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Means-testing and economic efficiency in pension design

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ABSTRACT

The present paper studies the efficiency properties of means-tested pay-as-you-go financed social security systems. Starting from a benchmark economy without social security, we introduce pension systems of various institutional designs and compare the costs arising from liquidity constraints as well as distortions of labor supply and the accumulation of savings versus the benefits from insurance provision against income uncertainty and mortality risk. We find a positive role of means-testing pension benefits against private assets from a long run welfare perspective. However, when taking transitional cohorts into account, our findings highlight strong aggregate efficiency losses.

1. Introduction

Social security systems of developed countries show a large variety of institutional designs reflecting the specific redistribution and insurance objectives of the respective societies. Countries such as Germany, Austria or France operate universal pension systems of a classic Bismarck design where retirement benefits are linked to the individual earnings history of a retiree. Due to the universality of these systems their respective budgets are very large — public pension outlays in Germany for instance amounted to 10.7% of GDP in 2008, see OECD (2011). On the other end of the spectrum countries like the United Kingdom, Australia, Ireland or New Zealand operate progressive flat-rate schemes of a Beveridge design with the prevention of old-age poverty as their main goal. Pension benefits within these systems are not linked to individual contribution-histories and are typically less generous. In addition, benefits are mostly targeted in order to reduce the size of the program. Consequently, their respective budgets are significantly smaller in comparison — public pension outlays in the UK for instance amounted to only 5.4% of GDP in 2008, see OECD (2011).

Means-testing pension benefits against individual income or assets allows governments to target benefits to poor retirees. Governments can flexibly adjust the margins of the targeted group by setting parameters such as the replacement rate and withdrawal rates of the means-tests, allowing for a higher flexibility to control spending on pension outlays. As a consequence, means-tested schemes require less funds than their universal counterparts, resulting in lower distortive contribution rates. On the other hand, means-testing benefits has been shown to be highly distortive to the accumulation of savings of poor elderly who rationally disaccumulate savings in order to maximize individual pension claims. Contrary to the policy intention of the means-test, this in turn contributes to higher pension outlays.

Given the vast diversity of real world targeted social security systems, it is important to understand the specific factors which determine the optimal institutional design: What is the optimal replacement rate? Should benefits be universal or should they be means-tested? What resources should be considered and what withdrawal rate should be applied in a means-test? Should means-tests exempt a minimum level of pensions from withdrawal? In order to answer these questions, the present paper attempts to compare the main merits and costs of means-testing in different pension designs using a general equilibrium overlapping generations model where households decide about savings and labor supply under idiosyncratic uncertainty. In our set-up the social security system increases welfare due to the insurance provision against labor income and longevity risk which is not provided by the market. At the same time contributions to the means-tested pension system distort labor supply and savings decisions and increase liquidity constraints. Consequently, the optimal pension design has to balance these benefits and costs.

Issues related to means-testing in the design of unfunded pension systems have already been discussed extensively by previous studies. Miles and Sefton (2003) as well as Sefton and van de Ven (2009) analyze the quantitative implications of various policy reforms for the UK's means-tested retirement benefit program using a partial equilibrium life-cycle model. Their results indicate a positive role of means-testing as long as the withdrawal rate is around 50%. Kumru and Piggott (2009) extend this approach using a large scale general equilibrium stochastic overlapping generations model calibrated to UK data. They find that even a 100% taper rate for means-testing is optimal. Tran and Woodland (2012) analyze the interdependence of pension

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generosity and the income taper rate in a stochastic OLG-model calibrated to the Australian economy. Their findings suggest that the optimal taper rate falls the more generous pension benefits within the social security system are. Kudrna and Woodland (2011) simulate the abolition of the asset means-test within the Australian pension system. In contrast to all previous studies their approach does not focus on long-run welfare consequences only. Instead they also consider transitional cohorts and compute compensating transfers which neutralize intergenerational income redistribution effects. However, they abstract from income uncertainty so that they do not take the insurance provision properties of the Australian pension scheme adequately into account. The latter is included by Fehr and Uhde (2013) who analyze the optimal design of pay-as-you-go financed social security systems in a model with uncertain income while considering both long-run and transitional cohorts. They find a negative correlation between progressivity and generosity when aggregate efficiency is used to identify the optimal design as well as a positive role for means-testing pensions within multi-pillar systems.

The present study builds on this previous work, but evaluates means-tested pension designs with respect to their optimal generosity and the precision of the means-test. Opposed to previous literature, we do not calibrate our model to match a real world economy, i.e. we start from an initial long-run equilibrium of an artificial economy without social security.[1] In order to quantify the macroeconomic, welfare and efficiency consequences of different pension formulas, we then introduce alternative pension systems of different institutional designs and compute the resulting transition paths, the new long-run equilibria as well as welfare consequences for different cohorts. In order to isolate the effect of the specific reform scenario on aggregate efficiency, we neutralize all resulting intergenerational redistribution in a final step by incorporating lump-sum compensations. We use the resulting pure aggregate efficiency effect as the criterion to compare pension systems with differing institutional parameters in order to identify the optimal design.

In line with the previous literature, our simulation results show that long-run welfare is higher in a means-tested system compared to a universal system. However, isolating the pure efficiency properties we show that means-testing induces losses in aggregate efficiency for all considered institutional designs. For systems granting very generous replacement rates, our results indicate that moderately positive taper rates dominate universal and fully means-tested systems. In our model, a universal social security system with a replacement rate of around 40% yields the highest efficiency gains.

