return helps to define a suitable investment strategy. For Swiss pension funds the threshold portfolio return has become one of the most important metrics used in risk management and has a significant impact on the investment strategy.

Financial Engineering, A New Longevity Bond to Manage Individual Longevity Risk

Author(s): Michael Sherris (School of Risk and Actuarial Studies, UNSW Business School), Yuxin Zhou (School of Risk and Actuarial Studies, UNSW Business School), Mengyi Xu (School of Risk and Actuarial Studies, UNSW Business School), Jonathan Ziveyi (School of Risk and Actuarial Studies, UNSW Business School)

Abstract: This paper proposes a new type of longevity bond as a post-retirement investment product for individuals to hedge their longevity risk which has the flexibility to meet both income and bequest needs. The payoffs of the bond are composed of flexible monthly coupon payments until death and a principal payment at the time of death. In order to price and hedge the bonds, we calibrate arbitrage-free Nelsen-Siegel (AFNS) interest rate and a multi-factor continuous time mortality model with Australian data. We show how to construct a hedging portfolio for a portfolio of these bonds issued to individuals with existing traded government and corporate bonds on the Australian market to minimize the interest rate risk. We also assess the capital requirements for the longevity risk and any remaining mismatching risk in the portfolio to quantify the capital cost to include in the individual bond price. The bond has the benefit of including a natural hedge through a principal payment on death and the flexibility to generate income with different patterns over older ages to meet increasing age care needs.

Developing a Counter-Cyclical Risk Measure

Author(s): Marie Kratz (ESSEC CREAR), Marcel Bräutigam (ESSEC CREAR / LPSM Sorbonne Univ), Michel Dacorogna (Prime Re Solutions)

Abstract: The pro-cyclicality of risk measurements is the phenomenon that the future risk is over-estimated in times of crisis, while under-estimated in quiet times. Pro-cyclicality itself is a known fact, which has been assessed from a macro-economic perspective (see e.g. Athanasoglou et al. (2014) for an overview), also within the banking regulation (implementing a `counter-cyclical' capital buffer, see Basel III) and Solvency 2 (suggesting transitional measures). While such a perspective, usually using a modelling framework, is important, it leaves open the question which conclusions can be drawn from statistical analyses on the underlying financial time series itself. Based on a methodology developed by Bräutigam et al. (2019) to evaluate the amount of pro-cyclicality in the way financial institutions measure risk, and to identify factors explaining this effect, the authors use those recent findings, both empirical and theoretical, to construct a simple but reasonable countercyclical risk measure(s), based on the sample quantile process.

Continuous Time Valuation Framework for Home Equity Release Products

Author(s): Jonathan Ziveyi (UNSW Business School), Michelle Royters (UNSW Business School), Pengyu Wei (University of Waterloo)

Abstract: This paper develops a continuous-time valuation framework for home-equity release products which include reverse mortgages and home reversion contracts. A continuous-time valuation framework allows for easy comparison of various home-equity release products while at the same time facilitating the design of hedging strategies which can be utilized as tools for mitigating various risk sources impacting such products. Key risk factors incorporated in the modelling framework include interest rates, house prices and mortality rates. The risk factors are jointly modelled using affine processes which facilitate derivation of closed-form expressions for home-equity release products and their associated hedge ratios. The closed-form expressions are tractable and computational efficient compared with traditional simulation-based approaches. Model parameters have been fitted to Australian datasets which include the yield curve data from the Reserve Bank of Australia, Sydney house price index data from Corelogic and mortality data from the Human Mortality Database.

