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Bagis, Bilal

Istanbul 29 Mayıs University

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Macroeconomic Implications of Changes in Social Security Rules

Bilal Bagis

Economics Department, Istanbul 29 Mayıs University, Istanbul, Turkey. Phone: +90-5327857012

Abstract

The Turkish social insurance system has been feverishly debated for years, particularly through its burden on the economy. The most recent reform is an attempt to neutralize the deterioration within the social security system and its effects on the economy. After the recent reform, 'the way that retirement benefits are calculated' is changed unfavorably for workers and the minimum age for retirement is increased. In particular, for an agent with 25 years of social security tax payments, the 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. The author's findings indicate that labor supply, output and capital stock increase when changes above are applied to the benchmark economy calibrated to the Turkish economy data in 2005. A critical change with the current reform is that the marginal benefit of working has become uniform over ages. In a simulation exercise, the marginal retirement benefit in the benchmark economy is changed to be uniform over ages while keeping the size of social security system unchanged. As a result, the benefit of retiring at a later period increases. However, uniform distribution of the marginal benefits itself decreases both the capital stock and output of the economy. Increasing the retirement age has positive effects on the economy since agents obtain retirement benefits for fewer years and at an older age.

Key words: Social Security Reform, Retirement Age, Replacement Rate, Macroeconomics.

JEL classification: D1, E2, H2, H5, J1, J2

Introduction

The Turkish social insurance system has been an active area of debates for its generosity and the huge deficits in its budget, especially after the 1980s. This is particularly because high public sector deficits have so far been one of the main challenges for the fragile Turkish economy. Although a significant portion of those public deficit stems from deficits on the other components of the public budget, the social security system is another significant source (Sayan and Kiraci, 2001). It should also be stated that the social insurance budget deficits are mainly due to two most common issues in developing economies: early retirement and unofficial employment (Alper, Imrohroglu and Sayan, 2004).

Both the early retirement and the unofficial employment challenges are basically caused by the traditional 'no minimum age requirement' rule and a lower number of payment days of premium to get retired (Akbulak and Akbulak, 2004). This negative outlook is supported by the fact that, as was revealed in the OECD-Economic Outlook statistics, Turkey usually ranks quite high between the OECD countries in accordance with individual tax burden. In the US, for example, the payroll taxes currently stand at 12.4% on wages up to \$113,700 (employer and employee combined). High taxes in Turkey encourage informal economy and discourage the economic activity and employment (Özbek, 2006). Social security taxes account for around 40 percent on average, for instance.

Meanwhile and according to the IMF calculations, despite all the favorable demographic figures, the total amount of social security system deficits amounted to 475 billion TL between 1994 and 2004. This was equivalent to 110% of the total GDP of Turkey or 1.5 times the total debt stock, as of the end of 2004. It therefore deserves a large part to be blamed for Turkey's fiscal challenges. Naturally, there have been several attempts to reform the social security system in the past two decades. Initially, in 1999, the first reform was in effect and it actually temporarily decreased the deficit slightly. Later on, in 2006, the three separate social security institutions would be theoretically united. The reform process would peak through 2008.

In Turkey, transfer payments to the social security institutions from the public budget amounted to 4.5 percent of GDP per year, as of 2005. This is a heavy burden for the fragile Turkish economy; and causes economic instability. Particularly considering almost 85 percent of the population in Turkey has social insurance record (Ministry of Labor and Social Security statistics of 2005), severity of the problem gets clear. Meanwhile, the ILO (International Labor Organization), the IMF and the MLSS statistics (TUSIAD, 2004), show that, Turkey is among the most rapidly aging countries because of its current high young population ratio and relatively downward trended population growth rates (Ministry of Labor and Social Security reform book, 2008). Projections and the related statistics show that along the following 20 years, active labor force population is expected to increase (TUSIAD, 2004). Yet, following that period, the dependency ratio is expected to rise. Assuming no new reforms on the current pension system, the total deficit of the social security institutions is expected to rise to 6% by 2050, and further up to 7% by 2070.

In order to benefit from this demographic opportunity, Imrohroglu (2004) suggests that Turkey should have a fundamental structural reform to deal with the upcoming shift in the demographic profile. Due to the higher economic growths anticipated for the following years, it is suggested that savings and the funds of the social insurance institutions should be increased along this period (TUSIAD, 2004). Sayan and Kiraci (2001), on the other hand, offer control over deterioration in the dependency ratio; via changes in minimum retirement age and another change in the contribution and replacement ratios in order to deal with deficits in the pension system.

Pension systems in most developing economies, including in Turkey, have pay-as-you-go structure (PAYG). Workers basically pay the taxes, set by their governments, while they work; and get whatever pensions the government decides once they get retired. Most European and some other, relatively social, advanced countries are also within this group. In countries such as USA and many other western economies, though, the social insurance systems have a defined-benefit (or defined-contribution) setup. In this case, the workers are the ones that decide how much to pay while they work; and therefore, they are the ones to decide how much they would want to get paid after the retirement. There is also an important

state-pension system vs. the private plans or the occupational-retirement plans distinction to be analyzed. Yet we skip all these distinctions, as all of these classifications are beyond our scope here.

