Description for the general public

Population longevity is a phenomenon widely observed in the world, including Poland. It poses new challenges to various economical areas and is strongly connected to the pension system and insurance contracts. Therefore it becomes extremely important to understand, to model and to correctly forecast this phenomenon and processes connected to it. One of the crucial indicators is changing in time population mortality rate. There are various models to describe it. However, each model can become obsolete and may need actualisation through the years, such as parametres adjustment. To that purpose, very helpful will be a procedure allowing, upon observation of mortality rate process only, to "rise an alarm" which will be indicating that what we observe does not fit our model anymore and it is time to modify that model.

Construction of such procedure is the purpose of this project. Primarily we want to examine how mortality rate of our society is changing through the years and to point out moments of drift (trend) changes. It could be expected that there can be periods in which mortality will be rapidly decreasing (e.g. due to medical discoveries or political changes), as well as periods in which mortality will be at stable level. The detection of moments of passing throuh such periods may be of extreme value while forecasting society structure in the future and current revising of the pension systems.

Therefore besides constructing the procedure, we will be analysing the data concerning lifetables (mainly Polish, but for comparison also foreign). Apart from examining lifetables for men and women separately, one very important part of the project will be modeling mortality rate for both sexes jointly as two correlated processes. This relationship between mortality of men and women seems to be obvious and for instance is a result of their common social and economical life conditions. Including that to our model will be possible thanks to statistical methods that we will be using, which allow us to generalise the procedure to joint analysis of two correlated processes.

Our procedure will be based on the problem of so called change point detection of stochastic processes, which by some statistical and probabilistic methods leads to a certain optimalisation problem. This in turn leads to construction of a generalised Shiryaev-Roberts statistics. Besides theoretical considerations – which are necessary for checking the correctness of the procedure – we will focus on description of full calibration of the model basing on lifetables. Data tested in that way will allow to determine how moratlity rate trend of both men and women was changing during past decades and what we can expect in the future.