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Fair dynamic valuation of longevity- and equity-linked insurance liabilities

Author(s): Hong Li (University of Manitoba), Ze Chen (Renmin University of China), Tianyu Yang (Tsinghua University)

Abstract: This paper proposes a dynamic fair valuation framework on valuating and hedging variable annuity liabilities under the latest insurance regulations. Recent solvency regulations in the insurance industry, such as Solvency II and Swiss Solvency Test, have required insurance companies to adopt a fair valuation, which takes into account the market value of the hedgeable parts of their insurance liabilities, rather than only focusing on the model-based value. In this paper, we extend the recently proposed fair valuation methods (Dhaene et al., 2017, IME; Barigou et al., 2019, IME) to the valuation of the liability of Guaranteed Lifetime Withdrawal Benefits (GLWB) variable annuities. In particular, we derive dynamic replicating portfolios to determine the market value of the hedgeable equity and longevity risk of the GLWB portfolio, and value the remaining, unhedgeable risks by appropriate stochastic models. The valuation process considered in this paper is market-consistent (marking to market), model-consistent (marking to model), and time-consistent, and is illustrated using real world equity and mortality data. In addition, we show that hedging longevity risk using index-based securities can substantially reduce the longevity risk exposure, and thus the fair valuation of the GLWB liabilities.

Suicide Death Number Estimation for Insurers by Neural Networks : Grasping trend changes caused by Economic and Social / Demographic Change

Author(s): Taichi Kaneyama (Tokai Tokyo Financial), Miwaka Yamashita (Tokai Tokyo Financial)

Abstract: Institute of Actuaries of Japan AFIR study group started a project to examine how actuaries make use of Artificial Intelligence. Here a specific research result is presented. The annual number suicide deaths in Japan is notoriously high among developed countries. In such a condition, in general, Japanese life insurance policies are not completely excluding suicide from death benefit. Although estimation of the number of suicide deaths, its trend, and its sensitivity of economic factors is important for Japanese insurers, so far, the task was tough. Above that, recent economic and social/demographic changes in Japan have made and are making its trend suddenly and largely changed, and the task more difficult. Recent neural network programming (NN) is solving these issues. This research performs forecast of the number of suicide deaths and its trend in Japan by a NN and compare a typical regression method. This research includes how different and useful those methods are and, economic, medical stuff and others' sensitivity analysis by both methods. NN makes clear the sensitivity of each factors better than a regression. We examined Permutation Importance and Sharpley Value.

Sustainable Investing in the Europeans and US Insurance Industry : A Text Mining Analysis

Author(s): Philipp Reichel (Friedrich-Alexander-University), Nadine Gatzert (Friedrich-Alexander University Erlangen-Nürnberg (FAU))

Abstract: Sustainable investing has become increasingly relevant in the last years, mainly driven by environmental, social and governance (ESG) concerns as well as regulation and public initiatives. In this paper, we study the development of the awareness and relevance of sustainable investing in the European and US insurance industry in detail as reflected in their reports. The sample consists of 727 annual, sustainability- and investment-related reports and documents of 55 firms from 2013 to 2017. Our text mining approach shows an increasing awareness of sustainable investing over the last years as reflected in the insurers' reports. Impact investing and ESG integration are the most important strategies during the sample period, especially for life & health insurers, while screening strategies are less referenced (and mostly by P&C insurers). Furthermore, while the ranking of terms and strategies is overall similar in the US and European sample, European insurers report much more extensively about sustainable investing, also in their annual reports. Finally, we observe a strong increase in the relative importance of sustainable investment approaches in terms of the proportion of word count relative to the total number of words in reports as well as investment references.

Machine Learning : quelles opportunités de pilotage ALM pour un assureur vie ?

Author(s): Benjamin Tessiaut (Command Strategy Advisory), Nicolas Dusserre (Command Strategy Advisory)