Despite the Eldred's (Eldred, 1981) well-known definition of the social security systems as overcharging some while undercharging some others to have the 'social adequacy' (while having its budget balances in equilibrium); the famously generous Turkish social security system has almost always overcharged the majority of its participants. Meanwhile, the replacement ratio in the Turkish public insurance system is quite high compared to its European and other developed or developing counterparts. Currently, the replacement ratio is 2.6 percent on average for the first 25 years (Articles 506, 5434, 1479 and 5510 of the related institutions). 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 just 68.7 percent (OECD country statistics).

Another huge issue with the Turkish social security system (as opposed to its world counterparts) was the deteriorating dependency rate. 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) also point to the increasing dependency ratio (ratio of retirees to workers, which again gets worse as it goes up) as the sign of potentially serious future financial difficulties in the pension systems.

There are two basic ways to cope with problems related to the social insurance systems. You would either increase the tax collections or a decrease in the retirement benefits (by lowering the replacement rate for instance, for instance). The most recent Turkish reform decreases the retirement benefits by changing the benefits calculation formula. For instance, formerly, there was a 65 percent replacement rate for 25 years of contribution payments, whereas the new act requires a 50 percent pension payment for the same period. Also, the marginal retirement benefit was gradually decreasing by years in the labor force, previously.

Benefits calculation in the benchmark economy was sum of a '3.5' percent per every year of the first ten years, another '2' percent per each year of the following fifteen years and finally '1.5' percent per each year thereafter. The reform economy, on the other hand, requires a uniform contribution to the replacement ratio per each year of work. Marginal retirement benefit becomes uniform over ages. Reform also increases minimum age for retirement benefit collections. Minimum retirement age is increased from 60 to 65.

This paper employs a dynamic setup of Overlapping Generations (OLG) model to examine the macroeconomic effects of the two major changes by the recent, extensive social insurance reform. The author develops 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 to the retirement benefits (corresponding to a minimum 25 years of work), workers face utility costs if their labor supply is still positive. Agents' labor-leisure decisions after this period depend on the utility cost they face; and labor productivity of these agents changes deterministically by age.

The author evaluates four alternative economies in this paper. The main reforms implemented and the results of the paper are as follows. The first reform deals with just the formula change for the benefit payments calculation. Replacement rate for the same years of experience is down, and overall this modification decreases the social security expenditures from the government's perspective. Agents, on the other hand, work for more periods to compensate for this decrease in the periodical contributions to the replacement ratio. Decreasing the marginal benefits for retirement, for the first 10 years from '3.5' percent to '2' percent, and promoting staying in the labor force even after getting entitlements for retirement benefits; has positive effect on the labor supply, output and capital stock of the economy. Output and capital stocks increase by 12 percent and 15 percent respectively. Hours at work and the average retirement ages per agent do not show any significant changes, however. Social security tax, τ , in the reform economy with replacement rate changes is down to '15.2' percent on average.

Then, the marginal benefits of retirement (per each year of experience) are changed, by changing its distribution only. That is, the replacement rate formula is changed, while the size of the social security

system is kept constant. Changing just the distribution of the replacement rate and decreasing the contribution of each of the first 8 periods (corresponds to the age of 60), increases tendency to work. Thus, decreases the dependency ratio and increases payment inflows into the social security system. Changing the distribution of the replacement rate has negative effect on the economic activity of the model economy. Both the output and the capital stock are down by '3.75' and '5.6' percent respectively. This outcome, briefly, means that savings are decreased, but labor supply is increased (by more years at work). Decrease in the economic activity is because of the dominance of savings fall over the labor supply increase.

The third reform is the case where minimum age for collection of the retirement benefits is increased to 65. Increasing the minimum age for the retirement benefits promotes more days in the labor force and encourages more social security premium payments. Meanwhile, agents get retirement benefits for less time, after the retirement. Age increase for the retirement benefits collection, as shown in the reforms section, seems to be more effective than the basic replacement rate change in the previous reforms.

Implementing both the "age rise" and "changing the benefits calculations formula" modifications together, in the last reform economy, reflects the combined aggregate effects of both of the changes to the model economy. The last alternative economy shows substantial changes both in the capital stock and the output of the economy. This is primarily because increasing minimum age for benefit payments is more effective and dominates the moderate effects of change in calculation of benefit payments. The model provides a new rate in equilibrium, as an outcome of the new social security system. In a way, the social security reform encourages more time in the labor force and therefore more tax payments to the system. And this will, in return, help decrease the social security taxes. Social security taxes in reform economy with both the age and benefit formula reforms applied, decreases to around 13 percent.

Literature Review

The macroeconomic effects of a social security reform are not a common area of focus in the literature over social insurance, especially in the developing countries (Glomm, 2006). Ferreira studies social security reforms in the Brazilian economy (Ferreira, 2004 and Ferreira, 2005), and reveals useful information regarding the contributions of the reforms for the 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 the generous public sector pension systems) are an essential step towards the efficacy of social security reform analysis for any other developing country. The researcher benefits from these two lines of research to better capture the macroeconomic implications of the reforms.

In the developed economies, though, the macroeconomics effect of social security reforms is an expanded area of study. 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 the portfolio distribution of the social security funds over the interest rates; and model the relationship between the two. Their findings indicate that as the size of the US Social Security Trust Funds or the portfolio share of bonds or equities in those funds increase, interest rate over that investment is decreased (Elder and Holland, 2002). Yet, the financial market implications and the portfolio flow effects are also beyond the researcher's focus, as this paper just concentrate on the real macro implications in developing economies.

