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THE EFFECTS OF LATEST PARAMETRIC REFORM ON FINANCIAL SUSTAINABILITY AND ACTUARIAL FAIRNESS FOR PAY-AS-YOU-GO PENSION SYSTEM IN TURKEY AND SOME ALTERNATIVE REFORM OPTIONS

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ABSTRACT

Especially for the last 25 years, regulations that do not take into account actuarial balances, globalization phenomenon and changes in the population structure has brought great burden on the pension systems all over the world. Moreover, factors such as governments' desire to decrease contribution rates to provide international competition due to increasing labor costs, high level of informal employment, generous pension systems, increase in life expectancy, low level of fertility rates and aging has begun to threat the sustainability of the pension systems. As in the light of such events, countries have had to develop new measures/methods in order to maintain sustainability of the pension systems. The unsustainability of these systems will result in not fullfilling their future liabilities. This means that future generations can not obtain their pensions although they contribute to the system. Aiming to prevent this condition, implementing necessary arrangements has been great importance to cope with those threats.

In Turkey, parametric reforms such as increasing retirement age, reducing the accrual rate to a more reasonable level so providing incentives to work for a longer period and decreasing valorization of past wages are crucial. Consequently, it is possible to maintain the sustainability of the system through the creation of less generous system. Furthermore, strenghtening the link between the contributions paid and pensions obtained will enable people to remain in the sytem longer by maintaining the transition to a fairer system.

The aim of this term project is to examine the effects of parameters such as retirement age, valorization of past wages, accrual rate and indexation of pensions amended with the Act No. 5510 Social Insurance and Universal Health Insurance Law in Turkey on the deficit of the system and actuarial coverage ratio. According to the results, alternative proposals such as decreasing accrual rates based on ages and gender will be introduced for those amendments to maintain sustainability and ensure actuarial fairness. The effects of these alternatives will be discussed comparatively in the light of the results of the calculations made.

Keywords: Financial Sustainability, Actuarial Fairness, Actuarial Coverage Ratio, Parametric Reforms, Accrual Rates, Valorization, Retirement Age

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ABBREVIATIONS

OECD: Organization For Economic Cooperation and Development

GDP: Gross Domestic Product

SSI: Social Security Institution

ACR: Actuarial Coverage Ratio

UK: United Kingdom

US: United States

ILO: International Labor Organization

WB: World Bank

PAYG: Pay-as-you-go

DC: Defined Contribution

DB: Defined Benefit

NDC: Notional Defined Contribution

UN: United Nations

EU: European Union

SSK: Sosyal Sigortalar Kurumu

ES: Emekli Sandığı

BK: Bağ-Kur

TUIK: TurkStat

CPI: Consumer Price Index

PROST: Pension Reform Option Simulation Tool-kit

CSO: Commissioners Standard Ordinary

TCR: Total Contribution Revenues

TPL: Total Old-age Pension Liabilities

TDL: Total Disability Pension Liabilities

TSL: Total Survival Pension Liabilities

1. INTRODUCTION

The most important country pioneering in the development of today's pension systems was Germany where Bismarck Model was developed in 1889. Great Britain where Danish or later Beveridge Model was implemented in 1891 followed Germany and then came the Continental Europe, North and South America and Asian countries. The common characteristic in these systems adopted by the developing and developed countries today is the dominance of social insurance approach. After the second half of the 1970s pension systems in many developed countries were faced with serious financial crises as a result of changing social requirements and they entered a new phase where radical reforms were performed.

Demographic changes pose major challenges to many Organization For Economic Cooperation and Development (OECD) countries, particularly those in Europe. These developments have major implications for public policy, particularly for pension systems. OECD projections (taking account of pension reforms that are still being phased in) show that old-age pension spending could rise on average by 3 to 4 per cent of Gross Domestic Product (GDP) in the period up to 2050, compared with a base of around 7.5 per cent of GDP in 2000 (Whiteford and Whitehouse, 2006). In order to meet these challenges, many OECD countries have already undertaken a wide range of pension reforms, including changes in benefit formulas, changing the indexation of pensions in payment, linking pensions to higher life expectancy, as well as reforms designed to increase incentives for later retirement.