Abstract: Dans un contexte économique et réglementaire en perpétuelle mouvance, le pilotage ALM de l'assureur vie doit nécessairement faire intervenir une optimisation de la structure de son passif. A cette fin, cette contribution propose d'expérimenter et de comparer quatre méthodes de Machine Learning : Gradient Boosting , Neural Networks , Support Vector Machine et Random Forest. Dans un premier temps, nous calibrerons la méthode d'apprentissage étudiée sur une base test représentative d'un portefeuille d'assurance vie (âge, salaire, profession, patrimoine, ...), et comportant pour chaque client la notation associée à la répartition de son allocation entre fonds euros et unités de comptes (indicateur synthétique de risque (ISR) de la norme européenne PRIIPs). Dans un second temps, le modèle sera étudié sur une autre base test de données-clients, afin de valider sa précision quant à la détection de couples (profil ; investissement) statistiquement incohérents, et ainsi proposer à ces clients une allocation en ligne avec les politiques ALM et commerciale de l'assureur. Enfin, nous étudierons l'application de ces approches sur la problématique du transfert d'épargne d'un contrat d'assurance vie vers un autre contrat d'assurance vie du même assureur dans le cadre de la Loi PACTE.

Consequences of IBOR reform on insurance sector

Author(s): Eleonore Haguët-Trouplin (BNP), Patrice Odo (CDC)

Abstract: In the aftermath of IBOR scandals and due to a decrease on volume of transactions associated to interest rate indexes, regulators required a transition to new reference rates. In Europe, European Parliament and Council of the European Union adopted The Benchmark Regulation (BMR) which is intended to improve governance and controls over the benchmark process. Actual interest rates, like Euribor, Libor or Eonia have to be reformed to be BMR-compliant. This new regulation impact all financial players. For insurance companies, both part of their balance sheet is affected. Assets are invested on products linked to those interest rate references and insurance companies face the same changes as banks or other asset managers. Insurance liabilities are discounted using the risk free rates based on EIOPA term structures. For Euro, they are currently based swap using 6 month Euribor then adjusted for credit and default risk with OIS rates linked to EONIA. Even if Benchmark reforms could disturb interest rates used in solvency II, this one is absent of 2020 review because the transition in interest rates is still underway and work has not been completed on several subjects. We will present this transition on European and international interest rates and possible consequences on Solvency II and the Best Estimate Liability.

Cyber risk: the responsibility of the actuary in setting up individual, collective and coordinated protection

Author(s): Emmanuelle Huguet (Addactis), Thomas Bastard (Addactis)

Abstract: The ongoing 4th industrial revolution already opened fantastic opportunities for Cyber crime, from the emergence of the Internet in the 80's to the day-to-day reliance of both individuals and companies on cloud solutions and the Internet of Things of the 20's. Individuals are mainly exposed to Cyber crime through the third party liability of companies: e-reputation, Cyber harassment, release of Personal Information... Companies' Cyber vulnerability management is key to enhance the protection level of individuals. Actions must be taken collectively and should be influenced by governments and public authorities. These actions must rely and evolve with the knowledge of the risk. Actuaries are key actors to provide companies and governments with the most up-to-date research and operational studies to risk modelling and protection solutions. First, this paper tackles the challenge of systemic Cyber risk modelling based on a Catastrophe approach and accumulation scenarios. Second, the modelling of the frequency is investigated with a strong focus on dependencies, for different kinds of economic player and attacks. More specifically, the study considers the limits of the Poisson and Negative Binomial distributions, autoregressive processes, discrete and continuous modelling based on self-exciting point processes of which Hawkes processes then a diffusion matrix-based approach. Eventually, the paper highlights the main limit of Cyber Modelling, lack of data, and reminds collective best practices of sharing data.

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Efficient and Reliable Solvency II Loss Estimates With Deep Neural Networks

Author(s): Ning Lin (Deloitte), Zoran Nikolić (Deloitte)

Abstract: The Solvency II Directive from 2009 requires from life insurance companies to derive the full probability distribution forecast for one-year losses. Since no analytical formula for one-year losses exists and a full Monte Carlo nested calculation is computationally infeasible, life insurers utilize either the Standard Formula or a proxy methodology. Using the ideas from Least-Squares Monte Carlo proxy method, we explain how neural networks can be used to reliably predict the one-year losses opening the door to finally use risk models for other important value generating applications like asset liability management, strategic asset allocation and product strategies.

