QUANTITATIVE IMPLICATIONS OF CHANGES IN SOCIAL SECURITY RULES: THE 2008 REFORM OF TURKEY

by

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Abstract

The Turkish social insurance system has been under feverish debates for years, particularly through its burden on the economy. The most recent reform on the social insurance system is an attempt to neutralize deterioration in social security system and its effects on the economy. After recent reform, the way that retirement benefits are calculated is changed against workers and minimum age for retirement is increased. In particular, for an agent with 25 years of social security tax payments, replacement rate is down from 65 percent to 50 percent. On the other hand, retirement age is up from 60 to 65. The aim of this paper is to investigate the macroeconomic effects of these changes using an OLG model. My findings indicate that labor supply, output and capital stock increase when the changes mentioned above are applied to the benchmark economy calibrated to the Turkish economy data in 2005. A critical change with current reform is marginal benefit of working became uniform over ages. In another simulation exercise, I change the marginal retirement benefit in the benchmark economy to be uniform over ages while keeping the size of social security unchanged. As a result, benefit of getting retired in a later period is increased. Uniform distribution of marginal benefits decreases both capital stock and output of economy, however. Increasing retirement age, on the other hand, result in agents getting retirement benefits for less time and in an older-age. Age increase has substantial positive effect on both labor supply, capital stock and output.

Keywords: Social Security Reform, Retirement Age, Replacement Rate.

SOSYAL GÜVENLÍK KURALLARINDAKÍ DEĞÍŞÍKLÍKLERÍN SAYISAL UYGULAMALARI: TÜRKÍYE'NÍN 2008 REFORMU

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Özet

Türk sosyal güvenlik sistemi, özellikle ekonomi üzerindeki ağır yükü dolayısıyla, sürekli ağır eleştirilerin hedefi olmuştur. Son yapilan reform, sosyal güvenlik sistemindeki kötü gidişi ve dolayısıyla onun ekonomi üzerindeki olumsuz etkisini kırma amacını taşımaktadır. Son yapılan reformla emeklilik gelirinin hesaplanma yöntemi çalışanlar aleyhine değiştirilmiş ve emeklilik aylığı almak için gerekli minimum yaş arttırılmıştır. Özelde, 25 yıl çalışan biri için bağlama oranı, yüzde 65'ten yüzde 50'ye düşürülmüştür. Diğer taraftan, emeklilik aylığı almak için gerekli yaş 60'tan 65'e çıkarılmıştır. Bu çalışmanın amacı, bahsedilen değişikliklerin makroekonomik etkilerinin OLG modeli kullanılarak incelenmesidir. Bulgularım, yukarıdaki değisikliklerin 2005 Türkiye datasının uyarlandığı benchmark ekonomiye uygulanması durumunda, işgücü arzı, üretim ve sermaye stoğunun arttığını gostermektedir. Reformdaki kiritik önemde bir değisikliklik, çalışmanın marjinal faydasının tekdüze hale getirildiği değisimdir. Başka bir simülasyon çalışmada, çalışmanın marjinal faydasının, sosyal güvenlik sisteminin büyüklüğü sabit tutularak, tekdüze hale getirilmesidir. Sonuç olarak daha geç yaşta işten ayrılmanın faydası arttırılmıstır. Marjinal faydanın yaşlar arasında denk olarak dağıtılması sermaye stoğu ve üretimi azaltmaktadır, bununla birlikte. Emeklilik aylığı almak için gerekli minimum yaşın arttırılması, diğer taraftan, calışanların emekliliğin getirilerinden daha az zaman için ve daha geç yaşlarda faydalanmalarına neden olur. Minimum yaştaki bu artış, işgücü arzı, sermaye stoğunu ve üretimi önemli oranlarda olumlu etkilemektedir.

Anahtar Kelimeler: Sosyal Güvenlik Reformu, Bağlama Oranı, Emeklilik Yaşı

1 Introduction

The Turkish social insurance system has been an active area of debates for its generosity and deficits in social security budget, especially after 1980s. This is particularly because the public sector deficits are the main challenges of the Turkish economy. Although a significant portion of the deficit stems from deficit in the public budget, deficit in the social security systems is another important source (Sayan and Kiraci, 2001). The social insurance budget deficits are mainly due to early retirement and unofficial employment[1](Alper, Imrohoroglu and Sayan, 2004). Both early retirement and unofficial employment are basically caused by no minimum age requirement to be entitled to the pension and lower number of payment days of premium (Akbulak and Akbulak, 2004). According to OECD-Economic Outlook statistics, Turkey ranks quite high in OECD countries in accordance with individual tax burden. Social security taxes accounts for 40 percent on average for instance. High taxes over income, or for social security, encourages informal economy and discourages economic activity and employment (Ozbek, 2006).

Transfer payments to the social security institutions from the public budget amounts 4.5 percent of GDP, as of 2005[2]. This is a heavy burden for the fragile Turkish economy and causes instability. Particularly considering almost 85 percent of the population in Turkey has social insurance record (Ministry of Labor and Social Security statistics of 2005), gravity of the problem with the former social security system gets more clear.