As for modeling, the researcher benefits from a large literature of modeling the structure of the reel economy. Kydland and Prescott's revolutionary 1982 paper, time to build and aggregate fluctuations, is a classic reference to get a better understanding of reel economy effects of a random policy shock, including in OLG model setups. The author benefits from their analysis of the reel economy effects of an external shock. Meanwhile, Auerbach and Kotlikoff's 1987 book "Dynamic Fiscal Policy" is a reference book in studies over fiscal policy analysis, in particular for those in an overlapping generations context. The discussion in this paper also links up very well with the literature by Sayan and Kiraci (2001), Huggett and Ventura (1997) and Kaygusuz (2015) in its modeling of the social security system in Turkey. The author builds his OLG model setup following the literature in that line.

As part of a study for TUSIAD, Imrohorglu (2004) compares the Turkish social insurance system with its other OECD countries counterparts and introduces a general equilibrium model for the Turkish social insurance system (Alper, Imrohorglu, and Sayan, 2004). According to that paper, the current distributive pay-as-you-go (PAYG) setup of the social security system deters savings as well as decreasing the labor supply and employment. It, thus, reduces the real wages and GDP of a country, as it is in Turkey. Alper, Imrohorglu and Sayan (2004), together, present a comprehensive model for the Turkish Social insurance system reform. They, in particular, point to the potential financial distresses and dangers of aging in population of Turkey.

Sayan and Kiraci (2001), on the other hand, study an alternative pension reform with higher retirement age and a few other slight changes in the contribution and replacement rates to the PAYG system in Turkey. They mainly follow the age requirement arrangement in 2000. They focus on the public pension system deficits and propose options to the on-going PAYG system to decrease those deficits. Their model is illustrative in many senses to give an idea about the context of the necessary reforms to the ongoing social insurance system.

Finally, it should also be noted again that, early retirement is, indeed, not just a huge problem in developing countries; developed economies face similar structural issues. For instance, Canada's social security system, with its income security structure, disables working in older ages. And, therefore, early retirement is still an important issue there. Beker, Gruber and Milligan (2003) study the impacts of social security structure on the retirement behavior of participants in Canada. They suggest control over lifetime earnings that they believe has significant incentives for retirement in early ages. Gruber also demonstrates the early retirement incentives of the social security system (Gruber, 1999). Haveman, Holden, Wilson and Wolfe (2003) focus on the 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. This punishment, if you want to call it, is directly related to the early retirement issues in another advanced economy, the U.S. Yet, the Turkish case with decreasing the replacement rates and initiation of more years in the labor force is also, in a way, a similar punishment for early retirement in its nature.

The paper will continue as follows: The next section discusses the model, which includes the household's problem, firms' problem, modeling of the social security system and the definition of equilibrium. Calibration to the Turkish economy data follows in section 3. Then the reforms are applied to the benchmark model; and in section 5 results are revealed and findings are examined. Finally, the conclusion section summarizes the paper, its findings and fulfills the study.

Model and Methodology

This paper deals with the structural problems of a developing economy. In particular, it analyzes the famously deficient (with huge budget deficits) social security system of the fragile Turkish economy. It analyzes the related main issues prior to the 2008 social security reform and impacts of the recently implemented reforms. The paper discusses the pros and cons of a reform applied to deal with the huge public deficits, argued to be mainly due to the social insurance deficits. The author creates a model economy with agents that differ in their asset holdings, ages, past mean earnings, utility costs, and their experience in the labor force. The setup is developed within a partial equilibrium life-cycle model. This model follows a broad literature discussed in Huggett and Ventura (1997).¹

Given particular preferences, a production technology and fixed endowments; the researcher applies a social security reform and then observe the macroeconomic effects (in particular the output, labor supply and the capital stock movements) the reforms result in. The social security reform rearranges the minimum age for retirement benefits and changes calculation of the replacement rate for the retirement benefits. And through that variation, the aggregate effects over the model economy are evaluated by the steady-state comparison of the two cases.

¹ Some other important overlapping generations models to model the social security are Imrohorglu, Imrohorglu, Joines (1995); Rios and Rull (1996), Hubbard and Judd (1987), Cooley and soares (1995, 1996), Conesa and Krueger (1998), Imrohorglu (1998), Rust and Phelan (1997), Storesletten, Telmer, and Yaron (1997)).

The paper has a dynamic model of overlapping generations (OLG) economy. The economy is populated by a continuum of male agents (representing their families) with the total measure of one. Agents live through periods 1 to T where each period corresponds to a five-year interval and the total population equals to one in each period. Every period a new generation (cohort) is born. Each cohort's share in population η_j is calculated by the following formula:

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

Where the indicator function 'I (j)' is follows,

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

Here, "j = 8", is the period corresponding to the age of '60'; when agents begin to face the mortality risk and 'j' is the age of an agent at a specific date.

