Sustainability conditions for partially funded pension systems

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Introduction

- Two kinds of Financial management for pension systems:
  - Pay-as-you-go (PAYGO) principle
  - Fully funded plan
- How to hedge sustainability of pension systems?
  - Contribution rate
  - Rate of return on the total pension liability

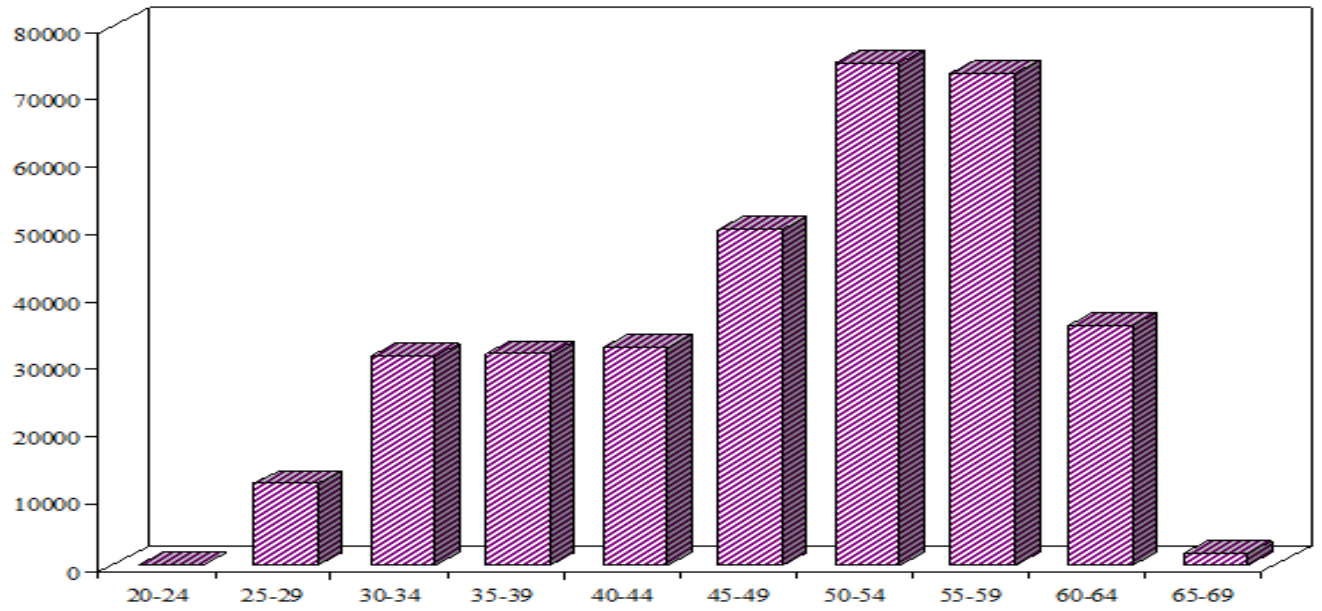
Outline

Example/ Facts

FONDAZIONE E.N.P.A.M.

ENTE NAZIONALE DI PREVIDENZA ED ASSISTENZA MEDICI

DISTRIBUZIONE PER CLASSI DI ETÀ DEGLI ATTIVI ISCRITTI AL FONDO AL 31.12.2009



RELAZIONE SUL BILANCIO TECNICO AL 31.12.2009 (PUBBLICATO IN G.U. n. 31 DEL 6.2.2008)

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The Model Functions

For each t in T, we have that:

$\alpha(t)$ is the contribution rate, with $\alpha(t) \geq 0$

$C(t) \geq 0$ and $W(t)$ are the instantaneous flow of contributions and the instantaneous flow of wages, respectively, with $C(t) \geq 0$, $W(t) > 0$, and $C(t) = \alpha(t) W(t)$

$P(t)$ is the instantaneous flow of the pension expenditure, with $P(t) > 0$

$F(t)$ is the pension system fund

$r(t)$ is the instantaneous rate of return on fund

$L^T(t)$ is the total pension liability, with $L^T(t) > 0$

$r_L(t)$ is the instantaneous rate of return on the total pension liability.

The Model Definitions

Definition 1. *A pension system is sustainable in time interval T if and only if*

$$F(t) \geq 0 \text{ for each } t \text{ in } T.$$

Definition 2. *For each instant t in T, the unfunded pension liability is*

$$L^{UN}(t) = L^{T}(t) - F(t).$$

It is assumed that $L^{T}(t) \geq F(t)$ for all values t in T. The unfunded pension liability is then subjected to the condition $L^{UN}(t) \geq 0$, for all values t in T.

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The Model Basic Equations

Equation 1. $\dot{F}(t) = F(t)r(t) + C(t) - P(t)$

Equation 2. $\dot{L}^T(t) = L^T(t)r_L(t) + C(t) - P(t)$

Equation 2. uses two important control variables of the pension system, the rate of return on the pension liability, $r_L(t)$, and the contribution rate, $\alpha(t)$.

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