According to the ILO (International Labor Organization) and the MLSS statistics (TUSIAD, 2004), Turkey is among the most rapidly aging countries because of its current younger population and relatively high growth rates (Ministry of Labor and Social Security (MLSS) reform book, 2008). Statistics show that along the following 20 years, active labor force population will increase (TUSIAD, 2004). And following that period the dependency ratio is expected to rise. In order to benefit from this demographic opportunity, Imrohoroglu (2004) suggests that Turkey have a reform to deal with the upcoming deterioration in the demographic profile. Due to higher economic growth anticipated for the following years, it is suggested that savings and funds of

[1]Which is still about 46.9 percent according to the latest TUIK statistics

[2]Ministry of Labor and Social Security statistics, 2005

the social insurance institutions should be increased along this period (TUSIAD, 2004). Sayan and Kiraci (2001) offer control over deterioration in dependency ratio in to change minimum retirement ages, and to change the contribution and replacement ratios in order to deal with deficits in pension system[3] .

Despite Eldred's classification of social security as overcharging some while undercharging some others to have 'social adequacy' while having its budget balances in equilibrium (Eldred, 1981), the Turkish social security system almost overcharges the majority of its participants. Replacement ratio[4] in the Turkish public insurance system is quite high compared to its European and other developed counterparts. Currently the replacement ratio is 2.6 percent on average for the first 25 years (Articles 506, 5434, 1479 and 5510). The world average, however, is 1.5 percent per year. The replacement ratio in aggregate may be over 100 percent in Turkey while its OECD counterparts' average is 68.7 percent.(OECD country statistics, oecd.com/economics)

On average a social insurance system should have 4 participants for each retiree, the world average for the dependency ratio. Turkey, on the other hand, has 1.9 participants for each retiree (MLSS reform book, 2008). Sayan and Kiraci (2001) point to the increasing dependency ratio (ratio of retirees to workers) as the sign of financial difficulties in pension systems.

There are 2 ways to cope with related problems with the social insurance system; increase in tax collection or decrease in retirement benefits (lower replacement rate). Recent reform decreases retirement benefit calculation formula. Formerly, there was 65 percent replacement rate for 25 years of contribution payment whereas the new act requires a 50 percent pension payment for the same period. Marginal retirement benefit was decreasing by years in labor force previously. Benefit calculation in benchmark economy was sum of 3.5 per every year of the first ten years; 2 percent per each year of the following fifteen years and 1.5 percent per each year thereafter; the reform economy requires a uniform contribution to the replacement ratio per each year of work. Marginal retirement benefit becomes uniform over ages. Reform also in-

[3]Replacement rate is: (retirement benefits) / (past mean earnings)

[4]I will use Replacement rate and Replacement ratio interchangeably.

creases minimum age for retirement benefit collections. Retirement age is increased from 60 to 65.

This paper employs a dynamic model of Overlapping Generations model to examine the macroeconomic effects of three major changes by the recent, extensive social insurance reform. I develop a partial equilibrium life-cycle model. This model mostly follows the model used in Huggett and Ventura (1997). Agents start out as workers and they are allowed to make labor supply and saving decisions. After being entitled for retirement benefits (25 years of work), workers face utility costs if their labor supply is positive. Agents labor-leisure decisions after this period depends on this utility cost they face. Labor productivity of agents changes deterministically by age.

I evaluate 4 alternative economies in this paper. In the first alternative economy, calculation of benefit payments and therefore replacement rate for retirement benefits is decreased. Second alternative economy has calculation of benefit payments changed while social security system taxes and retirement benefits are kept at its benchmark economy level. The third alternative economy has only minimum age for retirement benefits collection increased. Finally, I consider the economy with all three major changes applied. That is the economy with uniform distribution of marginal retirement benefits (2 percent) and retirement age at 65. The macroeconomic effects of the changes are demonstrated by steady-state comparison of the benchmark and reform economies. I apply these changes individually and then compare macroeconomic variables to capture effects of each change. The pay-as-you-go (PAYG) property of social security system is kept through all alternative economies.

The main results of the paper are as follows. Decreasing replacement rate, results in decrease in retirement benefit for the same periods of contribution payments. Hence, agents work for more time and make more savings before retirement. Changing replacement rate decreases size of social security system. Social security tax rate decrease to $\theta = 15.20$ from its benchmark value, $\theta = 17.35$. Output change by 15.38 percent and capital stock increase by 12 percent are substantial responses to replacement rate modification while hours in work and average retirement ages changes slightly.

Secondly, I investigate the case with changing only the distribution of marginal benefits of retirement (contributions to replacement rate). Marginal benefits of retirement are kept uniform without changing social security taxes rate (θ =17.35) and benefit payments. This time benefit of getting retired in a late period is increased. After the first 25 years, agents get extra benefit payment for each year in work. Changing only distribution of replacement rate, surprisingly, decreases economic activity, however. Output falls by 3.75 percent while capital stock decreases by 5.6. Hours of work also decrease, but average retirement age is increased slightly (1.36 percent).

Another major change is that minimum age for collection of retirement benefits is increased to 65. Agents get pensions for less time and get their pensions in an older-age. This arrangement leads to more time at work and more savings before retirement. Retirement age increase is the most effective change over macroeconomic variables in reform. Output and capital stock of economy are increased up to 28 percent and 42 percent respectively. Equilibrium social security tax and wage rates are also changed, social security taxes decrease to approximately $\theta = 14$ from its benchmark value 17.35 percent.