Actuarial (R)evolutions

Author(s): Pierre Miehe (Milliman)

Abstract: This paper presents how the IT and actuarial science have evolved in parallel since antiquity, and how the recent speed up of IT evolution could revolution actuarial science: is it today easier for an actuary to pick up machine learning than it is for a data scientist to understand insurance? The paper will conclude on the new privileged IT solutions & trends to develop actuarial models.

The European Safe Asset Debate

Author(s): Malcolm Kemp (Barnett Waddingham)

Abstract: This paper explores reasons why some policymakers and researchers propose creating additional European (Eurozone) safe assets and why others think that this may be challenging. By 'safe' assets we mean ones that are as free from credit risk as possible, potentially even more creditworthy than any current (Eurozone) sovereign. A case can be made on financial stability grounds for such issuance, e.g. because it could assist in the mitigation of risks present in the maturity transformation occurring within the financial system. Less clear is whether there is the political will to support large scale issuance of such debt by central EU bodies. Nor is it clear how large might be robustly quantifiable economic benefits not linked to financial stability or broader political agendas (such as the EU's Banking Union or Capital Markets Union). Research has therefore tended to focus on other approaches (potentially including private sector solutions) that could be used to manufacture such assets, including the use of tranching. However, these approaches would likely suffer from additional costs and a complexity premium which may limit the enthusiasm of third-party investors to support such approaches.

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A Megatrends + ESG long-term investing approach

Author(s): Fernanda Salas (Vitalis)

Abstract: We are living times in which technology, communications and other trends make the world change more rapidly than ever. In recent years, business and economies have moved dynamically to satisfy actual and future generation's needs. Looking further into the future is essential specially in the investment world, that is why investing in the so-called Megatrends has lately become more popular. Not only this Megatrends refer to futuristic "Sci-Fi" investments in robotics and automation, but also to companies that, without being extremely new (and irrationally expensive), are growing more than the economy by helping to improve processes, health, wellbeing and decarbonization. Many of these Megatrends fulfill the Millennium Development Goals (MDGs) set by the United Nations or are compliant with the UN PRI (Principles for Responsible Investments), or ESG investments. These investments match naturally with the Megatrend philosophy and they are also gaining popularity in many parts of the world, particularly in Europe and Latin America. Therefore, it makes sense to combine both strategies in one investment product. The aim of this presentation is to show that a Megatrend + ESG investment strategy can bring good returns in the long run when it is managed with the right risk approach.

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Intercultural research and motor insurance premiums: prejudices, multi-dimensional criteria and global trends

Author(s): Michael Fackler (Consulting Actuary)

Abstract: This paper presents fundamental findings from the field of empirical intercultural research. These findings are of interest to the insurance industry in their own right. They become even more interesting, however, when viewed through the eyes of an actuary who applies advanced statistics to big data sets and, in doing so, has to tackle challenges similar to those faced by cross-cultural researchers: complex data, many random effects and the desire to interpret statistics intuitively, yet still remain as objective as possible. If one views the results of intercultural research with the same pragmatism as one would the premium rating outputs of e.g. GLMs – i.e. being neither overly skeptical about the models nor trusting them blindly – one realises they can serve as a helpful source of inspiration for the day-to-day work.

Applications of affine interest rate and credit models in the valuation of options and guarantees for life insurers

Author(s): Grzegorz Darkiewicz (Milliman)

Abstract: Until recently a lot of companies limited stochastic valuation of options and guarantees to interest rate risk and equity risk. Credit risk is one of important risk factors which have been often neglected, what is now attracting increasing attention from supervisors. In practice even those companies which take into account credit risk in their valuation models, usually rely on oversimplified methods offered by Economic Scenario Generator providers, which - for example - neglect correlation between interest rates and credit. In this contribution we refer to affine models which represent a rich family of models which can be effectively used for joint simulation of interest rate and credit risk scenarios. We derive several numerical illustrations applying jointly G2++ model for interest rates and selected affine models for intensity of defaults (Ornstein-Uhlenbeck or Feller process). Finally we present the impact of the credit risk model on Time Value of Financial Options and Guarantees for a realistic block of participating business in the Italian market, focusing in the first place on the impact of dependence between interest rates and credit which is often neglected in existing approaches.

