Review of Pension Schemes Under Segmented and Asymmetric Labor Market

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Abstract

This paper analyses the pension system in Turkey using Computable General Equilibrium (CGE) and Overlapping Generations Models (OLG). The objective of the paper is to evaluate the effects of current pension policies on the macroeconomic aggregates when a segmented and asymmetric labor market is considered. We introduced a composite factor of capital and non-qualified labor and a qualified labor factor to define the production process. We further supposed that there is an unemployment risk for the non-qualified agents as in the Fodha at all.(2003).

Ultimately, this model aims to compute the transition path of a life cycle economy with multiple OLG, in order to analyze and compare the implications of different pension policies on macroeconomic aggregates. A similar analysis has already been done by Sayan and Kenc (1999) for the Turkish case. However, the effects of the segmented labor market was not taken into account. In this paper, simulations under different pension policy parameters show that segmented and asymmetric labor market hypotheses help identify how the decisions of the different agents and the unemployment rates vary according to the pension policy chosen.

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1 INTRODUCTION

Recent discussions on public policies are concentrated about the optimality of current social security systems. Pay-as-you-go (PAYG) pension scheme which is based on the payment of the retirement benefits of the elderly by the current working generations', contributions is a commonly used pension scheme in many developed and developing countries; since this scheme spreads risks and any dynamic political inefficiencies among and within generations. However, PAYG may create distortions to labor supply and saving decisions as it is an additional income taxation. The performance of such a scheme is strongly related to the proportion of the elderly and the working young generations in the population. Due to changing patterns of population distribution in most developed and many developing countries PAYG has become inefficient. Since working population is relatively small compared with retired population, the pension contributions of the former are far to be sufficient to pay retirement benefits of the latter and the share of pension deficits in public budget is growing. Alternative pension schemes are to be considered.

Since Feldstein (1974) analysing the effects of social security on retirement age, saving decisions and income distribution, there is a growing literature on the economic consequences of the social security systems. The pioneer work of Auerbach and Kotlikoff (1987) uses an overlapping generation computable general equilibrium (OLG-CGE) framework to study the effects of the U.S. social security reform. They define a non-stochastic environment to analyse the effects of social security on labor supply and capital accumulation. Hubbard and Judd (1987) add borrowing constraints and life time uncertainty to analyse welfare effects of social security. Imrohoroglu et al. (1995) introduce a stochastic labor income hypothesis and study the effects of social security in an economy where the initial steady state is dynamically inefficient. Hugget and Ventura (1999) compare steady states of policy options with a stochastic modeling of labor endowment process. Fuster (1999) includes two sided altruism in the model and find a welfare decreasing effect of social security especially for poorer agents. Huang et al. (1997) use a stochastic income and life span setup, without unemployment, to study inter and intra generational effects of social security transition policies. De Nardi et al. (1999) add time-variying conditional survival probabilities, population growth rates, endogenous labor supply and bequest motive in the model. Conesa and Krueger (1998), Cooley and Soares (1999) use voting theory to analyse the political sustainability and the distributional effects of a social security system in OLG-CGE set up.

This paper uses a OLG-CGE to study Turkish pension system and reform options. Previous work by Sayan and Kenc (1999) take into account demographic changes and compare reform options that ensure improvement in fiscal balances. They find that the aging of population will have significant effects on output, labor supply, investment and they analyse the impact of alternative social security policies on aggregates and prices. Imrohoroglu (2004) finds that a pension reform with a partial and mandatory funding strategy of the public PAYG scheme leads to an increase in output, capital stock, aggregate consumption and investment while promoting real wage growth and inducing a decrease in real interest rate .

We consider alternative reform scenario under a segmented and asymmetric labor market hypothesis. We suppose two categories of labor, namely qualified and non-qualified which differ in their marginal productivity, elasticities of substitution with respect to capital and unemployment risks. This formulation of the labor market aims to capture characteristics of Turkish labor market studied by Gursel and Levent (2003). We compare the initial PAYG scheme to the proposed two pillar pension policy. This proposal suggests the set up of both mandatory PAYG and funded schemes so that the total contribution rates remain equal to the initial pre-reform rates. We aim to study the long run effects of the reform scenario proposed by Imrohoroglu (2004) on wealth distribution and welfare differentials between categories in the above mentioned labor market conditions.

This paper is organised a follows: The first part describes the theoretical model; the second part includes calibration of the model and presentation of alternative scenarios. The last section presents simulation results and concludes.