The final alternative economy is the one with all three changes applied. Minimum age for retirement benefits calculation increase and benefit calculations decrease were demonstrated to increase labor supply, capital stock and output of economy. The fourth economy has similar outcomes. Output increases by 33 percent and capital stock of economy is increased by 50 percent, with an almost half impact. Hours in work in aggregate seems almost not to change while average retirement age is increased by 4.5 percent. Social security system is decreased in equilibrium, θ=13 percent. That is agents have more time in labor force, pay less taxes and get retirement benefits for less time. Savings and labor supply are increased in this economy.

1.1 Literature

Macroeconomic effects of social security reforms is not a common issue in the literature over social insurance in developing countries (Glomm, 2006). Ferreira has studied social security

reforms in the Brazilian economy (Ferreira, 2004 and Ferreira, 2005). He reveals contributions of the reform to economic recovery of Brazil as a developing country. Glomm (2005 and 2006) on the other hand, concentrates on the large scale implications of the generous public sector pensions in Brazil. Glomm's findings regarding early retirement effects of generous public sector pensions is an essential step in social security reform analysis of any other developing country.

Macroeconomics effects of social security is an expended area of study in developed countries, however. Elder and Holland (2002) study macroeconomic effects of social security on interest rate through investment of social security funds to the bonds or equities market. They examine the effect of the size and portfolio distribution of the social security funds over the interest rates and model the relationship between the two. They find that as the size of US Social Security Trust Funds or the portfolio share of bonds or equities increases, interest rate over that investment is decreased (Elder and Holland, 2002).

Kydland and Prescott's revolutionary 1982 paper, time to build and aggregate fluctuations, is a classic reference to get better understanding of an OLG model in many aspects. Also, Auerbach and Kotlikoff's 1987 book "Dynamic Fiscal Policy" is a reference book in studies over overlapping generations model.

The discussion in this paper links up well with the literature by Sayan and Kiracı (2001), Huggett and Ventura (1997) and Kaygusuz (2007) in its modeling the social security system in Turkey.

As part of a study for TUSIAD, Imrohoroglu compares the Turkish social insurance system with its OECD countries counterparts and introduces a general equilibrium model for the Turkish insurance system reform (Alper, Imrohoroglu, and Sayan, 2004). According to Imrohoroglu (2004), the current distributive Pay-As-You-Go social security system deters savings as well as decrease in labor supply and employment and, thus, reduces real wages and GDP of a country, as it is in Turkey. Alper, Imrohoroglu and Sayan (2004) present a comprehensive model for the Turkish Social insurance system reform. They point to the potential financial distress and danger

in aging of the population in Turkey.

Sayan and Kiraci (2001) study an alternative pension reform with higher retirement age, and changes in contribution and replacement rates to the PAYG system in Turkey after the age requirement arrangement in 2000. They focus on the public pension system deficits and propose options to PAYG system to decrease deficit.

Early retirement is not just a problem in developing countries indeed. Beker, Gruber and Milligan (2003) study the impact of social security on retirement behavior of participants in Canada. Canada's social security system has income security structure that it disables working in older ages. They suggest control over life-time earning that has incentive for retirement in early ages. Gruber also demonstrates the early retirement incentives of the social security systems (Gruber, 1999). Haveman, Holden, Wilson and Wolfe (2003) in their paper " Soacial Security, Age of Retirement, and Economic Well-Being: Intertemporal and Demographic Patterns among Retired-Worker Beneficiaries" focus on effects of early retirement on the economic well-being of retired-workers. They find strong links between accepting early-retirement benefits and poverty in older ages. Although, this is much a problem with the punishment rate for early retirement in the States, the Turkish case with decreasing the replacement rate and initiating more years in labor force is in a way such a punishment for early retirement.

Paper will continue as follows. The next section is the model, which includes household's problem, firms' problem and the definition of equilibrium. Calibration to the Turkish economy data follows in section 3. Then the reform is applied to the model and in section 5 results are revealed. Finally, conclusion section summarizes the paper and fulfils the study, in section 7.

2 The Model

This paper describes an economy with agents that differ in their asset holdings, ages, past mean earnings, utility costs, and experience in labor force. I develop a partial equilibrium life-cycle model. This model mostly follows the model used in Huggett and Ventura (1997)[5].

Given particular preferences, production technology and endowments fixed, I will apply a social security reform and then will observe the macroeconomic effects the reform will result in. Social security reform rearranges minimum age for retirement benefits and calculation of replacement rate for retirement benefits. And through that variation, the aggregate effect over the economy is evaluated by steady-state comparison of the two cases.

I have a dynamic model of overlapping generations economy. The economy is populated by a continuum of male agents with total measure one. Agents live through periods 1 to T where each period is five years and total population equals one in each period. Every period a new generation (cohort) is born. Each cohort's share in population η_j is calculated by,

$$\eta_j = (1 - I(j)\rho_j)\frac{\eta_{j-1}}{1+n}, and \sum_j \eta_j = 1$$

where the indicator function,

$$I(j) = \begin{cases} 0 & \text{if } j \leq 8 \\ 1 & \text{if } 8 < j \leq T \end{cases}$$

8, here, is the period corresponding to age 60 where agents begin to face mortality risk and 'j' is age of an agent at a specific date.