In Turkey, debate on pension system has been very hot as it was in other countries. Moreover, it has been stated by the most of the public that the system could not have been sustainable as long as it had gone on existing situation and it has to be restructured. In fact, as a consequence of common problems arose in all over the world and problems that are special to Turkey, Turkey felt the need to carry out a reform on the pension system in 1999. Due to the deficiencies of that reform on sustainability, new social security reform was performed by Social Security Institution (SSI). Reform activity announced by the 58th government has been continued by considering the proposals, critics and contributions of the public and social partners. As a result of these

activities, Social Insurance and Universal Health Insurance Law has been enacted on 1 October 2008.

The rest of the project is organised as follows: In the second section, structure of pension systems, their problems and reform implementations in the world have been briefly summarized. In the third section, some figures about the financial structure of Turkish pension system, the problems of the system and major parameters amended by the latest reform have been presented. Forth section has explored the effects of new regulations implemented with the new reform; especially retirement age, accrual rate and valorization on the deficits and actuarial coverage ratio (ACR); some alternative reform proposals such as calculating accrual rates on the basis of actuarial fairness according to age and gender have been explained and the effects of these have been focused on. The last section has drawn conclusion based on the results obtained in the previous sections.

2. HISTORICAL BACKGROUND AND STRUCTURE OF PENSION SYSTEMS, THEIR PROBLEMS AND REFORM IMPLEMENTATIONS IN THE WORLD

European scholars have identified two types of pension systems in Europe (Bonoli, 2000). First, Bismarckian social insurance systems provided workers a pension that reflected a proportion of their income while working and put pressure on other European states to respond to increased worker demands and state imperatives for greater old-age security. Second, the Danish (1891) or later Beveridgean model which emphasized poverty relief and the maintenance of basic minimum living standards was essentially an extension of the poor laws.

Bismarckian social policies are based on social insurance and the objective of income maintanence; provide earnings-related benefits for employees; entitlement is conditional upon a satisfactory contribution record; and financing is mainly based on employer/employee contributions. In contrast, Beveridgean social policy is characterized by universal provision and has the aim of poverty prevention; entitlement is based on residence and need (or only residence); benefits are typically flat rate and are financed through general taxation (Bonoli, 1997).

As noted by Werding (2003), public pension schemes that follow a primarily Bismarckian tradition can be found in Austria, Belgium, Germany, Greece, Italy, Luxembourg, Portugal and Spain. Public pensions that are built on the Beveridgean tradition exist in Ireland, the Netherlands, New Zealand and the United Kingdom (UK). Public pensions that combine the elements of both types are operated in Denmark, Finland, France, Sweden, Switzerland and the United States (US).

2.1. General Outlook To Pension Systems

In this section, the diffusion process, goals and types of pension systems in the world will be investigated. Consequently, general framework about the pension systems will have been introduced.

2.1.1. Global Spread of Pension System Adoption

Global spread of pension system adoption can be divided into two phases.

2.1.1.1. The First Phase (1889-1994)

In the first phase state wealth, size, industrialization and geographic location are the four factors that determine the diffusion process of pension systems all over the

world (Orenstein, 2003). Pension systems were adopted across Western and Central Europe before the First World War, with Eastern European and some Latin American states, plus South Africa, adopting in the interwar period. But the major explosion of pension systems around the world occurred in the wake of the Second World War and under the influence of the international principles announced by the International Labor Organization (ILO) in its Declaration of Philadelphia in 1944. Those principles included the creation of unified, national pension insurance systems under a central social security administration, to provide a specified set of benefits, including disability and old-age pensions (ILO, 1944). ILO, in conjunction with major countries including the US, vigorously promoted these aims in regional conferences.

2.1.1.2. The Second Phase (1981-2001)

Whereas the first episode of reform covers the establishment of first pension systems in the context of broader social system development, the second phase involves reforming pension systems created in the first wave. The second phase started with Chile's movement to privatize its pension system in 1981, and its primary effects were seen in Latin America and European countries. The leading international organization involved in formulating and spreading the reform was The World Bank (WB) which has been dominant in the spread of multipillar reform, reflecting shifts in global discourse on social and economic policy.