2 The model

The model is based on Diamond (1965). Agents are heterogeneous. There are two types of agents: qualified and non-qualified. Each period, different categories of agents face different unemployment risks and has different wage incomes. During the retirement period both category of agent receives pension benefits from funded and unfunded schemes. There is an unemployment insurance program managed by the government. We do not include any deficit option for the government, neither for the pension schemes and agents are liquidity constrained.

2.1 Population

The superscript h denotes the agent type and we set $h = 1$ for non-qualified agents and $h = 2$ for qualified agents. There is no lifetime uncertainty for both type of agents. Total population is denoted by N.The age and category dependant population share is $\mu^{h,j}$ and satisfies

$$\sum_{h=1}^{2} \sum_{j=1}^{J^h} \mu^{h,j} = 1 \tag{1}$$

where J^h is the life length for an agent type h. We suppose that the population growth rate n is constant and equal for both group. As a result we have time-invariant population shares. The dynamic of population shares can be written,

$$\mu^{h,j} = (1+n)^{-1}\mu^{h,j-1}$$

2.2 Households

The qualified and non-qualified agents are born and enter the labor market at the age of 21. There is no lifetime uncertainty but life span is category dependent such that qualified agents live longer than non-qualified agents, 80 and 70 years respectively. The mandatory retirement age is 60.A time period is ten years. As individuals enter the economy at 21 years old, the life length J^h is five and six periods for non-qualified and qualified agents respectively. This imply that at each date t, five generations of non-qualified and six generations of qualified agents coexist. Age j^* is the retirement age. We suppose that age $j^*$is mandatory and identical. First four periods of life are supposed to be the working years. At the beginning of age j^*, the fifth period, everybody retires.

2.2.1 Intertemporal Utility

We describe households behavior in per capita values. The utility of an agent h of age j is a function of his consumption $c^{h,j}$. If we denote the time preferences by ρ, we have the following discounted lifetime utility function:

$$\bar{U}^h = \sum_{j=1}^{J^h} \frac{1}{(1+\rho)^{j-1}} U(c^{h,j}) \tag{2}$$

where instantaneous utility is defined as a CRRA as follows,

$$U(c^{h,j}) = \frac{(c^{h,j})^{1-\frac{1}{\gamma}}}{1-\frac{1}{\gamma}}$$

Note that $\rho \geq 0$ and $\frac{1}{1+\rho}$ is the subjective discount factor, γ is elasticity of intertemporal substitution.

2.2.2 Budget Constraints

During working periods, each agent is endowed with one unit of labor which is inelastically supplied in the labor market. But given the labor market rigidities, only a fraction of the labor supply of category h is employed at time t. The agents are supposed to be in one two states s during working period: employed (denoted by e) or unemployed (denoted by u). This unemployment risk is supposed to be independent from the previous period state and uniformly distributed over the whole working age population. We define the unemployment risk for the labor category h as

$$\varepsilon_t^h = P(s=i|s^{'}=j) = P(s=i) \quad \text{for} \quad i,j = e,u$$

If they are employed, agents earn a wage w^h and if they are unemployed they receive an unemployment benefit u^h which is a given fraction χ of the wage $u^{h,j} = \chi w^h$. Note that w^h is the age-independent wage rate. At each period, all agents in the working population gte the same wage. Employed agents pay an income tax at rate τ, a contribution to the unemployment insurance at rate τ_{uw} and a pension contribution at rate θ. θ satisfies,

$$\theta = \theta_f + \theta_u$$

where θ_f and θ_u are rates of funded and unfunded schemes respectively. Unemployed agents do not pay any tax or contribution.

At the first period of retirement agents receive all of their pension accumulations b_f^h from the funded scheme. During the following retirement periods, they only receive pension benefit b_u^h from the unfunded scheme. Retired agents do not pay any taxes on their pension benefits.

All agents are supposed to pay interest income tax at rate τ_r on the return of their savings. Each period total net income (after tax and contribution payments) of an agent h is allocated between consumption $c_s^{h,j}$ and saving in the form of capital shares $a_s^{h,j}$.

The budget constraint of an agent of age j at state s is ,

$$c_s^{h,j} + a_s^{h,j} = q_s^{h,j} + (1 + (1 - \tau_r)r)\, a_{s'}^{h,j-1} \tag{3}$$

where $c_s^{h,j} \geq 0$ and $a_s^{h,j} \geq 0$ for all j such that $a^{h,0}$ is given and $a^{h,J^h} = 0$. By the following equation we can define $q^{h,j}$,

$$q_s^{h,j} = \begin{cases} (1-\tau)(1-\theta-\tau_{uw})w^h & \text{for } \ j = 1, 2, .., j^* - 1 \text{ if } s = e \\ \chi w^h & \text{for } \ j = 1, 2, .., j^* - 1 \text{ if } s = u \\ b_f^h + b_u^h & \text{for } \ j = j^* \\ b_u^h & \text{for } \ j = j^{*+1}, ..., J^h \end{cases} \tag{4}$$

The restriction on $a^{h,J^h} = 0$ implies that there is no bequest motive at the end of the lifetime and $a_s^{h,j} \geq 0$ means that agents are liquidity constrained.