[5]Some other important overlapping generations models to model the social security are Imrohoroglu, Imrohoroglu, Joines (1995); Rios and Rull (1996), Hubbard and Judd (1987), Cooley and soares (1995, 1996), Conesa and Krueger (1998), Imrohoroglu (1998), Rust and Phelan (1997), Storesletten, Telmer, and Yaron (1997))

There is an age J that agents become entitled to retirement and its benefits, but have to wait until age 'R' to get retirement benefits. Agents retire at age 'R' for sure. Retirees get retirement payment after age 60 $\equiv$ period 8 until age 'T' as long as they survive. Agents will face a mortality risk after age of 60, (ρ). Asset holdings left from people died are distributed to the living agents. This is called the transfer payments from government, TR, and is uniformly distributed to the living agents.

Every period a new generation is born and population grows at rate 'n'. Also, each period an agent is given 1 unit of labor. Agent devotes 'l' proportion of his labor to work and keeps the remaining proportion as leisure (1-l) since he will get utility from both consumption and leisure. Agents will have different productivity levels (z) by their ages. Productivity level will determine labor income agents will get and will change by age.

$$z_j \in Z = (z_1, z_2, ..., z_R)$$

Agents will get income from labor equal to $z_j lw$. Where 'w' is real wages. There is a consumption tax τ^c and social security tax θ as well as some income tax τ over the total income from labor and assets (a). Asset holdings will provide an interest payment at rate 'r'.

The utility function of agents at any period is given below. Utility function I use here is a common labor-leisure decision utility function consistent with stylized facts which was also used by Kaygusuz (2007). All agents are identical in their preferences and have identical utility function.

$$U_j(c, 1-l) = log(c) - \sigma_1 \frac{(l)^{1+\sigma_2}}{1+\sigma_2} - \mu(l, j)\Pi^{j-J} q_J$$

For some,

$$\mu(l,j) = \begin{cases} 1 & \text{if } l > 0 \text{ and } j > J \\ 0 & \text{if } o/w \end{cases}$$

Each agent has some utility cost when he is born. After age J, agents face this idiosyncratic utility cost (q) that will affect agent's decision regarding working attitudes. Utility cost is from an exponential distribution, where $\bar{q}$ is calibrated and, and q changes by age, that is:

$$f(q) = \frac{1}{\bar{q}} e^{-\frac{q}{\bar{q}}}$$

and utility cost,

$$q_t = \Pi^{j-J} q_J$$

given $t > J$.

Which briefly means: Some agents will prefer not to work after facing high utility costs and wait for their retirement benefit payments, while some others may prefer to keep working until age R depending on the utility cost they will face.

2.1 Pension earnings

Retirees get a benefit payment $b(\bar{e})$ after age R if they have completed their social security payments and are entitled to retirement. $\bar{e}$ is the average past labor income of an agent.
Former social security system requires the following benefit payments after age R;
With 'j' age and 'i' number of years worked (experience):

$$b(\bar{e},h)=\begin{cases}(\psi_1 h)\bar{e} & \text{if } h\leq i_1\\ (\psi_1 i_1+\psi_2(h-i_1))\bar{e} & \text{if } i_1<h\leq i_2\\ (\psi_1 i_1+\psi_2(i_2-i_1)+\psi_3(h-i_2))\bar{e} & \text{if } h>i_2\end{cases}$$

Where, $\bar{e}$ is the average past labor income, h is years of experience, $i_1 = 10$, $i_2 = 25$, and ψ_1, ψ_2, ψ_3, are marginal retirement benefits corresponding to 3.5, 2 and 1.5 percents respectively.

The new social security system, however, has the following benefit formula:

$$b(\bar{e},h)=\begin{cases}(\gamma h)\bar{e} & \text{if } h>0\end{cases}$$

where $\bar{e}$ is again the average past labor income, and γ is 2 percent marginal retirement benefit added to replacement rate per years of work.

The new social security system, as is clear from the benefit formula, have redistributed and decreased the replacement rate (the benefit payment coefficients) in order to encourage workers remain in labor force and pay more social security taxes.

2.2 Households' problem

Households differ in their ages (j), productivity levels (dependent on age) (z_j), average past earnings $\bar{e}$, idiosyncratic utility costs q_j and asset holdings (a). Each period, agents observe their assets (a), number of periods worked (i) and past mean earnings ($\bar{e}$) and given their utility costs q_j they face between ages J and R, they will decide whether to work more or have more leisure.

Households at age 1 has zero asset holding, zero initial wealth. I have the state variables a,j,$\bar{e}$,q, i and control variables 'a' and 'l'. Bellman equation for household's problem is as follows,

$$V(a, j, \bar{e}, q, h) = max_{a' \geq 0, l} U(c, 1-l) + \beta(1 - I(j)\rho_{j+1}) V(a', j+1, \bar{e}', q, h')$$

subject to,

$$(1+\tau^c)c + a' = z_j l w - \theta(z_j l w) - \tau(z_j l w + ra) + (1+r)a + I(j)b(\bar{e}, h) + TR$$

recalling that $I(j)$ was as follows,

$$I(j) = \begin{cases} 0 & \text{if } j \leq R \\ 1 & \text{if } R < j \leq T \end{cases}$$

and

$h = 0$ if $R < j < T$

$h \in [0, 1]$ if $j \leq R$

Since 'i' is the sum of years worked until age 'j', then, the average past income at time 'j+1' is as follows,

$$\bar{e}' = \begin{cases} \frac{\bar{e}h + z_j w l}{h'} & \text{if } j < R \\ \bar{e} & \text{if } j \geq R \end{cases}$$

and,

$$h' = \begin{cases} h+1 & \text{if } l > 0 \\ h & \text{if } l = 0 \end{cases}$$

$q' = \Pi q_J$

$l = 0$ if $R < j < T$

$l \in [0,1]$ if $j \leq R$.

