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Welfare and generational equity in sustainable unfunded pension systems

Alan J. Auerbach [a,*], Ronald Lee [b]

[a] Department of Economics, University of California, 508-1 Evans Hall, Berkeley, CA 94720-3880, United States
[b] Department of Demography, University of California, 2232 Piedmont Ave, Berkeley, CA 94720-2120, United States

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ABSTRACT

Using stochastic simulations we analyze how public pension structures spread the risks arising from demographic and economic shocks across generations. We consider several actual and hypothetical sustainable PAYGO pension structures, including: (1) versions of the US Social Security system with annual adjustments of taxes or benefits to maintain fiscal balance; (2) Sweden's Notional Defined Contribution system and several variants developed to improve fiscal stability; and (3) the German system, which also includes annual adjustments to maintain fiscal balance. For each system, we present descriptive measures of uncertainty in representative outcomes for a typical generation and across generations. We then estimate expected utility for generations based on simplifying assumptions and incorporate these expected utility calculations in an overall social welfare measure. Using a horizontal equity index, we also compare the different systems' performance in terms of how neighboring generations are treated.

While the actual Swedish system smoothes stochastic fluctuations more than any other and produces the highest degree of horizontal equity, it does so by accumulating a buffer stock of assets that alleviates the need for frequent adjustments. In terms of social welfare, this accumulation of assets leads to a lower average rate of return that more than offsets the benefits of risk reduction, leaving systems with more frequent adjustments that spread risks broadly among generations as those most preferred.

1. Introduction

Population aging threatens the financial viability of Pay-As-You-Go (PAYGO) pension programs in many countries, and demographic fluctuations may lead to generational inequities. The old-age dependency ratio in the United States is projected to rise by 80% between 2010 and 2050, to more than double in Japan, and to rise by 55 and 70% in Sweden and Germany (United Nations, 2007).[1] Baby booms and busts have characterized the recent past of industrial nations, and fertility has recently risen in many countries with formerly hyper-low fertility (Goldstein et al., 2009). PAYGO programs are typically not structured to deal automatically with changing old-age dependency ratios, and as a consequence now promise a level of benefits that cannot be sustained at current tax rates. Thus, deep structural reforms are expected and in some countries have already occurred.

Beyond the problem of fiscal instability, most PAYGO programs are of a Defined Benefit (DB) structure and create incentives for early retirement (Gruber and Wise, 1999) and distort labor supply decisions over the whole life cycle. Furthermore, in creating unfunded pension claims, these programs may weaken incentives to save and thereby reduce national wealth. Reforms that adjust the general level of taxes or benefits in PAYGO programs can address the problem of fiscal sustainability, but reforms that maintain existing program structures might have little effect on incentives for work or saving. Moreover, such reforms provide no permanent solution to fiscal imbalances given subsequent demographic and economic shocks.

Any PAYGO system tends to reduce national saving by creating transfer wealth, but transition to a funded system involves potentially large burdens on transition generations, and therefore may not be a politically viable reform option. Even within the PAYGO framework, however, there are alternatives that might be more attractive than a simple realignment of taxes and benefits. A new kind of pension program, called Notional, or Non-financial, Defined Contribution (NDC), is intended to address both permanent fiscal stability and labor supply incentives. Sweden has developed and implemented an NDC system and some other countries have followed suit including Italy, Poland, Latvia, Mongolia and the Kyrgyz Republic. Germany has recently adopted pension reforms that reflect some of the NDC principles, and France is also considering doing so (Legros, 2003; Holtzmann and Palmer, 2005).

The basic approach of NDC plans is to mimic the structure and incentives of funded Defined Contribution (DC) plans, such as 401(k) plans in the United States. As in actual DC plans, individuals contribute

* Corresponding author. Tel.: +1 510 643 0711; fax: +1 510 643 0413.
E-mail addresses: auerbach@econ.berkeley.edu (A.J. Auerbach), rlee@demog.berkeley.edu (R. Lee).

[1] These figures are for increases. The actual levels also differ widely with a projected old-age dependency ratio for the US in 2050 at 33.3 persons aged 65 and over per 100 persons age 15 to 64. Comparable figures for Japan, Sweden and Germany are 70.8, 41.8 and 50.1.

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to their own, *notional* accounts which yield a specified rate of return and are converted into annuities yielding a specified rate of return at an age chosen by the individual but above some stated minimum age. However, in the NDC plans, the specified rate of return earned annually by the accounts and paid by the annuity is generally linked to the growth rate of wages, which given the PAYGO setting should help make NDC systems more fiscally sustainable without frequent active policy interventions. Furthermore, the individual accounts based on individual contributions and explicit rates of return can reduce the distortion of work incentives if workers view their benefits and taxes as more closely linked than under traditional DB systems, in which the linkage of taxes and benefits may be minimal or not transparent.

NDC or related plans are designed to provide fiscal stability by incorporating automatic adjustments of benefits and, in some cases, taxes, in response to economic and demographic shocks. In an earlier paper (Auerbach and Lee, 2009) we explored the effects of such adjustments on fiscal stability. Fiscal stability is, of course, a desirable feature, but how the stability is achieved will affect the manner in which the risks associated with shocks are spread among generations. This risk-spreading will influence individual and social welfare, and in this paper we consider the performance of different NDC plan variants in this regard.