Individuals solve a discrete, finite state, finite horizon dynamic program subject to (3).

$$V^j(a_s^{h,j}, s) = \underset{(c^j,\, a_{s'}^{h,j+1})\, \epsilon\, \Omega^h(a,s)}{Max} \left\{ U(c_s^{h,j}) + \beta E_{s'} V^{j+1}(a_{s'}^{h,j+1}, s') \right\} \tag{5}$$

where $\Omega(a, s)$ is state space of an agent of type h. According to optimisation problem households choose for lifetime consumptions and savings.

2.3 Firms

Technology of production requires some proportion of the labor input to be poorly qualified or/and non-qualified that can be easily combined or/and substitutable with capital while the other proportion is less substitutable to capital. This technological constraint can be expressed within a nested-CES function. We define a composite factor of capital K and non-qualified labor L_1, KL, with a Cobb-Douglas technology. We further suppose that CES technology uses the composite factor KL and qualified labor L_2. We have a constant global productivity factor A. The output is then,

$$Y = A\left[\alpha(K^{\phi}(L^1)^{1-\phi})^{\frac{\sigma-1}{\sigma}} + (1-\alpha)(L^2)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \tag{6}$$

where σ is the elasticity of substitution between composite factor and qualified labor such that $0 < \sigma < 1$, α is the contribution of the composite factor to output and ϕ is the share of capital in composite factor. We suppose that capital depreciates at a constant rate δ each period. The total cost of one unit of the capital is then $(r + \delta)$. Firms pay pension contributions and unemployment insurance contributions at rates τ_w^h, τ_u^h which add to labor cost. The firm's problem is to maximise real profit Π with respect to L^1, L^2, K.

$$\underset{\{L_1,L_2,K\}}{Max}\ \Pi = AF(K, L^1, L^2) - (r+\delta)K - w^1(1+\tau_w+\tau_u)L^1 - w^2(1+\tau_w+\tau_u)L^2$$

We can write first order conditions in per capita terms,

$$r + \delta = \alpha\phi k^{\frac{\phi(\sigma-1)}{\sigma}-1}(l^1)^{\frac{(1-\phi)(\sigma-1)}{\sigma}} A^{\frac{\sigma-1}{\sigma}} y^{\frac{1}{\sigma}} \tag{7}$$

$$w^1(1 + \tau_w + \tau_u) = \alpha(1-\phi)k^{\frac{\phi(\sigma-1)}{\sigma}}(l^1)^{\frac{(1-\phi)(\sigma-1)}{\sigma}-1} A^{\frac{\sigma-1}{\sigma}} y^{\frac{1}{\sigma}} \tag{8}$$

$$w^2(1 + \tau_w + \tau_u) = (1-\alpha)(l^2)^{\frac{-1}{\sigma}} A^{\frac{\sigma-1}{\sigma}} y^{\frac{1}{\sigma}} \tag{9}$$

where k, l^1 and l^2 are in per capita terms. Given the taxes and prices firms determine their optimal factor demands.

2.4 Labor Market

Labor market is supposed to have a segmented and asymmetric structure due to qualification differences. The segmentation arises from difference in qualifications while asymmetry is a consequence of the production technology. Production technology favors qualified agents in terms of unemployment risk by setting non-qualified agents more substitutable with respect to capital. Moreover, due to wage rigidities, a lack of employment opportunities relative to total labor supply arises. We denote by ε^h the unemployment risk (rate) for an agent of category h. The equilibrium of each segment of the labor market is given by

$$l^h = (1-\varepsilon^h)\sum_{j=1}^{j^*-1}\mu^{h,j} \tag{10}$$

where l^h is the per capita labor demand of category h.