2.3 Firm‘s problem

I have a constant return to scale (CRS) type Cobb-Douglas production function and a representative firm in this economy. K is the aggregate capital and L is aggregate labor supply.

Production function:

$$Y = F(K,L) = AK^{\alpha}L^{1-\alpha} \tag{1}$$

Where A is normalized to 1. $\alpha \in (0,1)$ is capital share of output and will be constant, and $\delta \in (0,1)$ will be the capital depreciation rate for the economy. Firm‘s maximize their profit;

$$max_{K,L}F(K,L) - wL - rK \tag{2}$$

given (w,r).

3 Calibration

This section studies calibration of the model economy to the data from the Turkish economy and selection of the parameter values of the model economy. Simulation of the economy is examined through selecting values of demographic, production and preference parameters, and then parameterizing social security system.

3.1 Demographics

The model economy is calibrated to the Turkish economy data in 2005. Each period is 5 years. And each agent, through periods 1 to T, lives for 13 periods. Agents are born and economically active at age 20. Agents live through ages 20 to 85 and die for sure at age 85 (T=85), $\rho_T = 1$. Each agent is able to work through ages 20 to 60 (R=60 in benchmark economy). Thus, they are economically active at age 20 and can not work after the age 60 (Which will be set to 65 by reform). At age J=45, each agent with 5 periods of experience, 'i', is entitled to retirement benefits. Demographic variables are set for a period of 5 years. Population growth rate n is set equal to the average growth rate in Turkey between 1985 and 2005 (data from the Turkish Statistical Institute, TUIK) which equals 1.8 percent. Mortality rate after age 60 is set so that the fraction of population over 60 to population over 20 equals 14.9 percent ($\rho = 0.233$).[6]

3.2 Productivity

Considering agents of ages between 20 and 60 (and 65, for the reform economy), the market productivity levels should also be determined. Productivity levels will change by age. Mean hourly wages are calculated as in Kaygusuz (2007). Productivity level z_j and its distribution is derived from household's labor force data.[7] Weekly working hours and wages from 1985 to 2005 for each group of agents are derived from the database. Then, hourly wages are evaluated, where

[6]Data from the Turkish Social Insurance Institute (SII) statistics and the Turkish Statistical Institute (TUIK)

[7]The data of household labor force database from the Turkish Statistical Institute (TUIK).

mean hourly wage is 3.2274.[8]

Table 1: Productivity by Age

Age	Productivity
1	0.570
2	0.808
3	1.012
4	1.129
5	1.201
6	1.232
7	1.134
8	0.858
9	0.697

3.3 Production Technology

Recalling our production function:

$$Y = F(K, L) = AK^{\alpha}L^{1-\alpha}$$

Production parameters for the Turkish economy follow study by Imrohoroglu (as a part of Alper, Imrohoroglu and Sayan, 2004). The technology level A is normalized to 1. α, the capital share of output, is set to be 0.35. And the depreciation rate, δ, is set equal to 0.055.[9]

[8]Hourly wage is simply, wages divided by 4 (weekly payments) and then divided by working hours per week. Mean hourly wage will be average hourly wage for those working over 30 hours a week, that is of full-time workers.

[9]See paper by Alper, Imrohoroglu, Sayan (2004) from TUSIAD

3.4 Preferences

Utility function of agents is as follows:

$$U_j(c, 1-l) = log(c) - \sigma_1 \frac{(l)^{1+\sigma_2}}{1+\sigma_2} - \mu(l, j)\Pi^{j-J} q_J$$

Regarding preferences, we have the discount factor parameter β to be set, which is used to evaluate the steady state capital to output ratio to be consistent with the value in data. Capital output ratio is 2.73, which is calculated from the data at the State Planning Organization (DPT). $\frac{l}{\sigma_2}$, Frisch elasticity of labor supply is set to be 0.5, as in its literature estimates by Blundell and MaCurdy (1999) and MaCurdy (1981). Imrohoroglu (2004), on the other hand, use capital -output ratio equal to 2.52 which is indeed quite close to our estimates over data from the Turkish State Planning Organization (DPT). Also, I have σ_1 (the coefficient of relative risk aversion) that will also be calibrated to match hours per week data.

