Journal of Econometrics 178 (2014) 582–601

Contents lists available at ScienceDirect

Journal of Econometrics

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

Longevity, life-cycle behavior and pension reform☆

Peter Haan [a,b], Victoria Prowse [c,*]

[a] DIW Berlin, Germany
[b] Freie Universitaet Berlin, Germany
[c] Department of Economics, Cornell University, United States

ARTICLE INFO

Article history:
Received 8 June 2012
Received in revised form
19 July 2013
Accepted 23 August 2013
Available online 16 September 2013

JEL classification:
D91
J11
J22
J26
J64

Keywords:
Life expectancy
Public pension reform
Retirement
Employment
Life-cycle models
Consumption
Tax and transfer system

ABSTRACT

How can public pension systems be reformed to ensure fiscal stability in the face of increasing life expectancy? To address this question, we use micro data to estimate a structural life-cycle model of individuals' employment, retirement and consumption decisions. We calculate that, in the case of Germany, an increase of 3.76 years in the pension age thresholds or a cut of 26.8% in the per-year value of public pension benefits would offset the fiscal consequences of the increase in life expectancy anticipated to occur over the next 40 years. On average, individuals value the increase in the pension age thresholds at 3.44% of baseline consumption, and are willing to forgo 8.51% of baseline consumption to avoid the cut in per-year pension value. The increase in the pension age thresholds makes 87.7% of individuals better-off, and generates large responses in labor supply and retirement behavior. However, the favorable effects of this reform depend on the availability of jobs for older individuals.

1. Introduction

Over the last several decades the longevity of individuals living in the developed world has improved considerably and consistently, and this trend looks set to continue.[1] Such demographic change poses numerous social and economic challenges. Notably, many public pension systems, which are typically compulsory defined benefit schemes, are being strained by the greater pension demands concurrent with higher life expectancy. In response to this problem, an important political debate has arisen concerning how to reform public pension systems to address the fiscal demands created by improving longevity. This debate has focused on identifying effective ways of increasing the age-based eligibility requirements associated with public pension benefits. The policy response thus far has reflected this theme: e.g., Germany and the US have recently announced plans to gradually increase the full pensionable age, that is the age from which an individual may claim a non-reduced public pension, from 65 to 67 years of age.

We use a comprehensive dynamic structural model to understand the relationship between life expectancy, the public pension system and individuals' employment, retirement and consumption decisions over the life-cycle. We use Indirect Inference to estimate the model's parameters. Drawing on this framework, we are the first to analyze how changes in life expectancy affect optimal individual employment, retirement and consumption through the life-cycle. By looking at how individuals respond to changes in individual-specific and cohort-specific longevity, we break new

☆ The authors thank three anonymous referees and participants at the NBER Summer Institute Workshop on Aging and at the Netspar International Pension Workshop, Amsterdam. We also thank seminar audiences at: Statistics Norway; Frankfurt; CREST; Cologne; DIW Berlin; University at Albany - SUNY; McMaster; Mainz; Southampton; RAND, Santa Monica; Cambridge; and the Max Planck Institute for Demographic Research. Financial support from Netspar is gratefully acknowledged. Peter Haan thanks the Thyssen Foundation for financial support in the project AZ.10.11.2.085. Alex Lau provided valuable research assistance.

* Corresponding author. Tel.: +1 607 227 3126.
E-mail addresses: phaan@diw.de (P. Haan), prowse@cornell.edu (V. Prowse).

[1] E.g., Oeppen and Vaupel (2002) show that over the last 150 years life expectancy at birth in the developed world has increased at a rate of 2.5 years per decade, and argue that this linear trend is likely to continue.

0304-4076/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.jeconom.2013.08.038

ground by exploring the desirability of changes to the public pension system that are designed to cope with the fiscal challenges posed by increasing life expectancy. This paper, therefore, makes a novel contribution to the policy debate on how public pension systems can be reformed to deal effectively with the consequences for Government finances of increasing life expectancy.

Our structural life-cycle model includes stochastic job offers, involuntary separations, saving opportunities and borrowing constraints, early retirement possibilities, unobserved heterogeneity in preferences, employment opportunities and wages, and detailed specifications of the tax and transfer systems. Moreover, the modeling approach naturally allows life expectancy and the public pension system to influence the decisions of forward-looking individuals planning for retirement. This methodology is ideally suited to quantifying the effect of life expectancy on behavior and to exploring the consequences of reductions in public pension generosity. By considering the interplay between life expectancy and public pension reform when individuals may adjust employment, retirement and consumption behavior, we expand on previous applications of structural life-cycle models. In particular, our paper builds on several previous studies that have used life-cycle models to investigate the effects of public pension systems on labor supply, retirement and consumption decisions (e.g., Casanova, 2010; French, 2005; French and Jones, 2012; Gustman and Steinmeier, 1986, 2005; Heyma, 2004; Jiménez-Martín and Sanchez Martín, 2007; Rust and Phelan, 1997; van der Klaauw and Wolpin, 2008) and on work that developed structural life-cycle models in which individuals choose jointly consumption and labor supply (e.g., Imai and Keane, 2004; Keane and Wolpin, 2001).[2] Our paper is also related to a small literature that looks at the effect of life expectancy on the saving decision alone (see Brown, 2001; De Nardi et al., 2010; Gan et al., 2004; Hurd, 1989).