There is a separate fixed-age 'J' that shows when the agents start to become entitled to retirement and its benefits, but they have to wait until the age of 'R' to get the retirement benefits. Agents retire at the age of 'R' for sure (they are enforced to). Retirees get the retirement payments after the age of 60 (= period 8); and it continues until the final age of 'T', as long as they survive. Agents also face a mortality risk after the age of 60 (ρ_j). Asset holdings, left from people died, are uniformly distributed to the living agents. This is represented as and is called the 'transfer payments' from government, 'TR' in the model.

Every period a new generation is born and the population grows at a rate of 'n'. Also, each period any agent is given 1 unit of labor endowment. Agents devote 'l' proportion of this labor to work and keep the remaining proportion as leisure (1-l), since they get utility from both the consumption and the leisure. Agents also have distinct productivity levels (z) by their ages. The productivity levels determine the labor income agent get and changes by age.

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

Agents get their labor income from the labor supply equal to $z_j l w$. Where 'w' is the real wage. There is also a consumption tax ' τ^c ', and social security tax ' τ^s ', as well as some other income tax ' τ ' over the total income from the labor supply and the assets held (a). Asset holdings will provide an interest payment at the real rate of 'r'.

Utility function of the agents at any period is given below. The utility function that the author uses here is a common labor-leisure decision utility function, consistent with stylized facts. All agents are identical in their preferences and hence have the following 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,

$$\mu(l, j) = \begin{cases} 1 & \text{if } l \geq 0 \text{ and } j \leq J \\ 0 & \text{if otherwise} \end{cases}$$

Each agent has (or chooses) some utility cost as he is born. They draw it at their birth, but have to wait till they start to deserve retirement, to observe it. After age J , agents face this idiosyncratic utility cost (q); and it affect the entire process of the agent's decision regarding their working attitudes looking forward.

The utility cost, drawn at the birth, is derived from an exponential distribution, where \bar{q} is calibrated and, 'q' changes by the age. The exponential function for the utility costs' distribution is as follows:

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

And the utility cost varies over time as,

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

And, again, it is observed for the periods, $t \geq J$.

This utility cost idea briefly means that: Some agents might prefer not to work after they face a high utility cost; and instead wait for their retirement benefit payments, while some others may prefer to keep working until the age of R , all depending on the utility costs they face.

Pension Earnings

Retirees get a benefit payment $b(\bar{e})$ after the age of 'R'; if they have completed their social security payments and are entitled to retirement. \bar{e} in this formula, is the average past mean labor income of an agent or worker. The retirement benefit payment will be a function of this weighted average past mean income, along with another coefficient for the replacement.

The former social security system required the following benefit payments calculation (with 'j' being the age and 'i' the 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 again the average past labor income, 'h' is years of experience; $i_1 = 10$, $i_2 = 25$, and ψ_1 , ψ_2 , ψ_3 , are the marginal retirement benefits corresponding to '3.5', '2' and '1.5' percent each, respectively.

Post the reform, the new social security system, has the following simpler and relatively uniform benefit formula:

$$b(\bar{e}, h) = \left\{ \begin{array}{l} (\gamma h) \bar{e}, \text{ if } h \geq 0 \end{array} \right.$$

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

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

in the labor force and pay more social security taxes. Although not formulated here, it brings forth an age increase as well.

The Households' Problem

Households differ in their ages (j), productivity levels (dependent on the age and the experience), Z_j ; average past mean earnings \bar{e} , an 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 , then they decide whether to work more or have more leisure.

Households at period 1 (the starting age corresponding to the age of 20) have zero asset holding and zero initial wealth. The model have the state variables "a, j, \bar{e} , q, l"; and the control variables "a and l". Then the 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,

$$(1 + \tau^c)c + a' = z_j lw - \mathcal{G}(z_j lw) - \tau(z_j lw + ra) + I(j)b(\bar{e}, h) + TR$$

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

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

And,

$$\begin{aligned} h &= 0, \text{ if } R \leq j \leq T \\ h &\in [0, 1], \text{ if } j \leq R \end{aligned}$$

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

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

And,

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

Where,

$$q' = \pi q_j$$

$$l = 0, \text{ if } R \square j \square T$$

$$l \in [0, 1], \text{ if } j \leq R$$

The Firm`s Problem

The model has a constant return to scale (CRS) Cobb-Douglas form production function and a firm to represent the supply side in this economy. The production function is a standard supply-side assumption in recent publications over an economic analysis of a policy change. The list includes almost all advanced or developing economies, including those over the Turkish economy. It better capture the dynamics of response of output to capital stock and labor supply changes. 'K', in this formula, represents the aggregate capital stock and 'L' is the aggregate labor supply.

The production function, then, is as follows:

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

Where 'A' will be normalized to 1. α is a constant between (0,1), and should be read as the capital share of output. δ is also between (0,1) and will be the capital depreciation rate for the economy. Firms maximize their profit according to the following profit maximization equation:

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

For some given (w, r) couple.

Calibration of the Model Economy

This section presents calibration of the model economy to the data from the Turkish economy and the process for selection of the parameter values for the model economy. Simulation of the economy is examined through selection of the values of the demographic structure, the production function and the preference parameters to match the Turkish economy. It then parameterizes the social security system to better capture the quantitative implications of each of the reforms implemented over the economy. A brief summary of parameter values is provided on table 3.