Calibration takes place in accordance with the following target values for the benchmark economy:

Targets	Values
K/Y	2.73 per year
Hours	52.1 per week
average Retirement	55 years

(3)

3.5 Utility cost

Labor force participation of agents between ages J=45 and R=60 depend on the distribution of the level of utility cost agents face, $\phi(q, j)$. Utility cost might be the utility agents would get from rest at home instead of working or sometimes the benefit participants would get from informal employment, as it is in many developing countries that people keep working without any social insurance record. Which is indeed beneficial both to employer and the employee. Agents have their utility costs when the are born, but face this utility cost at the age of J. Utility costs

are idiosyncratic and also change by age, once they occur. Utility cost is from an exponential distribution, where $\bar{q}$ will be calibrated and,

$$f(q) = \frac{1}{\bar{q}} e^{-\frac{q}{\bar{q}}}$$

Then the distribution of the utility cost is as follows:

$$q_j = \Pi^{j-J} q_J$$

given $j > J$.
where Π is calibrated from the model such that together with mean utility cost $\bar{q}$, they match half of agents that continue working after age 45 (period 5), retire by age 55. J=45, here, is the age participants get entitled to retirement benefits and j is age of the agent. Mean utility cost, $\bar{q}$ will also be calibrated.

3.6 The Social security system

The social security system should be in balance at all periods. Income of the social security system is from to the social security taxes θ and payments are in accordance with the replacement rate and past mean earnings, $\bar{e}$. In this model, I use the given replacement rate and decide the social insurance tax that balances social security budget. Benefit functions are given for both the benchmark and the reform economies and I analyze the equilibrium values of social security taxes that adjust to have the budget balanced.

Benchmark economy replacement rate calculation is as follows:

$$b(\bar{e}, h) = \begin{cases} (\psi_1 h)\bar{e} & \text{if } h \leq i_1 \\ (\psi_1 i_1 + \psi_2(h - i_1))\bar{e} & \text{if } i_1 < h \leq i_2 \\ (\psi_1 i_1 + \psi_2(i_2 - i_1) + \psi_3(h - i_2))\bar{e} & \text{if } h > i_2 \end{cases}$$

The Reform economy benefit calculation formula, on the other hand, is as follows:

$$b(\bar{e}, h) = \begin{cases} (\gamma h)\bar{e} & \text{if } h > 0 \end{cases}$$

Where, past mean earnings ($\bar{e}$) and experience (h) of agents change as follows:

$$\bar{e}' = \begin{cases} \frac{\bar{e}h + z_j wl}{h'} & \text{if } j < R \\ \bar{e} & \text{if } j \geq R \end{cases}$$

and,

$$h' = \begin{cases} h + 1 & \text{if } l > 0 \\ h & \text{if } l = 0 \end{cases}$$

Above are calculations of replacement rates for two cases of social insurance system. Regarding the benchmark social insurance system‘s replacement rate, I have ψ_1, ψ_2 and ψ_3 that equals 0.035, 0.02 and 0.015 per years of experience respectively. Which is indeed, on average, 13 percent per each period in first 5 periods. Reform in social insurance system changes the distribution of the marginal retirement benefit. γ is 0.02 for each year of social security payments after the reform. Which is actually, 10 percent per period.

Premium ratio is 40 percent on average in Turkey. However, approximately 17 percent of this payments are done by agents. The exact amount changes by social security institution from 15 to 19 percent. Maximum taxable labor income E_max is 3.802,50 YTL in Turkey, which is six times the wage floor in 2006.[10]

[10]Wage floor in 2006 is 585.00YTL (from TUIK statistics)

3.7 Interest rates

I use the capital-GDP ratio from DPT statistics to decide the interest rate, r. Which is simply derived from first order conditions of the production function with respect to capital and labor.

3.8 Income and consumption taxes

There are two additional taxes paid apart from the social security tax: the income tax, τ, and the consumption tax, τ^c. Income tax is paid over labor income plus interest income while consumption tax is proportional to the consumption at each period. Income tax, τ, equals 6.6 percent on average from statistics of Maliye Bakanligi (2005). Income tax is derived by formula below.

Income tax= (Total income tax paid)/(Total income(Labor income+ Interest income))

Consumption tax, τ^c, on the other hand is 13.6 percent, again from statistics of Maliye Bakanligi in 2005.[11]

[11]Maliye Bakanligi, "Genel Faaliyet Raporu - 2006", www.maliye.gov.tr - June 2007.

Table 2: Parameter values of the model economy

Parameters	Values
α	0.35
δ	0.055
β	0.952
r	0.073
n	0.093
ρ	0.233
τ	0.066
τ^c	0.136
K/Y	0.546
Π	1.15
$\bar{q}$	0.65
σ_1	10
$\frac{1}{\sigma_2}$	0.5

4 Reforms

This section studies the reforms, that is changes by the social insurance reform. I will examine 4 alternative economies where each economy reflects a different change by reform in order to get a better understanding of individual effect of each change. There are three types of variations by the reform that I will study. The study takes place as follows: First, each change is applied independently and then, secondly, three variations are applied together to see the aggregate effect over the economy. Benchmark economy variables are then compared to the reform economy values, and results are driven.

Three types of changes to the social security system are as follows. First of all, calculation of benefit payments is changed. Then, the distribution of marginal benefit of retirement is changed. Following that, minimum age for retirement benefits collection is increased and finally all three changes by the reform to the benchmark economy are considered together.

4.1 Reform-1

I initially focus on the alternative economy where calculation of benefit payments is changed and agents get less benefits payments for the same years of experiences. Where the social security system includes the age of 60 for calculation of retirement benefit payments and marginal benefit of retirement is 2 percent for each years of work.