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A sustainable capital allocation method under economic value-based solvency regime

Author(s): Naoki Matsuyama (School of Interdisciplinary Mathematical Sciences)

Abstract: We propose a sustainable capital allocation method for insurers under economic valuation (i.e., market-consistent valuation of assets and liabilities). Capital allocation is an essential instrument for ERM. However, especially for insurers with insufficient ALM, the introduction of an economic value-based solvency regime may impair sustainability of the capital allocation by causing the economic solvency ratio (ESR) to fall below 100% (i.e., capital shortage). The fact that the average ESR of 41 Japanese life insurers in the field test of economic value-based solvency, conducted by the Japanese financial supervisory authority, was 104% (as of March 2016) suggests that ESR below 100% can really do happen. In that case, measures to improve capital efficiency including ALM are required as well as recapitalization, then capital allocation method is also useful to improve capital efficiency if the method works. Our sustainable capital allocation method is designed to support those measures to improve ESR. To make capital allocation method workable regardless of the ESR level, we refer to previous studies on allocation of expected value of default (EVD) which corresponds to the cost of default. By extending the EVD approach to be consistent with recapitalization and ALM, our capital allocation method achieves practicality and sustainability regardless of the ESR level.

In Measuring the Value Creation by Enterprise Risk Management for Insurance Companies: Does ESG (economic, social, governance) Performance Matter?

Author(s): Madhu Acharyya (GCU London)

Abstract: The implementation of Enterprise Risk Management (ERM) in the financial sector, insurance, in particular, has gained increasing attention in recent years. However, the majority of studies used financial data and overlooked the non-performance of the company while evaluating the performance of ERM. Considering the role of insurance industry to protect the environmental, social and governance (ESG) challenges of the business it is important to evaluate its own ESG performance. This primary aim of this study is to investigate the determinants which drive the implementation of the ERM in the insurance companies, which also include Environmental, Social, and Governance (ESG) factors that are neglected by the existing studies. The secondary aim is to examine whether the ERM system can add value to the firm once implemented. Based on the data of world-leading insurers with market capitalisation over one billion pounds, the multivariate linear regression analysis and the multiple logistic regression analysis are performed. The results suggest that the firms should engage in the ERM program as it has positive relationship with the firm value, as measured by Tobin's Q. Besides, the factors which lead to positive changes in level of ERM implementation are company size, ROA, gross premiums written, social disclosure score, and credit ratings. We conclude that in addition to financial factors, the non-financial factors influence insurers ERM performance.

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Market sophistication - Valuation considering the most relevant companies of the NASDAQ 100 using PLS-SEM algorithms

Author(s): Fernando Jose Marine Osorio (Anáhuac University Mexico), Juan Carlos Bribiesca Aguirre Anáhuac University Mexico)

Abstract: Investors can experience behaviors that usually are seen entirely irrational from the classical economic principles. The focus of this research is to generate reflective behavioral constructs, which helps to measure the economic effects of investor decisions in the stock market. The foundation of the applied algorithms are structural equation models (SEM), and partial least squares (PLS). This approach allows the analysis of dependent and independent variables that are not identically independent or distributed; the advantage of this methodology is that it can be applied to small samples, with complex relationships, including categorical variables, improving the reliability and validity of the models by reduction of the random error random term, with an appropriate collinearity handle. The innovation relies on the use of time series for path modeling. Three investor categories were defined: winners, indifferent, and losers that interact in the NASDAQ 100 stock market and with the top ten enterprises in capitalization, deploying seven different phases or emotional stages ranging from financial panic to market euphoria. The results also helped to test the central idea of prospect theory in which the human being tends to be less excited about gains and suffers more from losses in the decision process, and also to gauge investor confidence, to measure if the market is overvalued or undervalued result of the possible feedback interactions.