The Demographics

Considering the reform was applied in early 2008; the model economy has got to represent an earlier period Turkish economy, to better represent the benchmark economy. In that regard, the model economy is calibrated to the Turkish economy data in 2005, as one of the good example of a transition periods. Each period in the model economy corresponds to 5 years. And, each agent lives for a total of 13 periods at most, through periods 1 to T. Agents are born and economically active at the age of 20 (the start-up point).

They are active through ages 20 to 85; and die for sure at the age of 85 (T = 85), where " $\rho_T = 1$ ". Each agent is able to work through the ages 20 to 60 (R = 60 in the benchmark economy). Thus, they are economically active at the age of 20 and cannot work after the age of 60 (strictly enforced). At the age of "J = 45", each agent with 5 periods of experience, 'i', is able to get entitled to the retirement benefits. All of the demographic variables are set for a period of 5 years.

The 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 the age of 60

is set so that the fraction of population over 60 to the population over 20 equals '14.9' percent ($\rho = 0.233$).²

Productivity

Considering all of the agents between 20 and 60 (and 65, for the reform economy), the market productivity levels should also be determined, as they are also needed to model the production side of the economy. Productivity levels change by age (as seen in Table 1). Mean hourly wages are calculated as in Kaygusuz

(2015). Productivity level (Z_j) and its distribution is derived from household's labor force data of the Turkish economy, using the household labor force database from the Turkish Statistical Institute (TUIK).

Weekly working hours and wages from 1985 to 2005, for each group of agents, are derived from the official database. Then, hourly wages are evaluated over that data; where mean hourly wage is 3.2274.3

Table 1: Productivity by Age

<u>Age</u>	<u>Productivity</u>
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

Production Technology

Recalling our production function, again:

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

The production side parameters for the Turkish economy mostly follow the work by Imrohorglu (as part of Alper, Imrohorglu and Sayan, 2004). Here, the technology level, 'A', is normalized to 1, as was mentioned earlier. ' α ', the capital share of output, is set to be '0.35'. And, the depreciation rate, ' δ ', is set equal to 0.055.

Preferences

The utility function, representing the preferences of the agents, is given as follows:

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

Regarding these preferences, the paper has the discount factor parameter ' β ', to be calibrate, which is used to evaluate the steady state capital to output ratio to be consistent with the value in the data. Capital

² This statistics is driven from the data from the Turkish Social Insurance Institute (SII) statistics and the Turkish Statistical Institute (TUIK).

³ Hourly wage is simply, wages divided by 4 (weekly payments) and then divided by working hours per week. Mean hourly wage will be the average hourly wage for those working over 30 hours a week, which is of the full-time workers.

output ratio is 2.73, which is calculated from the data at the State Planning Organization (DPT). σ_2 is the inverse Frisch elasticity of labor supply and is set to be 0.5; as it is in its large literature estimates by Blundell and MaCurdy (1999) and MaCurdy (1981). Imrohorglu (2004), on the other hand, uses a capital/output ratio equal to '2.52'. This is, indeed, quite close to our estimates over the data from the

Turkish State Planning Organization (DPT). Also, the model has a σ_1 (the coefficient of relative risk aversion) that will also be calibrated to match the hours per week data.

The overall calibration of the model economy takes place in accordance with the following target (on Table 2) values for the benchmark economy:

Table 2: Benchmark table for model calibration

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

The Utility cost

Labor force participation of agents between the ages of 'J=45' and 'R=60' depends upon the distribution of the level of some utility cost (q) agents face, depending on $\phi(q, j)$. This utility cost might be the utility agents get from resting at home, instead of working or even sometimes the benefit participants would get from informal employment, as is common in many developing countries where people keep working without any social insurance record. This would, indeed, be beneficial both to the employer and to the employee.

Agents randomly pick their utility costs when they are born, but face this utility cost at the age of 'J' when they need to decide whether to work or not. Utility costs are idiosyncratic and also change by the age, once they occur. Utility cost is from the following exponential distribution function, 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, over time, is as follows:

$$q_t = \pi^{j-J} q_j$$

Again, given that $j > J$.

Here, ' π ' is calibrated from the model economy; such that, together with the mean utility cost \bar{q} , they should match half of agents that continue working after the age of 45 (period 5), and retire by the age of 55. "J = 45", in a way, is the minimum age participants get entitled to the retirement benefits (though they still have to wait till the age of 60 to start collecting it) and 'j' is the age of the agent at any specific period. Mean utility cost \bar{q} will also be calibrated.

The Social Security System

The social security system should be in balance at all periods. Income of the social security system is from the social security taxes ' \mathcal{G} '; and payments to the pensioners are in accordance with the replacement rate

and the past mean earnings, ' \bar{e} '. In this model, the researcher uses the given replacement rate formula and decides the social insurance tax rate that balances the social security budget. Benefit functions are given for both the benchmark and the reform economies and the researcher then analyzes the equilibrium values of the social security taxes that adjust, to have the budget balanced.

The 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 benefits 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:

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

Where,

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

Regarding the benchmark social insurance system's replacement rate, the model have ψ_1 , ψ_2 and ψ_3 that equals '0.035', '0.02' and '0.015' per years of experience, respectively. Reform in the social insurance system changes the distribution of the marginal retirement benefits. Marginal benefits, γ , are '0.02' for each year of social security payments after the reform; which, actually, corresponds to 10 percent per each period, for all periods forward.