Replacement rate formula for benchmark economy is as follows.

$$b(\bar{e},h)=\begin{cases}(3.5xh)\bar{e} & \text{if } h\leq 10\\ (3.5x10+2x(h-10))\bar{e} & \text{if } 10<h\leq 25\\ (3.5x10+2x15+1.5x(h-25))\bar{e} & \text{if } h>25\end{cases}$$

Where, $\bar{e}$ is the average past labor income, h is years of experience.

The new social security system, however, has the following benefit formula:

$$b(\bar{e}, h) = \begin{cases} (2xh)\bar{e} & \text{if } h > 0 \end{cases}$$

where $\bar{e}$ is again the average past labor income, 2 is marginal retirement benefit added to replacement rate per years of work.

Findings

This first reform results in participants‘ benefit from the payments for less time by the reform and with less replacement rate. Also social security tax, θ is decreased. Which means size of the social security system will be minimized in aggregate.

Social security taxes in benchmark economy is on average $\theta = 0.1735$. On the other hand, by the first reform, the reform economy social security taxes decrease to $\theta = 0.1520$. Decrease in social security system, decreases tax payments and minimizes the size of social security system.

Variable	Percent Change
Output	12.05
Capital	15.38
Hours	0.1
Retirement	2

(4)

Applying changes in calculation of replacement rate to the social security system has a substantial effect on output of economy. Output increases by 12 percent approximately.
Capital of economy has an even larger response to the reforms. Capital level increases by 15.38

percent. However, the average retirement age in economy and hours in labor do not show substantial changes surprisingly. Hours in work per agent in a week remain the same almost.

4.2 Reform-2

Secondly, I study the alternative economy where the social security tax payment θ and therefore the size of social security system is not changed. I will only focus on change in the distribution of marginal benefit of retirement. That is agents pay the same taxes for more time and do not benefit from the reform while working. On the other hand, the replacement rate is increased by a coefficient, which was 2 percent for each years of social security payments after the reform.

The new social security system has the following benefit formula this time:

$$b(\bar{e}, h) = \begin{cases} (2.33xh)\bar{e} & \text{if } h > 0 \end{cases}$$

where $\bar{e}$ is the average past labor income and 2.33 is the adjusted marginal retirement benefit added to replacement rate per years of work.
This change in benefit formula corresponds to 16.36 percent increase in marginal benefit of retirement. In this way, I investigate just the effect of changing distribution of marginal benefit of retirement.

Findings

Given the table for results of second reform,

Variables	Percent Change
Output	-3.75
Capital	-5.6
Hours	-0.24
Retirement	1.36

(5)

The social security tax payment, θ, is naturally not changed. θ is constant as its value in benchmark economy, $\theta = 0.1735$. To get this result, we need a coefficient for the replacement rate equal to 1.1636, which means marginal utility from retirement should be increased by 16.36 percent per each year of experience.

Output of the economy is decreased surprisingly, in this case. Whereas, hours in labor force and retirement ages are not varied too much. Capital level, in contrast to the preceding reform, is also decreasing slightly. Changing the distribution of marginal benefit of retirement for each year has proven to be negatively effective on economic activity. This is related to increasing benefit of retirement which results in agents saving less and producing less.

4.3 Reform-3

The third alternative economy is the case where only the age increase is applied. Replacement rate formula is the same as its benchmark economy formula.

$$b(\bar{e}, h) = \begin{cases} (3.5xh)\bar{e} & \text{if } h \leq 10 \\ (3.5x10 + 2x(h-10))\bar{e} & \text{if } 10 < h \leq 25 \\ (3.5x10 + 2x15 + 1.5x(h-25))\bar{e} & \text{if } h > 25 \end{cases}$$

Minimum age for retirement benefits collection, on the other hand, is increased from 60 to 65.

Findings

Here is the output of the new reform economy.

Variables	Percent Change
Output	27.7
Capital	42.2
Hours	0.6
Retirement	3

(6)

It is clear from the above table that minimum age requirement for benefit collection change has more impact than the change in marginal benefits. Output increases by 27.7 percent when age requirement for retirement benefits is increased to 65. Capital increase is even greater than output response. Aggregate capital increases by 42.2. Hours of work per week and average retirement ages, however, are slightly changed. Therefore, it is quite easy to assert that even without changing hours in work it is possible to have substantial changes in aggregate economic activity, by prompting more years in labor force. The social security tax payment, θ, is dropped to 14.14. Since agents are working for more time and will get retirement benefits for fewer years at retirement, size of social security and and therefore social security tax payments are decreased.

4.4 Reform-4

The final alternative economy examines the aggregate effect of both replacement rate and age changes. This final reform economy has the following benefit formula.

$$b(\bar{e}, h) = \begin{cases} (2xh)\bar{e} & \text{if } h > 0 \end{cases}$$

where $\bar{e}$ is again the average past labor income, 2 is marginal retirement benefit added to replacement rate per years of work.

And minimum age for retirement benefits collection is increased from 60 to 65.

Findings

This final reform economy has the following outputs.

Variables	Percent Change
Output	32.4
Capital	50.2
Hours	0.3
Retirement	4.5

(7)

The above table shows the case with both reforms (replacement rate and age modifications) in effect. Changing only minimum age for retirement benefits was shown to have considerable effect on economic activity of the economy. Applying both reforms to the model economy is analogous in many respects to the age requirement increase, but of course more influential in some respects.