2.1.2. Objectives of Pension Systems

Pension systems have multiple objectives which are insurance, consumption smoothing, poverty relief and redistribution (Barr and Diamond, 2006). A central purpose of retirement pensions is consumption smoothing—a process which enables people to transfer consumption from their productive middle years to her/his retired years. The other objective is insurance. Since people face a range of uncertainties, including how long they are going to live, they have to protect themselves from those uncertainties. Thus a pension based on individual saving faces the person with the risk of outliving those savings, or of consuming very little to prevent that happening. Poverty relief targets resources on people who are poor on a lifetime basis, and thus unable to save enough. Pension systems can redistribute incomes on a lifetime basis, complementing the role of progressive taxes on annual income. Lifetime redistribution can be achieved by paying pensions to low earners that are a higher percentage of their

previous earnings thus subsidising the consumption smoothing of lower earners. Pension systems can also redistribute across generations, for example if a government reduces the contribution rate of the present generation, thereby requiring future generations to pay higher contributions or have lower pensions.

Alongside these primary objectives, pension policy may have secondary goals, including economic development broadly and economic growth specifically. Badly designed pensions may create adverse labor-market incentives. Excessive public pension spending contributes to high tax rates, putting growth at risk. Conversely, pension arrangements can assist the operation of labor and capital markets and may encourage saving (Barr and Diamond, 2006).

2.1.3. Types of Pension Systems

Pension systems can be arranged in different ways regarding to the relation between contributions and benefits and the financing method.

According to financing method pension systems are divided into two groups. In a fully funded scheme, pensions are paid out of a fund built over a period of years from its members' contributions. With pay-as-you-go (PAYG) schemes, in contrast, pensions are paid out of current income. In principle fully funded schemes always have sufficient reserves to pay all outstanding financial liabilities (Barr and Diamond, 2006).

There are four approaches when determining how closely pension benefits are related to a worker's previous contributions. In a defined contribution (DC) scheme, also called funded individual accounts, each member pays into an account a fixed fraction of his or her earnings. These contributions are used to purchase assets, which are accumulated in the account, as are the returns earned by those assets. When the pension starts, the assets in the account finance post-retirement consumption through an annuity or in some other way (Whitehouse, 2007). In a defined benefit (DB) scheme, a worker's pension is based not on his accumulation, but on his wage history, possibly including length of service. A key design feature is the way wages enter the benefit formula. In DB schemes, the amount a pensioner receives depends on the number of years of contributions and on some measure of individual earnings throughout the working life (Barr and Diamond, 2006). A recent innovation internationally, pure notional defined contribution (NDC) systems are conceptually similar to pure DC

pensions in the way one aspect of risk is shared, with all adjustment taking place on the benefits side, but different, in that they are not fully funded and may be entirely PAYG. In a point system, workers earn pension points based on their individual earnings for each year of contribution. At retirement, the sum of pension points is multiplied by a pension-point value to convert them into a regular pension payment. Table 1 summarizes the structure of pension systems in OECD countries.

Table 1: Structure of Pension Systems

Function	Mandatory Insurance		Function	Mandatory Insurance	
Provision	Public	Private	Provision	Public	Private
High-Income OECD Countries			**Eastern Europe and Central Asia**		
Australia		DC	*Bulgaria*	DB	DC
Austria	DB		*Croatia*	Point System	DC
Belgium			*Czech Republic*	DB	
Canada	DB		*Estonia*	Point System	DC
Denmark	DB+DC		*Hungary*	DB	DC
Finland	DB		*Latvia*	NDC	DC
France	DB+Point System		*Lithuania*	DB	DC
Germany	Point System		*Poland*	NDC	DC
Greece	DB		*Slovak Republic*	Point System	
Iceland		DB	*Turkey*	DB	
Ireland			**Latin America and Caribbean**		
İtaly	NDC		*Argentina*		DC
Japan	DB		*Chile*		DC
Korea	DB		*Colombia*		DC
Luxemburg	DB		*Costa Rica*	DB	DC
Netherlands		DB	*Mexico*		DC
New Zeland			*Peru*		DC
Norway	Point System		*Uruguay*	DB	DC
Portugal	DB		**Middle East and North Africa**		
Spain	DB		*Algeria*	DB	
Sweden	NDC	DB+DC	*İran*	DB	
Switzerland	DB	DC	*Jordan*	DB	
UK	DB		*Morocco*	DB	
US	DB		*Tunisia*	DB	