We implement our model in the context of Germany, a country with a compulsory pay-as-you-go defined benefit public pension system that displays many similarities to Social Security in the United States. Couching the analysis in the context of Germany allows us to exploit a unique pattern of variation in the evolution of demographic group-specific life expectancy that arose due to events following German reunification in 1990. Specifically, drawing on variation between demographic groups in the extent of improvements in life expectancy, we demonstrate that the estimated model predicts the observed relationship between life expectancy and retirement. This suggests that our model provides a sound basis for counterfactual policy simulations that explore the effect of life expectancy on employment, retirement and consumption behavior.

In terms of data sources, we obtain projections of age-specific life expectancies by cohort, region and gender from the Human Mortality Database for Germany. Data on life expectancy are combined with a sample of older individuals taken from the German Socio-Economic Panel and covering the years 1991–2007. In addition to replicating the observed relationship between life expectancy and retirement behavior as discussed above, the fitted model is able to reproduce the distribution of observed wages, the age profile of wealth and the age-specific rates of transitions between employment and unemployment.

The leading results of counterfactual policy simulations based on the estimated structural life-cycle model are twofold. First, in response to an increase in life expectancy we find individuals work more and postpone retirement, thereby increasing public pension benefits for their now longer retirement periods. The increase in Government revenue generated by the increase in employment is dwarfed by the increase in public pension demands. Quantitatively, the 6.4 year increase in age 65 life expectancy anticipated to occur over the next 40 years leads average net Government revenue per person, summed over the life-cycle starting at age 40 years and continuing until death, to decrease by approximately 66,095 Euros.

Second, we demonstrate striking differences in behavioral and welfare responses to policies that involve revenue-equivalent reductions in public pension generosity. We calculate that the fiscal consequences of the 6.4 year increase in age 65 life expectancy anticipated to occur over the next 40 years can be offset by either an increase of 3.76 years in all pension age thresholds, including the full pensionable age, or a cut of 26.8% in the per-year value of public pension benefits. The increase in the pension age thresholds elicits a marked increase in the employment rate. However, this favorable employment response depends crucially on older individuals' employment opportunities; in the extreme, with very low employment opportunities for older individuals, it is impossible to offset the fiscal cost of an increase life expectancy purely by increasing the pension age thresholds. Meanwhile, the revenue-equivalent cut in the per-year value of public pension benefits has little impact on employment outcomes. In terms of welfare, on average individuals value the increase in pension age thresholds at 3.44% of baseline consumption, and are willing to forgo 8.51% of baseline consumption to avoid the cut in per-year pension value. To further inform on the nature of the optimal public pension system, we compare the welfare implications of a more extensive set of revenue-equivalent public pension reforms. Relative to the current system, the public pension system that individual value most highly is less generous to high-wage high-experience individuals but involves stronger labor supply incentives for those with, *ex ante*, the lowest propensity to work.

This paper proceeds as follows. Section 2 outlines our life-cycle model. Section 3 describes our data sources. Section 4 provides an overview the estimation methodology, presents our structural parameter estimates and demonstrates the model's goodness of fit. Section 5 discusses the results of counterfactual policy simulations. Section 6 concludes.

2. Model

2.1. Overview

To examine the impact of life expectancy on life-cycle behavior and to explore the effectiveness of public pension reforms, we develop a rich dynamic structural model of individual's employment, retirement and consumption decisions over the life-cycle. We propose a discrete-time finite-horizon model. Each quarter, i.e., every three months, an individual chooses his or her current labor market state and current consumption.[3] We distinguish three labor market states: full-time work (f); unemployment (u); and retirement (r).[4] Retirement is assumed to be an absorbing state, and all non-working non-retired individuals are categorized as unemployed. In our model, therefore, an unemployed individual may be a participant or a non-participant in the labor force. We discuss our definition of the employment and retirement states in Section 3.1.

[2] A largely separate literature presents empirical evidence from micro data of a direct effect of pension rights on retirement decisions (e.g., Blau, 1994; Blundell et al., 2002; Disney and Smith, 2002; French and Jones, 2011; Friedberg, 2000; Friedberg and Webb, 2005). Blöndal and Scarpetta (1997) and Gruber and Wise (1998) demonstrate a similar relationship at the macro level. Gruber and Wise (2004, 2007) survey the micro and macro evidence.

[3] Quarterly decision making allows accurate modeling of the Unemployment Insurance system.

[4] Full-time work is 39 h of work per week. This is the median hours of work of the sampled individuals.