2.5 Government

We suppose that the government collects taxes on wages and interest income to finance expenditures and manages separately unemployment insurance program. The government can not issue debt has to respect following constraints.

$$g = \tau\left[(1-\theta-\theta_u)\right]\sum_{h=1}^{2}\sum_{j=1}^{j^*-1}\mu^{h,j}(1-\varepsilon^h)w^h + r\tau^r\sum_{h=1}^{2}\sum_{j=1}^{J^h}\sum_{s}\mu^{h,j}a_s^{h,j} \tag{11}$$

The unemployment insurance scheme is self-financing. Given χ, the government chooses the total contribution rate to unemployment insurance program by the employee τ_{uw} and by the employer τ_u.

$$(\tau_u+\tau_{uw}) = \chi\frac{\sum_{h=1}^{2}\sum_{j=1}^{j^*-1}\mu^{h,j}\varepsilon^h}{\sum_{h=1}^{2}\sum_{j=1}^{j^*-1}\mu^{h,j}(1-\varepsilon^h)} \tag{12}$$

2.6 Pension Schemes

We consider that the pension system has two pillars. The first pillar is an unfunded PAYG scheme and the second pillar is a funded scheme. These two schemes are supposed to be managed separately. Benchmark policy is the case where the only mandatory scheme is PAYG, as in the current Turkish pension policy.

2.6.1 Unfunded PAYG Scheme

The principle of PAYG is to finance the pension benefits of retirees by the pensions contributions of current workers. The contributions of young generations pay the benefits of the retirees. Moreover, as in the Turkish pension scheme, firms contribute to the pension scheme at a rate τ_w of the wage. The budget constraint of PAYG scheme is then,

$$(\tau_w+\theta_u)\sum_{h=1}^{2}\sum_{j=1}^{j^*-1}\mu^{h,j}\left[(1-\varepsilon^h)\right]w^h = \sum_{h=1}^{2}\sum_{j=1}^{J^h}\mu^{h,j}b_u^h \tag{13}$$

We suppose that the pension benefit b_u^h is equal to a given proportion ϕ of the average wage income:

$$b_u^h = \phi \frac{\sum_{j=1}^{j^*-1} w^{h,j}(1-\varepsilon^{h,j})}{j^*-1} \quad (14)$$

where $\varepsilon^{h,j}$ and $w^{h,j}$ are the unemployment rate and the wage rate prevailing in the economy when the agent is j years old The unfunded pension scheme is self-financing and total contribution rate is determined given this replacement rate ϕ.

2.6.2 Funded Pension Scheme

A funded pension scheme implies that the retirement period is financed by the gross return of the contributions made during the working period. The contribution rate to the funded pension scheme of an agent of type h is θ_f. As the contributions to pension scheme are invested in the asset market, their rate of return equals the real interest rate. Considering these assumptions, the pension benefit from the funded scheme is

$$b_f^h = \sum_{j=1}^{j^*-1} \prod_{i=1}^{j} (1+r)^i \theta_f \left[(1-\varepsilon^{h,j})\right] w^{h,j} \quad (15)$$

2.7 Asset Market

We suppose that savings of households and contributions to funded scheme are in the form of capital share purchases. Each period, economy's total saving is invested and determines the next period capital stock . We can express the asset market equilibrium as

$$\sum_{h=1}^{2} \sum_{j=1}^{J^h} \sum_{s} \mu^{h,j} a_{t-1,s}^{h,j-1} + \sum_{h=1}^{2} \sum_{j=1}^{j^*-1} \mu^{h,j} \theta_f \left[(1-\varepsilon_{t-1}^h)\right] w_{t-1}^h = k_t \quad (16)$$

2.8 Goods Market

We suppose that the only good produced in the economy is consumed as well as a capital good and consumption good. In equilibrium the sum of the consumption of working age generations and retirees of each category h, government expenditure g and investment in capital shares is equal to per capita output produced in the economy. Goods market equilibrium can be written,

$$y_t = k_{t+1} - (1-\delta)k_t + c_t + g_t \quad (17)$$

where $c_t = \sum_{h=1}^{2} \sum_{j=1}^{J^h} \sum_{s^h} \mu^{h,j} c_{t,s}^{h,j}$.

2.9 Equilibrium

Given a set of policy rules for the government $\{\tau, \tau_r, \tau_{uw}, \tau_u, \chi\}$ and for pension schemes $\{\phi, \theta_u, \theta_f, \tau_w\}$ and an initial wealth distribution $\left\{a_0^{h,j}\right\}_{j=1}^{Jh}$, an equilibrium for this economy is such that the budget of the unemployment insurance program and the pension schemes are balanced; the sequence of decision rules $\left\{c_s^{h,j}, a_s^{h,j}\right\}_{j=1}^{J^h}$for $h = 1, 2$ and $s = e, u$ and the prices $\{w^1, w^2, r\}$ such that the relative prices solve the firms' maximisation problem, the sequence of decision rules solves the agents' dynamic program and all the markets clear.

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