Output increases by 32 percent and capital stock of economy is increases by 50 percent, with an almost half impact. Hours in work in aggregate seems almost not to change while average retirement age is increased by 4.5 percent. Aggregate economic activity is shown to change with even greater response to both age and replacement rate modifications of the reform.

5 Results

This section analyzes the effects of the reforms over the economy and the outcomes listed in tables in above section. Details of results are demonstrated in tables above. I will take each change to the social insurance system individually and then compare them with each other.

First reform is the one that the formula for benefit payments calculation is changed. Replacement rate for the same years of experience is down, and this decreases social security expenditures. Agents, on the other hand, work for more periods to compensate this decrease in periodical contribution to the replacement ratio. Decreasing marginal benefits for retirement to replacement rate for first 10 years from 3.5 percent to 2 percent, and prompting staying in labor force after even getting entitlement for retirement benefits has positive effect on labor supply, output and capital stock of the economy. Output and capital stocks increase by 12 percent and 15 percent respectively. Hours in work and average retirement ages per agent do not show outstanding changes, however. Social security tax in reform economy with replacement rate changes, θ, is 15.20 percent on average.

Then the marginal benefit of retirement per each years of experience is changed in its distribution. Changing only the distribution of the replacement rate, that is increasing benefit of getting retired in a later period and decreasing contribution of each period in first 8 periods (age of 60), increases tendency to work. Thus, decreases dependency ratio and increases inflows to the social security system. Change in distribution of replacement rate is the only negative effect on the economic activity of economy in question. Both output and capital are down by 3.75 and 5.6 percents respectively. Which briefly means savings are decreased, but labor supply is increased. Decrease in economic activity is because of dominance of savings fall over labor supply increase.

The third change is that the minimum age for collection of retirement benefits is increased to 65. Increase in minimum age for retirement benefits prompts more days in labor force and more social security premium payments. Also agents get retirement benefits for less time. Age increase for retirement benefits collection is shown above to be more influential than replacement

rate change by reform.

Applying both age increase and changing benefit calculation formula modifications reflects aggregate effect of both changes to the economy. The last alternative economy shows substantial changes both in capital stock and output of the economy. This is because increasing minimum age for benefit payment payments is more effective and dominates change in calculation of benefit payments. The model provides a new θ rate in equilibrium, by the new social security system. In a way, the social security reform will encourage more time in labor force and therefore more tax payments to the system. And this will help decrease the social security taxes (θ). Social security taxes in reform economy with both reforms applied (age and benefit formula) decreases to 13 percent.

6 Concluding Remarks

This paper employs an OLG model to study the quantitative implications of the changes by the reform in the Turkish Social Insurance System in 2008. The 2008 reform in the social insurance system affects the replacement rate for the persons entitled to the pension benefits such that it is decreased in aggregate, and the distribution of the marginal retirement benefit is also changed and minimum age to begin collecting the old-age pensions is increased to 65.

This paper shows that after the reform, pensioners work for more time and make more savings before retirement. Benefit of getting retired in a late period is increased by the reform. And people get pensions for less time and get their pensions in an older-age. Although hours in work per agent and average retirement ages are not changed much; prompting more years in labor force is shown to have positive effect on economic activity through increasing labor supply, output level and capital stock of economy.

Regarding all three changes in the social insurance system, the model demonstrates that social security tax, θ, is decreased to 13 percent from its benchmark value 17.35 percent. Benefit payments are also decreased (Replacement rate for 25 years of contribution payment decreased from 65 percent to 50 percent) since the replacement rate is decreased for an average agent. In a way size of the social security system is minimized.

Alternatively, considering just change in the distribution of marginal benefits of retirement, economic activity shows decrease in output and capital stock. Which means the social security tax, θ, is constant at 17.35 just as its value in the benchmark economy value, but marginal benefit of initial years is decreased and of later years is increased. The output and capital stock response to changing distribution of marginal contributions to replacement rate is negative.

In another simulation economy, changing (increasing indeed) minimum age for retirement benefits collection results in outstanding increases in output and capital stock of economy. Hours in labor work do not show substantial changes, however. On the other hand average retirement

age for agents is shown to change slightly.

Although distribution of marginal contributions to the replacement rate shows negative effect on economic activity; aggregate change in replacement rate and increase in age requirement for retirement benefits compensates this decrease and has even outstanding increases in labor supply, capital stock and output of the economy.

This model, therefore, presumes the recent reform in the Turkish social insurance system have positive effects on aggregate economic activity and saving behavior or agents, and thus capital stock in economy through prompting saving more. Since this reform is just launched, it will take time for reform to be effective in all respects. Hence, the reform is considered to be beneficial for the Turkish economy in the long run.

Future studies may include differentiation among the social security institutions for agents from varying areas of work. That is differentiating between SSK, BAĞ-KUR and Emekli Sandığı, three branches of the Turkish social security system. And the effects of the reform over all these social security systems should be examined. Reform in the social security system also aims to include those without any social security record, those previously held the green cards. If so, then, effects of including those funded from public budget should also be of interest for future studies. This paper, finally, have assumptions like everybody has the same minimum age to be entitled to and to get retirement benefits. Where in reality agents face different age requirements depending on the first years of their social security records. Discrimination between agents of differing restrictions for retirement benefits might be useful for the medium-run. As it is stated in the reform bulletin (MLSS reform bulletin, 2008), the reform indeed will take effect in all sides after 2048.

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