The premium ratio is 40 percent on average in Turkey. However, workers make approximately 17 percent of these payments. The exact amount changes by the social security institution, and varies from '15' to '19' percent. The maximum taxable labor income, on the other hand ($E_{\max} \text{Income}$) is 3.802,50 TL in Turkey; which is six times the wage floor in 2006. In the US, on the other hand, the payroll taxes (employer and employee combined) currently stand at 12.4 %, on wages up to \$113,700.

Interest rates

The author uses the capital/GDP ratio from the DPT statistics to decide the interest rate, r; which is simply derived from first order conditions of the production function with respect to the capital stock and the labor supply.

Income and consumption taxes

There are two additional taxes, apart from the social security tax: namely, the income tax, τ , and the consumption tax, τ^c . Income tax is paid over the labor income plus the interest income; while consumption tax is proportional to the total consumption at each period. The income tax (τ) equals '6.6' percent on

average (from the statistics of the Ministry of Finance, 2005). Income tax is derived via the following formula:

$$Income\ Tax = \frac{Total\ Income\ Tax\ Paid}{Total\ Income(Labor\ Income + Interest\ Income)}$$

Consumption tax, τ^c , on the other hand is '13.6' percent, on average, again from statistics of Ministry of Finance in 2005.

Table 3: 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

Reforms

This section studies all of the reforms one by one and their corresponding macroeconomic implications; that is the individual changes and the effects of all of these changes. The author examines '4' alternative economies where each economy reflects a different change by reform. This is to get a clear and better understanding of the individual effects of each of these changes. There are basically two types of variations by the reform: the minimum age increase and then the replacement rate formula reform. First, each of the changes is applied independently and then, all the variations are applied together to see the aggregate collective effect over the model economy. At the final step of each of the reform economy, the benchmark economy variables are compared to the reform economy values, and the results from the two outcomes are interpreted.

The changes applied in four different scenarios to the social security system are as follows. First of all, calculation of the benefit payments is changed. This is done in such a way that; the size of the social security system is also affected. Then, just the distribution of the marginal benefit of retirements is changed. Size of the social security system is kept constant in the second case. The third alternative scenario is the case where only the age increase is applied. And finally, at the fourth scenario, the author examines the combined effect of both replacement rate formula change and the minimum age increase.

Reform 1: Changing the Replacement Rate Formula

The author initially focuses on the alternative economy where only calculation of the benefit payments is changed. Therefore, at its core, the workers or agents of the economy just get fewer benefits payments for the same years of experiences. At this first reform economy, the social security system includes the existing minimum age of '60' for calculation of retirement benefit payments; and the marginal benefit of retirement is changed to '2' percent for each years of work experience.

The Replacement rate formula for the 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 mean labor income, and '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} again the average past mean labor income and '2' is the marginal retirement benefit added to the replacement rate, per each years of experience.

The first reform economy demonstrates a lower replacement rate on average and the participants' benefits from the retirement payments are paid for less time (at the retirement) as the reform encourages staying in the labor force. Meanwhile, the social security tax, \mathcal{G} , is also decreased. This basically means the size of the social security system will go down in aggregate. That, in return, could mean more payments by the central government to cover the deficits of the social security system.

Social security tax in the benchmark economy is on average " $\mathcal{G} = 0.1735$ " or '17.35' percent. On the other hand, following the first reform, the new reform economy's social security taxes decrease to " $\mathcal{G} = 0.1520$ " or '15.20' percent. Decrease in the size of the social security system, decreases total social security tax payments and minimizes the size of social security system. The other costs follow later on.

Table 4: Output table for reform 1

Variable	Percent Change
Output	12.05
Capital	15.38
Hours	0.1
Retirement	2

Applying the first reform to the economy, and changing calculation of the replacement rate of the social security system has substantial effects on the output of the model economy. Output increases by 12 percent approximately, as people are encouraged to save and increase the capital stock more and more. Capital stock of the model economy has an even larger response to the first reform: it increases by '15.38' percent. However, the average retirement age in the economy and hours in the labor force do not show substantial changes surprisingly. Hours of work per agent, in a week, remain almost the same.

Reform 2: Changing the Distribution of the Marginal Benefits

Secondly, the author studies an alternative economy where the social security tax payment ' \mathcal{G} ', and therefore the size of social security system is not changed. The researcher focuses only on the change in the distribution of the marginal benefits of retirement. That is, agents pay the same taxes, but for more time; and of course, do not benefit from the reform while working. On the other hand, the replacement rate is rising by a constant coefficient of '2' percent for each years of social security payments (years of experience) after the reform.

The post-reform social security system has the following all-new benefit formula this time:

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

Where \bar{e} the average past mean labor income and '2.33' is the adjusted marginal retirement benefit added to the replacement rate per years of work. This new change in the benefits formula corresponds to a '16.36' percent increase in the marginal benefit of retirement. It should be noted that, in this new reform, the researcher just investigates the effect of changing only the distribution of the marginal benefits of retirement.

The social security tax payment, \bar{g} , is naturally not changed. \bar{g} is kept constant at its value in the benchmark economy, " $\bar{g} = 0.1735$ ". To get this outcome for the model economy, the model economy needs a coefficient for the replacement rate equal to '1.1636', which basically means the marginal utility from retirement should be increased by '16.36' percent per each year of experience.

