

Asset Liability Modelling for Pension Funds by Introducing Leslie Model for Population Dynamics

Authors : Kristina Sutiene, Lina Dapkute

Abstract : The paper investigates the current demographic trends that exert the sustainability of pension systems in most EU regions. Several drivers usually compose the demographic challenge, coming from the structure and trends of population in the country. As the case of research, three main variables of demographic risk in Lithuania have been singled out and have been used in making up the analysis. Over the last two decades, the country has presented a peculiar demographic situation characterized by pessimistic fertility trends, negative net migration rate and rising life expectancy that make the significant changes in labor-age population. This study, therefore, sets out to assess the relative impact of these risk factors both individually and in aggregate, while assuming economic trends to evolve historically. The evidence is presented using data of pension funds that operate in Lithuania and are financed by defined-contribution plans. To achieve this goal, the discrete-time pension fund's value model is developed that reflects main operational modalities: contribution income from current participants and new entrants, pension disbursement and administrative expenses; it also fluctuates based on returns from investment activity. Age-structured Leslie population dynamics model has been integrated into the main model to describe the dynamics of fertility, migration and mortality rates upon age. Validation has concluded that Leslie model adequately fits the current population trends in Lithuania. The elasticity of pension system is examined using Loimaranta efficiency as a measure for comparison of plausible long-term developments of demographic risks. With respect to the research question, it was found that demographic risks have different levels of influence on future value of aggregated pension funds: The fertility rates have the highest importance, while mortality rates give only a minor impact. Further studies regarding the role of trying out different economic scenarios in the integrated model would be worthwhile.

Keywords : asset liability modelling, Leslie model, pension funds, population dynamics

Conference Title : ICCSDA 2017 : International Conference on Computational Statistics and Data Analysis

Conference Location : Rome, Italy

Conference Dates : July 17-18, 2017