Introduction
Background of Fuzzy Logic
Expert Judgement
Mass Lapse Risk Drivers
R-Shiny Implementation of the model
Concluding Remarks

London School of Economics

LSE

Dependency Elicitation Using Fuzzy Logic
London School of Economics

Victory Idowu

`v.idowu@lse.ac.uk`

Department of Statistics – Probability in Finance and Insurance
London School of Economics and Political Science, UK

R In Insurance 2017
8th June 2017

Introduction
Background of Fuzzy Logic
Expert Judgement
Mass Lapse Risk Drivers
R-Shiny Implementation of the model
Concluding Remarks

London School of Economics

Outline I

Introduction

Background of Fuzzy Logic

Expert Judgement

Mass Lapse Risk Drivers

R-Shiny Implementation of the model

Concluding Remarks

Introduction
Background of Fuzzy Logic
Expert Judgement
Mass Lapse Risk Drivers
R-Shiny Implementation of the model
Concluding Remarks

London School of Economics

LSE

Expert Judgement in Finance and Insurance

EIOPA Guidelines - on the Use of Internal Models

Chapter 4: Assumption setting and expert judgement

*   ***1.33.*** *The insurance or reinsurance undertaking should set assumptions and use expert judgment, in particular taking into account the materiality of the impact of the use of assumptions with respect to the following Guidelines on assumption setting and expert judgement.*

*   ***1.34.*** *The insurance or reinsurance undertaking should assess materiality taking into account both quantitative and qualitative indicators and taking into consideration extreme losses conditions. The insurance or reinsurance undertaking should overall evaluate the indicators considered. - EIOPA*

Introduction
Background of Fuzzy Logic
Expert Judgement
Mass Lapse Risk Drivers
R-Shiny Implementation of the model
Concluding Remarks
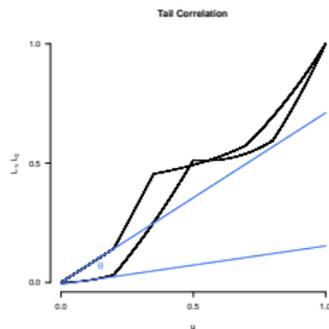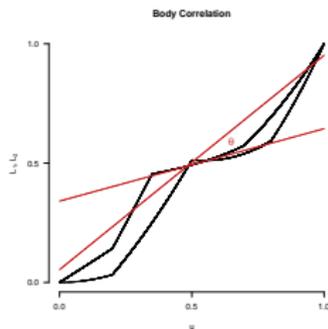
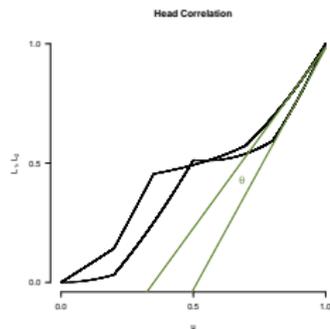London School of Economics

LSE

History of Fuzzy Logic

- The underlying mathematical framework used is called *Fuzzy Logic* created by mathematician Lotfi A. Zadeh.

- The purpose of Fuzzy Logic is to provide a mathematical representation of linguistic variables when under uncertainty.

- Since its creation, Fuzzy Logic has been used extensively in risk management and computer science.

- However, recently there has been increasing interest in the usage of fuzzy logic in the actuarial setting.

Introduction
Background of Fuzzy Logic
Expert Judgement
Mass Lapse Risk Drivers
R-Shiny Implementation of the model
Concluding Remarks

London School of Economics

LSE

Expert Judgement in Finance and Insurance

- Increasing pressure on financial institutions to have an in-depth understanding of their risk structure.
- Insurers need a greater understanding of the risks they face and the underlying nature of these risks.
- Insurers need to know the statistical properties of some of the risks they face, but are constrained by:
  - Data
  - Lack of knowledge of a suitable representation of experts and their judgement
  - Lack of a mathematical framework to model dependencies.

Introduction
Background of Fuzzy Logic
Expert Judgement
Mass Lapse Risk Drivers
R-Shiny Implementation of the model
Concluding Remarks

London School of Economics

Overview of the system

Introduction
Background of Fuzzy Logic
Expert Judgement
Mass Lapse Risk Drivers
R-Shiny Implementation of the model
Concluding Remarks

London School of Economics

Mass Lapse

Definition

Mass Lapse
Mass lapse risk is defined as when more than 30% policies lapse
[EIOPA, 2014].

In the study we consider a hypothetical multinational insurance
firm with experts who desire to establish the correlation of mass
lapse risk between two business entities.

Introduction
Background of Fuzzy Logic
Expert Judgement
Mass Lapse Risk Drivers
R-Shiny Implementation of the model
Concluding Remarks

London School of Economics

LSE

Insurance Markets

UK and USA Business

- We assume that there are two insurance business that the experts of the multinational insurer want to estimate the dependency structure between: namely the *UK* and *USA* insurance markets.

- The *UK* business unit is a new market and therefore is more susceptible to mass lapse by policyholders. Whereas its position in the *USA* market is well established with steady returns and it is viewed that only an adverse change in the equity market will cause mass lapse.

- The expert also believes that the possibility of regulatory change is high, with this more likely in the *USA* than *UK* market.

Introduction
Background of Fuzzy Logic
Expert Judgement
Mass Lapse Risk Drivers
R-Shiny Implementation of the model
Concluding Remarks

London School of Economics

Insurance Markets

UK and USA Business

- The brand of the company is stronger in the *USA* than the *UK* which is a new market for the business.
- The possibility of flaws in the distributional channels are very low as both are well regulated markets.

There is also a decision-maker who sets weights on each expert based upon his knowledge of the expert's past performance.

London School of Economics

R-Shiny Implementation of the model

Introduction
Background of Fuzzy Logic
Expert Judgement
Mass Lapse Risk Drivers
R-Shiny Implementation of the model
Concluding Remarks

London School of Economics LSE

Concluding Remarks

- A Mathematical framework is developed which models the reasoning process of an expert and can act as a mathematically robust justification of an expert's intuition.

- A dependency structure based on the experts' reasoning has been devised, through the model. We are now able to:
  - study the interaction between various experts beliefs and the decision-maker in the underlying structure of a risk
  - develop a dependency structure between the risks that can be broken down into its linear and non-linear components.
  - obtain empirical estimates for non-linear dependency.