The following table (Table 5) illustrates a summary of the results of the second reform economy,

Table 5: Output table for reform 2

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

As is clear from the table, the output of the reform economy is decreased surprisingly, in this case. Hours in the labor force and the retirement ages are not varied too much (indeed, decreased as the workers are negatively affected). The capital stock level, in contrast to the preceding reform, is also decreasing slightly. All in all, changing the distribution of the marginal benefit of retirement for each year (while all other parameters are kept constant) is proven to be adversely affecting the economic activity. This could be explained by decreasing marginal benefits at early years of experience; and increasing benefit of retirement, which in turn results in agents saving less and hence producing less.

Reform 3: Applying the Minimum Age Increase

In most discussions related to the problems of the social security systems, early retirement and the minimum age requirement for retirement are usually two of the key issues brought up. This is in particular true for the Turkish economy. In that regard, the third alternative economy is considered as the case where only the age increase is applied to the model economy. The replacement rate formula and the distribution of the marginal benefits of retirement are both kept the same as in the benchmark economy.

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

The minimum age for retirement benefits collection is increased from '60' to '65'. In a way, people are forced to stay in the labor force for longer periods. Below, the author discusses key macroeconomic outcomes of the reform implemented on the model economy.

Here, on table 6, is a summary of the basic output table of the new reform economy.

Table 6: Output table for reform 3

Variables	Percent Change
Output	27.7
Capital	42.2
Hours	0.6
Retirement	3

As is clear from the table above, increasing the minimum age requirement for benefit collections has more significant impact than just a change in the marginal benefits collection formula. For instance, output increases by a significant '27.7' percent when a basic minimum age requirement for the retirement benefits collections is increased to '65'. Capital stock increase is even greater, compared to the output's response. The aggregate capital stock increases by '42.2' percent. Hours of work per week and the average retirement age, however, are slightly changed. It would not be wrong to come up with a conclusion that even without changing hours at work, it is possible to have substantial improvement in the aggregate economic activity, by just enforcing more years in labor force.

The social security tax payment, \mathcal{Q} , is dropped to '14.14', in this case; since agents are working for more time and get retirement benefits for fewer years at their retirement. The size of the social security system; and therefore, the social security tax payments are decreased as a result.

Reform 4: Implementing Both of the Reforms Together

The final alternative economy examines the collective aggregate effect of both the replacement rate formula change and the minimum age for retirement increase. The author combines all the reforms and tries to get the cumulative effects of all the individual reforms applied simultaneously. Post the reform; the final reform economy has the following benefit formula.

$$b(\bar{e}, h) = \left\{ \begin{array}{l} (2xh)\bar{e}, \text{ if } h \geq 0 \\ \bar{e}, \text{ if } h < 0 \end{array} \right.$$

Here, ' \bar{e} ' is again the average past mean labor income; '2' represents the marginal retirement benefits added to the replacement rate, per years of work experience. And, as in the last reform, the minimum age for retirement benefits collection is increased from '60' to '65'.

This final reform economy has the following output table, table 7, when both of the reforms are implemented together.

Table 7: Output table for reform 4

Variables	Percent Change
Output	32.4
Capital	50.2
Hours	0.3
Retirement	4.5

The table above shows the cumulative outcomes of both of the two key reforms. Changing only the minimum age for retirement benefits entitlement was shown to have considerable positive effect on the economic activity, in the model economy above (in scenario 3). Applying both of the reforms together, to the model economy, is analogous in many respects to the age requirement increase, but of course more influential in again many aspects.

Output increases by '32' percent overall (as opposed to a 28% rise in scenario 3 and a 4% fall in scenario 2) and the capital stock of the economy is increased by a considerable 50 percent, with an almost half

impact. It should be noted that in scenario 3 (with just an age increase), the impact was a significant 42% increase, while that in scenario 2 was a modest 6% fall. Hours spent at work, in aggregate, seem not to be changing at all while the average retirement age is increasing by a mild 4.5%. The aggregate economic activity is shown to change with an even greater response, when both the age and the replacement rate modifications of the reform are implemented together.

The Results

The first reform was the one that the formula for benefit payments calculation was changed. Replacement rate for the same years of experience is down, overall; and this modification, at its core, decreases the social security expenditures. Agents, on the other hand, work for more periods to compensate for this decrease in the periodical contributions. Decreasing the marginal benefits for retirement, to the replacement rate, for the first 10 years (from 3.5 percent to 2 percent), and promoting staying longer in the labor force (even after getting entitlement for retirement benefits) is shown to have positive effects on the labor supply, the output of the economy and the capital stock of the economy. Output and the capital stocks increase by '12' percent and '15' percent respectively. Hours at work and the average retirement age per agent do not show any outstanding changes, however. The social security tax, τ , in the reform economy with the replacement rate changes, is '15.20' percent on average.

Then, the distribution of the marginal benefits of retirement is changed; by changing only the formula for calculation of the benefits per each year of experience, but keeping the size of the social insurance system constant. Changing only the distribution of the replacement rate, that is increasing benefits of getting retired at a later period and decreasing contribution of each period in the first 8 periods (corresponding to the age of up to 60), increases tendency to work. Thus, decreases the dependency ratio and increases inflows into the social security system. Changing the distribution of the replacement rate has negative effect on the economic activity of the model economy in question. Both the output and the capital stocks are down by '3.75' and '5.6' percent respectively. These figures briefly mean that savings are decreased, but the labor supply is increased. Decrease in the economic activity is mainly because of dominance of fall in savings over the increase in labor supply.