Note: The Slovak Republic has also introduced mandatory DC pensions (from January 2005)
Source: Whitehouse, 2007

2.2. Why Do Countries Reform Their Pension Systems

For the last 30 years, the threat on the sustainability of countries' pension systems has caused big concerns in all over the world. After the Second World War, pension systems had surpluses due to baby boom generations, increasing young cohorts entering labor markets and low level of pensioners. However, in 1980s, the systems started to run deficits together with low level of fertility rates and the maturity of the systems. Based on that threat, some European countries following most Latin America countries, especially Chile, have lauched some regulations to reform their pension systems since 1980s.

In this section, the reasons for reforming pension systems have been analysed. These are aging, increasing pension expenditures as a share of GDP, the generosity of pension systems, socioeconomic changes and other factors such as economic integrations and the need to maintain growth and increase savings in the countries.

2.2.1. Aging

Aging is the most important factor that threats the sustainability of the pension systems. Over the coming decades, world's demographic makeup will change dramatically. Populations are becoming older than ever before because of three major trends. First, as the baby-boom generation approaches retirement age, the share of older people will rise rapidly; second, birth rates have remained low for several decades; and third, we are all simply living longer and healthier lives.

According to United Nations (UN) Population Database, high level of fertility rates continued to follow a stable path upto the end of 1960s after Second World War, while it has started to fall since 1970s. The highest level of fertility rates belonged to Africa, whereas the lowest figures were seen in North America and Europe. The average fertility rates in the world were 5% in 1950, but it declined to 2.6% in 2000s. This decrease in fertility rates gave rise to a drop in labor force and therefore caused a fall in share of the young population as a percentage of total polulation. Moreover, this slowed down the speed of the increase in contribution revenues.

Table 2: Fertility Rate Projections, 2005–2050

	2005–2010	2015–2020	2025–2030	2035–2040	2045–2050
World	**2.55%**	**2.37%**	**2.21%**	**2.10%**	**2.02%**
Europe	1.45%	1.52%	1.61%	1.69%	1.76%
Asia	2.34%	2.16%	2.01%	1.93%	1.90%
Africa	4.67%	3.95%	3.30%	2.81%	2.46%
Latin America	2.37%	2.12%	1.97%	1.89%	1.86%
North America	2.00%	1.91%	1.83%	1.84%	1.85%
Oceania	2.30%	2.18%	2.08%	1.99%	1.93%
UK	1.82%	1.85%	1.85%	1.85%	1.85%
US	2.05%	1.94%	1.85%	1.85%	1.85%
France	1.89%	1.85%	1.85%	1.85%	1.85%
China	1.73%	1.83%	1.85%	1.85%	1.85%
Russia	1.34%	1.41%	1.51%	1.61%	1.71%
Germany	1.36%	1.44%	1.54%	1.64%	1.74%
Japan	1.27%	1.30%	1.40%	1.50%	1.60%
India	2.81%	2.32%	1.97%	1.85%	1.85%
Turkey	2.14%	1.98%	1.86%	1.85%	1.85%

Source: UN, 2006

While average fertility rate in the world was 2.6% in 2005, UN projections show that it will drop to 2% in 2050 due to improvements in family planning (Table 2). This

fall will increase the burden on the pension systems since less people can enter the labor force.

Another contributing factor to the aging of the population is increase in life expectancies. According to UN figures, life expectancy at birth experienced a significant increasing trend. Life expectancy at birth having 50 in 1950s will be 67 in 2010 and it is expected to reach to 75 in 2050. Simulations show that life expectancy will increase 1 point in every 5 year on average. It is forecasted that life expectancy in Turkey in 2050 will rise to 79 with an increase of 8 years compared to 2005 and it will be more than world average which will be 75 (Figure 1).