The remainder of the paper is organized as follows: Section 2 describes the general equilibrium model we use in our quantitative analysis. Section 3 discusses the parametrization of the model and the calibration of the initial equilibrium. Our simulation results are presented in Section 4, and Section 5 concludes.

2. The model economy

2.1. Demographics and intracohort heterogeneity

Our model economy is populated by overlapping generations of individuals which may live up to a maximum possible lifespan of J periods. At each date t a new generation is born with its size normalized to unity, i.e. we assume zero population growth. At the beginning of life, individuals are assigned a skill level $s \in \mathcal{S}$ with an (exogenous) probability $N_{1,s}$. Since individuals face lifespan uncertainty, cohort sizes decrease over time, i.e. $N_{j,s} = \psi_{j,s} N_{j-1,s}$, with $\psi_{j,s} < 1$ denoting the time-invariant conditional survival probability of an individual of skill level s at the age of $j-1$ and $\psi_{J+1,s} = 0$.

Our model is solved recursively. At any given point in time t, agents are characterized by the state vector $z_j = (s, a_j, \eta_j)$, with $j \in \mathcal{J} = \{1, \ldots, J\}$ marking the age of the individual, $a_j \in \mathcal{A} = [0, \infty)$ representing liquid assets held by the agent at the beginning of age j and $\eta_j \in \mathcal{E}$ denoting an idiosyncratic shock to individual labor productivity.

At a given point in time t, the cohort of j-old agents is fragmented into subgroups $\xi_t(z_j)$ determined by the initial distribution at birth, the income process, mortality and the respective optimal decisions of its individuals over their life cycle. We define $X_t(z_j)$ as the corresponding cumulated measure of $\xi_t(z_j)$. As $\xi_t(z_j)$ only gives densities within cohorts and is not affected by cohort sizes,

$$\int_{\mathcal{A}\times\mathcal{E}} dX_t\left(z_j\right) = N_{j,s} \text{ and } \sum_{j\in\mathcal{J}}\sum_{s\in\mathcal{S}} N_{j,s} = \sum_{j\in\mathcal{J}}\int_{\mathcal{Z}} dX_t\left(z_j\right)$$

with $\mathcal{Z} = \mathcal{S} \times \mathcal{A} \times \mathcal{E}$ holding $\forall\, t \in \{0, \ldots, \infty\}$. Furthermore, we define $Z_t = (\xi_t(z_j), B_{RAt}, \Psi_t)$ as the state of the economy at the beginning of period t, with B_{RAt} representing debt of the redistribution authority. Ψ_t marks the policy schedule at a point in time t. In the following, we will omit the time index t, the skill level s and the state indices z_j and Z_t whenever possible. Agents are then only distinguished according to their age j.

2.2. The household side

We assume an identical preference structure for all agents represented by a time-separable, nested CES utility function. By following the approach of Epstein and Zin (1991) we isolate the agent's relative risk aversion from the intertemporal elasticity of substitution. Abstracting from a specific bequest motive, a j-old individual decides about its optimal leisure ℓ_j, consumption c_j and asset holdings a_j, while the agent's time endowment is normalized to unity. The optimization problem of a representative j-old agent with the state z_j is formulated recursively as

$$V\left(z_j\right) = \max_{c_j,\ell_j}\left\{u\left(c_j,\ell_j\right)^{1-\frac{1}{\gamma}} + \beta\left(\psi_{j+1,s}E\left[V\left(z_{j+1}\right)\right]^{\frac{1-\frac{1}{\gamma}}{1-\mu}} + \left(1-\psi_{j+1,s}\right)\mathcal{B}\left(a_{j+1}\right)\right)\right\}^{\frac{1}{1-\frac{1}{\gamma}}}, \tag{1}$$

where the parameter β denotes the household's discount factor and γ marks the intertemporal elasticity of substitution between present and future consumption. The parameter μ defines the degree of the agent's relative risk aversion.[2] Since agents face an uncertain lifespan, expected utility $E[V(z_{j+1})]$ of the next period is weighted by the survival probability $\psi_{j+1,s}$ while utility from leaving bequests $\mathcal{B}(a_{j+1})$ is weighted with the probability to die.[3] The probability of a j-old agent to have a productivity shock η_{j+1} in the subsequent period conditional on the current productivity shock being η_j is represented by the distribution function $\pi_j(\eta_{j+1}|\eta_j)$. Expected utility is then given by

$$E\left[V\left(z_{j+1}\right)\right] = \int_{\mathcal{E}} \pi_j\left(\eta_{j+1}|\eta_j\right) \cdot V\left(z_{j+1}\right)^{1-\mu} d\eta_{j+1}.$$

In the event of death agents might derive utility from leaving bequests. This bequest motive is represented by the function

$$\mathcal{B}\left(a_{j+1}\right) = \lambda_1\left(\lambda_2 + \frac{(1+r)a_{j+1}}{\lambda_3}\right)^{1-\frac{1}{\gamma}} \lambda_i \geq 0$$

with λ_1 reflecting the strength of the bequest motive, i.e. the agent's concern about leaving bequests to others and λ_2, λ_3 measuring the

[1] Hence, tangible policy recommendations for real world social security systems undertaken by the previous literature cannot directly be deducted from our results as this would require calibration to match these macro-economies.

[2] Note that for the special case $\mu = \frac{1}{\gamma}$ Eq. (1) simplifies to the traditional expected utility specification; see Epstein and Zin (1991), p.266.

[3] This type of bequest motive has been called warm glow (De Nardi, 2004).