The third reform is where the minimum age for collection of the retirement benefits is increased to '65'. An increase in the minimum age for retirement benefits collection, promote more days in the labor force and encourages more social security premium payments. It also makes sure agents or the retirees get the deserved retirement benefits for less time, after the retirement. Age increase for the retirement benefits collection, as demonstrated above, seems to be more effective than the basic replacement rate changes implemented in the previous reforms.

Finally, the researcher discusses applying both the age increase and the benefits calculation formula modifications. Simultaneously apply both of the reforms reflects the combined aggregate effect of both of these changes to the model economy. This last alternative economy outcome demonstrates substantial changes both in the capital stock and the output of the economy. This is because increasing the minimum age for the retirement benefit payments is more effective and dominates the other key change in the calculation of marginal benefit payments calculation. The model, again, provides a new in the equilibrium, since the model leads to a new social security system.

Overall, in a way, the social security reforms are meant to encourage more time in the labor force and therefore more tax payments to the insurance system. And this, in return, helps decrease the social security taxes as well as the systematic deficits. Social security taxes in the reform economy with both reforms applied (age and benefit formula) decreases to around 13 percent on average.

Conclusion

The chapter has employed an overlapping generations (OLG) setup to study the quantitative implications of the two key changes of the most recent reform in the Turkish Social Insurance System. The 2008 reform basically negatively affects the replacement rate for workers entitled to the pension benefits. After the reform, the marginal benefits are decreased in aggregate. Meanwhile, the distribution of the marginal

retirement benefits is also changed and the minimum age to begin collecting the old-age pensions is elevated to '65' years.

This chapter shows that after the reforms, pensioners are expected to work for more periods; and hence make more savings before their retirement age. Benefits of getting retired at a later period are increased by the reforms. Post the reforms; people benefit from the pension system for less time and at a much older-age. Although hours at work per agent and the average retirement age are not changed much, promoting more years at the labor force is proven to have strong positive effects on the economic activity via increasing the labor supply, the output level and the capital stock of the economy.

A critical analysis of the basic modifications to the benefit payments collection formula, demonstrates that; the social security tax, θ , is on average decreased to '15.20' percent; down from its benchmark value of '17.35' percent. Benefit payments are also decreased. For instance, the replacement rate for 25 years of contribution payment is down from 65 percent to 50 percent. The replacement rate is decreased for an average agent and period. In a way, the size of the social security system is decreased along the reforms.

Alternatively, considering just a change in the distribution of the marginal benefits of retirement, the economic activity shows decreases in the output and the capital stock. This, simply means the social security tax, θ , is constant at '17.35' just as its value in the benchmark economy; but the marginal benefit of the initial years is decreased and that of the latter years is increased. The output and the capital stock responses to changing only the distribution of the marginal contributions to the replacement rate are both negative.

It should also be noted that, although the distribution of the marginal contributions to the replacement rate shows negative effects on the economic activity; the aggregate change in the replacement rate and the basic increase in the minimum age requirement for the retirement benefits, together, compensate for this decrease and has an even outstanding positive increases in the labor supply, the capital stock and the overall output of the economy.

This model, therefore, demonstrates that the 2008 reform in the Turkish social insurance system have had considerable positive effects on the aggregate economic activity and the saving behavior of the households, and thus the longer-term higher capital stock in the economy by promoting saving more. Since the reform discussed here has just recently been launched, it will for sure take time for reform to be fully effective in all aspects. Hence, the reforms are considered to be beneficial for the Turkish economy especially in the long run.

Future studies on the security reforms and extensions of this paper may include differentiation among different social security institutions (in particular for the case of Turkey) for agents from varying areas of work. That is, basically differentiating between SSK, BAG-KUR and Emekli Sandigi; the three branches of the Turkish public social security system. And the effects of the reforms over all these social security systems should be examined separately. The new reform in the social security system also aims to cover those still without any social security record; including those that previously held the green cards (the-free-riders). Considering that, then, the effects of including those already funded from the public budget, should also be of interest for future studies.

Meanwhile, this paper, also have few other basic simplifying assumptions like everybody having the same minimum age to be entitled to and to get the retirement benefits. Whereas, in reality, agents may actually face different age requirements depending on, for instance, the first year of their social security records. Differentiating between agents of differing restrictions for retirement benefits might also be useful for the medium-run outcomes. As is stated in the reform bulletin (MLSS reform bulletin, 2008), the reform will indeed fully take effect, in all aspects, after 2048.

As was mentioned in the introduction section, the financial market implications of changes in the social security systems; such as the fund flows and the long-run implications on the interest rate and liquidity in the market was not the researcher's priority concern here. The author skipped the financial market implications or the portfolio flow effects (that are frequently examined in advanced economy cases) and just

concentrated on the real macro implications for developing economies cases. This was done, in an effort, to limit the focus on the real macro effects of reforms in developing economies in this chapter. Future studies could and in fact even should be concerned with the financial market implications as well.

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