

## **Models of risk sharing in hybrid occupational pension schemes**

In many countries financing of the public pension systems becomes more and more problematic. Changes in economic and demographic conditions cause an increase in benefit expenditure as well as a decrease in contributions income. As a result parametric and structural reforms are instituted. One of the more common solutions is to promote private forms of saving for retirement, in particular occupational pension schemes. The main types of such schemes are defined contribution (DC) and defined benefit (DB). In a DC scheme the risk inherent in financing pension benefit is borne by the member, in a DB scheme by the employer. Schemes which are neither fully DC or DB are called hybrid schemes.

Aim of this dissertation is to characterize the risk sharing in hybrid pension schemes from both member's and employer's point of view, and to propose a new scheme which satisfies certain criteria. The risk is defined as an uncertainty as to whether the set contribution rate will allow for the required benefit amount to be achieved. Existing types of hybrid schemes as well as a new proposed type were investigated.

In this dissertation the following hypotheses were set:

1. An analysis of variability of the contribution rate payable by the employer and by the member allows to describe the sharing of risk between both parties.
2. In addition to risk sharing hybrid schemes include an additional protection for parties which pay contributions, by setting maximum contribution variability or by requiring change in contribution rate only in some specified conditions.
3. The proposed hybrid scheme as the only one among those investigated includes an additional protection for both member and employer.
4. The issue of risk sharing in a hybrid pension scheme can be presented and solved as a Nash bargaining problem.

The dissertation consists of five chapters: two theoretical ones and three presenting results of investigation of hybrid pension schemes. In the first chapter retirement solutions used in selected countries are presented. Classification of pension systems due to their aim and form of financing, as well as factors which influence changes in such systems are discussed. Parametric and structural reforms carried out in response to these changes are presented, in particular the formation of occupational pension schemes.

Second chapter is dedicated to the review of literature concerning hybrid occupational pension schemes. Hybrid forms functioning in selected countries, as well as new solutions proposed in the literature are presented. Existing schemes are classified according to the model of risk sharing.

Third chapter contains an overview of measures which can be used to investigate risk in pension schemes, as well as the definition of risk used in the dissertation. Models of two parameters which influence financing of a pension scheme – the rate of investment returns and life expectancy of beneficiaries - are presented. A model created to calculate and modify contribution rate in a pension scheme is described. Simulations are then used to illustrate risk in a traditional DC scheme.

Next part of the dissertation presents results of investigation of selected types of hybrid schemes. Simulations were used to identify additional contribution rates payable by the member and by the employer due to variable investment rate and life expectancy. Comparing these rates with the contribution rate payable in a DC scheme when the risk is not shared allows to illustrate the risk sharing in hybrid schemes. The first hypothesis is confirmed. Second hypothesis is not fully confirmed, as three out of four schemes under investigation offer additional protection to one of the parties who pay contributions, whereas the fourth one offers no additional protection. This confirms the third

hypothesis, as the new proposed scheme is the only one offering additional protection to both member and the employer.

In the last chapter game theory is used to solve the issue of setting the maximum variability of employer's contribution in the new proposed scheme. This is presented and solved as a Nash bargaining problem for assumed member's and employer's utility functions. This confirms the fourth hypothesis.

The ending contains the main conclusions. These can be used as a starting point for further methodological and practical research related to pension schemes.