There are many respects in which risk-spreading might differ among plans, including the degree to which shocks are spread among generations, and the relative treatment of generations of different sizes, of contiguous generations, of workers and retirees, and of current and future generations. It is difficult to summarize these effects using one simple measure of plan performance, and so we consider several measures in order to shed light on the welfare effects of different plans. To do so, we use a modified version of the stochastic forecasting model developed by Lee and Tuljapurkar (1998), and Lee et al. (2003) to generate a large set of sample paths under different social security systems, each sample path corresponding to a different realization of economic and demographic shocks.

We will consider several actual and hypothetical PAYGO pension structures, including: (1) the actual Swedish NDC system, together with several modifications of it developed in our earlier paper; (2) the actual reformed German system, which maintains annual fiscal balance using a combination of tax and benefit adjustments; and (3) hypothetical versions of the US Social Security system in which taxes, benefits, or both are adjusted annually to maintain fiscal balance with zero debt or assets.[2] Some of these structures are currently in use, and others are hypothetical extensions of existing plans, but all are modeled with a high degree of realism.[3]

The remainder of the paper is organized as follows. The next section describes the plans we analyze, focusing on the key characteristics that will affect the spreading of risks. Section 3 provides a brief description of our stochastic simulation model and how it has been adapted for the current project. Section 4 describes the measures we use to evaluate the different systems' welfare effects, and provides the results of our analysis, and Section 5 offers a summary of our findings and some concluding comments.

2. Varieties of PAYGO pension plans

Our simulation model is based on the average age profiles of tax payments and benefit receipts for surviving members of the population, which we might interpret as referring to each generation's representative individual. Since we do not consider within-generation heterogeneity, many pension plan details are irrelevant and therefore are not discussed below. Nor do we model behavioral responses to differences in pension plans, instead considering alternative assumptions regarding the valuation of resources that may be seen as corresponding to different assumptions regarding behavioral responses. Of course, these aspects of pension structure and behavioral response are important in their own right, but in this paper we simplify drastically in order to focus on macro uncertainty and intergenerational differences, and to include rich detail on pension systems and the possible array of economic and demographic shocks.

To facilitate comparisons of different pension systems, we hold certain characteristics constant across them. We start by scaling the contribution level of each pension system to equal 10.6% of taxable payroll when averaged over all trajectories, corresponding to the Old Age and Survivors (OASI) portion of the current US system. We assume that all individuals work until age 67, the long-run normal retirement age under current US law, and that all individuals are retired thereafter. Further details of the different systems, as we model them, now follow.

2.1. US social security

To the tax system just discussed, we add benefits based on current US profiles, estimated as described below in the section describing the simulation model. Because the current US Social Security system is not sustainable, we will consider three alternative versions that would maintain its fiscal balance. None is intended to characterize the actual process of adjustment that will occur, which is of course very difficult to predict, but by considering alternative adjustment mechanisms we hope to trace out the range of possible risk-sharing outcomes implicit in the current law US program.

In the "Tax Adjust" variant, the age schedule of taxes is adjusted by a multiplicative factor each year to produce the revenue needed to cover that year's benefits and thus keep the system in perfect balance each year. In the "Benefit Adjust" variant, the age schedule of benefits is similarly adjusted each year so that the benefits exactly equal that year's tax revenues. In the "50–50 Adjust" variant, balance is achieved half by adjusting taxes and half by adjusting benefits. These three mechanisms will differ in terms of how shocks are spread among cohorts, with the tax adjust variant, at one extreme, focused exclusively on younger, working age cohorts, and the benefit adjust variant focused only on older, retired cohorts.

2.2. Swedish notional defined contribution system

The actual Swedish NDC system, described more fully in our earlier paper and in Holtzmann and Palmer (2005),[4] specifies a rate of return earned on accounts in each year t equal to the contemporaneous growth rate of the wage rate, g_t. At the date of retirement, the individual's account is converted into an annuity based on the account's balance as of that date. The terms of the annuity reflect mortality conditions at the time of conversion and an assumed wage growth rate, but the annuity is adjusted *ex post* for deviations of wage growth from this assumed rate.[5] Because the sustainable steady state PAYGO rate of return is the growth rate of total wages, $g+n$ (where n is the labor force growth rate), this system may have stability

[2] Because it is convenient for technical reasons to carry out simulations of the Swedish systems beginning with a small initial asset balance, we start all systems with the same initial balance to keep them on an equal footing.

[3] Our model of the actual US system accurately matches projections of the Actuaries of the US Social Security system when similar deterministic demographic and economic trajectories are assumed, for example.

[4] Also see Swedish Social Insurance Agency (2008).

[5] The actual Swedish system uses a pre-specified expected wage growth rate of 0.016, but we use 0.011, the underlying average rate of labor productivity growth in our simulations. We also adjust the annuity level to reflect changes in mortality after retirement, which is not a feature of the actual Swedish system. We found in our earlier paper that this post-retirement updating had only a minor impact on system stability.