Portfolio Construction: Collaborations between Actuary and Portfolio Manager

Author(s): Mark Yu (New England Asset Management)

Abstract: Long-term (Life) insurance companies typically follow an Asset Liability Matching (ALM) approach for asset allocation. In this session, we will share a process of how portfolio manager works with actuary to construct and optimize asset portfolio to support the product liability. A case study will be presented to compare and contrast different ALM practices, such as cash flow matching, key rate duration matching and overall duration matching, and their trade-offs. Trade-off considerations such as yield expectation, duration, default, liquidity and convexity will be addressed with numeric examples.

Enhancing strategic decision-making: building on behavioral strategy - An illustrated roadmap for managing climate-related risks

Author(s): Naji Freiha (Paris Dauphine)

Abstract: Market and regulatory pressure on boards and the current complex environment have put more emphasis on enhancing strategic decision-making processes and systematically integrating forward-looking risk analysis. This article presents a practical approach to address these two issues simultaneously. It is illustrated through an integrated approach for managing climate related risks. It builds on insight from behavioral strategy, an evolving research discipline that allows for a better understanding of the biases to which strategic decisions processes under high uncertainty are prone. A taxonomy of the most recurrent biases is defined. A roadmap including three achievements counteracting these biases is presented: a few safeguards to be embedded as a checklist in a formal policy that governs the decision process, integrated performance and risk maps, and an aggregation of the outcomes of forward-looking simulations and stress-tests. By synthesizing prudential and financial information, this approach builds on available capacities to adapt the decision-making process. As such, it guarantees an efficient compliance with evolving regulatory requirements while ensuring an insightful integration of risk analysis in strategic decisions.

A review of the Solvency II Risk Margin

Author(s): Malcolm Kemp (Barnett Waddingham)

Abstract: This paper reviews the current design of the Solvency II risk margin. The current aim of the risk margin is to provide a quantification of the hypothetical cost a third party would expect to charge (in addition to the Solvency II 'best estimate liability') to take on a book of insurance liabilities. We make suggestions that respect this principle but address some perceived weaknesses in the existing design. Issues explored in the paper include: (a) the overall impact and sensitivity of the risk margin to changes in economic conditions, (b) the interaction between the Solvency II risk margin and the margin over current estimate in the IAIS global Insurance Capital Standard or the risk adjustment in IFRS 17, (c) the risks to include in the risk margin calculation, (d) the discount rate and cost of capital rate to use in the risk margin calculation, (e) multi-year dependencies and (f) the treatment of tax.

Création d'une alternative d'épargne long terme dans un contexte de taux bas

Author(s): Santiago Fiallos (Sia Partners)

Abstract: Le contexte économique et écologique actuel remet en question les bases mêmes de l'épargne long terme. Les individus sont non seulement confrontés à une baisse de la rémunération de leur épargne dans un contexte de taux négatifs mais aussi de plus en plus alertés par leur empreinte écologique. La lutte contre le réchauffement climatique nécessite de moyens financiers colossaux que certains Etats n'arrivent pas à assurer. Dès lors, comment mobiliser efficacement l'épargne individuelle vers le financement de solutions écologiques ? Plusieurs freins existent aujourd'hui. Nous proposons d'en étudier trois : le frein prudentiel introduit par des contraintes de solvabilité limitant les investissements non traditionnels, le frein contractuel lié à l'absence d'un produit de marché simple et attractif et le frein comportemental lié à l'aversion au risque et à la recherche de sécurité à tout prix de la part de l'épargnant. Après avoir dressé un panorama de l'épargne au niveau européen et de la régulation existante, nous montrons les limites de l'investissement en contrats d'assurance en situation de taux bas et la non-adaptabilité de Solvabilité 2 aux risques long terme. Nous proposons une solution d'investissement basée sur un plan d'épargne retraite commercialisé par un fonds de retraite professionnelle supplémentaire permettant d'investir une partie conséquente des actifs en projets écologiquement responsables.

