Journal of Public Economics 93 (2009) 586–604

Contents lists available at ScienceDirect

Journal of Public Economics

journal homepage: www.elsevier.com/locate/econbase

Retirement, pensions, and ageing

Ben J. Heijdra [a,b,c,d,*], Ward E. Romp [e,c]

[a] University of Groningen, The Netherlands
[b] Institute for Advanced Studies (Vienna), Austria
[c] Netspar, The Netherlands
[d] CESifo, Germany
[e] Faculty of Economics and Business, University of Amsterdam

ARTICLE INFO

Article history:
Received 26 March 2007
Received in revised form 18 October 2008
Accepted 29 October 2008
Available online 12 November 2008

JEL classification:
E10
J26
H55
D91
F41
J11

Keywords:
Retirement
Pensions
Ageing
Demography
Gompertz–Makeham Law of mortality
Overlapping generations
Small open economy

ABSTRACT

We study the effects of demographic shocks and changes in the pension system on the macroeconomic performance of an advanced small open economy facing a given world interest rate. We construct an overlapping-generations model which includes a realistic description of the mortality process. Individual agents choose their optimal retirement age, taking into account the time- and age profiles of wages, taxes, and the public pension system. The early retirement provision in most pension systems acts as a trap, inducing most workers to retire well before the normal retirement age. Simulations show that pension reform must be drastic for it to have any effects on the retirement behaviour of workers.

1. Introduction

Population ageing is playing havoc with the public pension schemes of many western countries. In a celebrated sequence of international comparative studies, Gruber and Wise (1999, 2004, 2005) and their collaborators have established a number of stylized facts pertaining to a subset of OECD countries. These facts are:

(SF1) For most developed countries, the pay-as-you-go social security system includes promises that cannot be kept without significant system reforms. In the absence of reform, current systems are *fiscally unsustainable*.

(SF2) From the 1960s until the mid 1990s, the trend was for older people to leave the labour force at ever younger ages. Retirement is a *normal good* in the sense that the demand for years of retirement rises as agents' income rises (Barr and Diamond, 2006, p. 27).

* Corresponding author. Faculty of Economics and Business, University of Groningen, P.O. Box 800, 9700 AV Groningen, The Netherlands. Tel.: +31 50 363 7303.
E-mail addresses: info@heijdra.org (B.J. Heijdra), w.e.romp@uva.nl (W.E. Romp).

0047-2727/$ – see front matter © 2008 Elsevier B.V. All rights reserved.
doi:10.1016/j.jpubeco.2008.10.009

(SF3) Only a very small fraction of the labour force retires before the earliest age at which public retirement benefits are available, the so-called *early eligibility age* (EEA hereafter). The EEA typically is in the range of 60–62 years of age. Similarly, only very few people work until the *normal retirement age* (NRA hereafter), which is typically 65 for most countries (Duval, 2003, p. 35). Together this implies that most people retire either at the EEA or somewhere in between the EEA and the NRA.

(SF4) Most social security programs contain strong incentives for older workers to leave the labour force. In most countries it simply does not pay to work beyond the EEA because *adjustments are less than actuarially fair*. The present value of expected social security benefits declines with the retirement age, so there is a high *implicit tax* on working beyond the EEA.

(SF5) In many European countries disability programs and age-related unemployment provisions essentially provide early retirement benefits, even before the EEA.

In our view, a formal analysis of issues surrounding ageing, retirement, and pensions can only be successful if it is able to accommodate at least some, but preferably all, of these stylized facts. In this paper we study the consumption, saving, and retirement decisions of individual agents facing lifetime uncertainty, or longevity risk. In addition, we also determine the macroeconomic consequences of individual behaviour and policy changes. We construct a simple analytical overlapping generations model and assume that the country in question is small in world capital markets and thus faces an exogenous world interest rate, which we take to be constant.

Our analysis makes use of modelling insights from two important branches of the literature. First, in order to allow for overlapping generations, we employ the generalized Blanchard–Yaari model developed in our earlier papers (Heijdra and Romp, 2008a, in press). In this model disconnected generations are born at each instant and individual agents face an age-dependent probability of death at each moment in time. By allowing the mortality rate to depend on age, the model can be used to investigate the micro- and macroeconomic effects of a reduction in *adult mortality*, another well know phenomenon occurring in many western countries over the last century or so. Finitely-lived agents fully insure against the adverse affects of lifetime uncertainty by purchasing actuarially fair annuities.

The second building block of our analysis concerns the labour market participation decision of individual agents. Following the seminal contribution by Sheshinski (1978) and much of the subsequent literature, we assume that labour is indivisible (the agent either works full time or not at all), that the retirement decision is irreversible, and that the felicity function is additively separable in consumption and leisure. All agents are blessed with perfect foresight and maximize an intertemporal utility function subject to a lifetime budget constraint. Workers choose the optimal retirement age, taking as given the time- and age profiles of wages, the fiscal parameters, and the public pension system. Not surprisingly, like Mitchell and Fields and many others we find that "the optimal retirement age … equates the marginal utility of income from an additional year of work with the marginal utility of one more year of leisure" (1984, p. 87).

The two papers most closely related to ours are Sheshinski (1978) and Boucekkine et al. (2002).[1] We extend the analysis of Sheshinski (1978) in two directions. First, as was already mentioned above, we incorporate a realistically modelled lifetime uncertainty process, rather than a fixed planning horizon. Second, we embed the model in the context of a small open economy and are thus able to study the macroeconomic repercussions of ageing and pension reform. We generalize the analysis of Boucekkine et al. (2002) by including a concave, rather than linear, felicity function, and by modelling a public pension system with realistic features such as an EEA which differs from the NRA and non-zero implicit tax rates. Furthermore, we conduct our theoretical analysis with a general description of the demographic process, whereas they use a specific functional form for this process throughout their paper.

The remainder of this paper is organized as follows. In Section 2 we present the model and demonstrate its main properties. Consumption is proportional to total wealth, consisting of financial and human wealth. With a realistic demography, the marginal propensity to consume out of wealth is increasing in the agent's age because the planning horizon shortens as one grows older and the agent does not wish to leave any bequests. We derive the first-order condition for the optimal retirement age and show that it depends not only on the mortality process but also on the features of the fiscal and pension systems. The mortality process, in combination with the birth rate, also determines a unique path for the population growth rate.

In Section 3 we abstract from the public pension system and study the comparative static effects on the optimal retirement age of various age-related shocks. A reduction in the disutility of working leads to an increase in the optimal retirement age. In contrast, an upward shift in the age profile of wages causes a negative wealth effect but a positive substitution effect, rendering the total effect on the optimal retirement age ambiguous. A reduction in adult mortality increases the expected remaining lifetime for everyone, though more so for older agents. We confirm the results of related papers by Chang (1991) and Kalemli-Ozcan and Weil (2002), in that the effect of increased longevity on the optimal retirement age is ambiguous in general. Intuitively, this is because the lifetime-income effect cannot be signed a priori. For realistic scenarios, however, the increased longevity only starts to matter quantitatively at ages exceeding the NRA so that the lifetime-income effect works in the direction of increasing the optimal retirement age.

Section 3 also presents the graphical apparatus that we use throughout the paper. We demonstrate that the optimal retirement decision is best studied in terms of its consequences for lifetime income and the *transformed retirement age*. This transformed age is a monotonically increasing transformation of the calender age and captures the notion of an agent's economic (rather than biological) age. Our graphical apparatus has the attractive feature that indifference curves are convex and that the budget

[1] In the interest of brevity, we refer the interested reader to the literature surveys on retirement and ageing by Lazear (1986), Hurd (1990, 1997), and Weil (1997). For a recent literature survey on pension reform, see Lindbeck and Persson (2003).