Optimal Insurance for Prudent Risk-Averters and Risk-Lovers

Author(s): Olivier Le Courtois (EmLyon business school)

Abstract: In this paper, we examine the structure of optimal insurance contracts for a broad class of insureds that includes both risk averters and risk lovers and by assuming that the insureds are prudent. We specify the difference in optimal contract form between risk averters and risk lovers. Treating these decision-makers as a unique group, we show that the optimal insurance form is dual limited stop-loss insurance with an upper limit, which shows that including risk lovers changes the contract in the small loss part. We restrict our study to contracts with a concave payoff, where the optimal contract form reduces to limited change-loss insurance or limited dual change-loss insurance depending on the coefficient of variation of the retained loss. Finally, we show the optimality of these contracts in the presence of a background risk.

Gradient Boosting Machine in Annuity Lapse Rate Studies

Author(s): Kubrom Tekka (RGA)

Abstract: In deferred annuity contracts, policy holders and insurance companies exchange funds in return to getting a competitive interest rate. Often times, Policy holders break the contract, by paying a surrender charge, to seek a better interest rate somewhere else. In this case the Policy holder has lapsed. In 2006, Cox and Lin [CL] studied annuity lapse rates using the tobit tools. However, this approaches have their limitations mostly related to their less predictive accuracy. Another limitation of the approach in [CL] was that the data used was an aggregated data, where information could easily be lost as a result of aggregation. In this study, we use machine learning techniques to investigate factors that affect lapse rates. Specifically, we use gradient boosting machine (GBM) to study factors that contribute to lapses. These factors include policy holder behaviors as well as external factors such as market conditions, employment rates, and regulatory environment. GBM has far better predictive accuracy and can easily handle interaction effects without a problem. To address the potential interpretability issues of GBM, we provide variable importance and partial dependency plots to explain the effect of each variable to lapse. In this study we use data at an individual level provided by a global life reinsurance company.

Correlation between cost and performance in eu equity retail funds

Author(s): Jean Berthon

Abstract: Understanding the key factors influencing fund returns helps retail investors make informed decisions on the allocation of their savings into good investment products. The main objective of this study is to assess whether there is a significant relationship between performance and fees of the actively managed equity funds domiciled in France, Belgium and Luxemburg offered to retail investors. We look at the parameters of generated excess return of the funds (alpha) in relation to the charged fees, tracking error, turnover ratio of the fund portfolio and size of the fund. The overall objective is to learn what impact these factors have on the above-benchmark return an investor could expect. In particular, the study evaluates the ability of the actively managed equity funds to persistently deliver positive alphas (outperform their respective benchmarks) and assesses the relationship between the total fund charges and the rolling 5-year average net past performance based on quarterly returns in excess to the funds' corresponding benchmarks.

Modélisation prospective du risque Incapacité : proposition d'une approche combinant modèle bi-dimensionnel et algorithmes d'apprentissage

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Abstract: Le coût du risque arrêt de travail augmente depuis un certain nombre d'années. Cette hausse est notamment expliquée par les risques psychosociaux. Cet article modélise le taux de prescription d'arrêts de travail grâce à un modèle dont les fondamentaux sont identiques à celui du modèle de LEE CARTER. Ce modèle prend en compte trois composantes : l'année, la tranche d'âge atteint et l'origine de la prescription de l'arrêt de travail. Les algorithmes d'intelligence artificielle permettront d'objectiver la corrélation entre les composantes et le nombre de paramètres à estimer. La première partie de l'article consiste en une analyse des risques incapacité/invalidité. Nous parlerons des tendances nationales constatées sur ce risque depuis une dizaine d'années. Dans la deuxième partie de l'article, nous décrivons le modèle utilisé, dont l'estimation des paramètres sera faite en utilisant les algorithmes de Machine Learning et les données nationales. L'utilisation des résultats de nos modèles dans l'estimation, le pilotage et le suivi du risque arrêt de travail (dans un cadre ORSA en particulier et la détermination des actions de prévention) est étudiée dans la troisième et dernière partie.

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