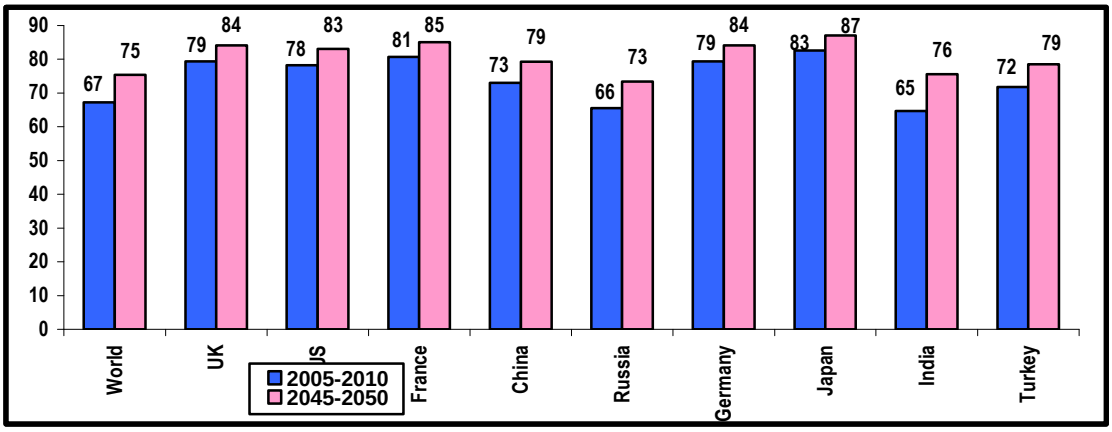

Figure 1: Comparison of Life Expectancy at Birth, 2005–2050
Source: UN, 2006

With the decline in fertility rates and increase in life expectancy, it is expected that old-age dependency ratio, number of people over 65 divided by the number of people aged 15-64, will increase drastically. Especially in Europe, this ratio will double in 2050 compared to 2005. The most dramatic change will take place in Japan where old-age dependency ratio will reach around 74% in 2050 although it was 30% in 2005 (Table 3).

According to UN population projections, the share of 65+ populations in total population will double and reach 16%, whereas young population (aged 0-14) as a percentage of total population will decline from 28% in 2005 to 20% in 2050. Certainly, the aging process will affect all countries but it will do so to varying degrees. For example, in Turkey, in 2050 the share of 65+ populations in total population will triple and reach 19% compared to 2005.

Table 3: Old-Age Dependency Ratio

	2005	2020	2030	2040	2050
World	**11.39%**	**14.32%**	**17.99%**	**22.06%**	**25.40%**
Europe	23.30%	28.66%	35.87%	42.14%	47.68%
Asia	9.69%	13.18%	17.40%	22.92%	27.16%
Africa	6.14%	6.67%	7.48%	8.53%	10.65%
Latin America	9.82%	13.44%	18.02%	23.29%	29.17%
North America	18.38%	24.80%	31.74%	33.79%	34.96%
Oceania	15.83%	21.25%	26.29%	29.56%	31.19%
UK	24.37%	29.56%	35.14%	39.53%	40.28%
US	18.31%	24.48%	31.09%	32.99%	34.07%
France	25.00%	32.19%	38.33%	43.18%	44.64%
China	10.82%	17.10%	24.38%	35.73%	38.81%
Russia	19.38%	21.45%	28.22%	30.78%	38.92%
Germany	28.10%	34.56%	45.84%	53.55%	53.73%
Japan	29.75%	47.33%	52.33%	64.69%	73.82%
India	8.02%	10.09%	12.94%	16.42%	21.48%
Turkey	8.48%	10.98%	15.72%	21.78%	28.72%

Source: UN, 2006

2.2.2 Pension Expenditures As a Share of GDP

Another reason that accelerates the reform process is the rapid increase in the pension expenditures as a percentage of GDP. OECD Social Expenditures Database shows that average public spending on old-age and survivors benefits in the OECD countries increased from 6.7% of GDP in 1990 to 7.7% in 2003. There were falls in only seven countries, notably in Finland, Luxembourg and New Zealand. There were very large increases in Italy, Japan, Poland, Portugal and the Slovak Republic of between 3.5% and 7.5% of GDP. In Turkey, pension expenditures rose from 3.2% in 1990 to 5.4% in 2003 (OECD, 2007).

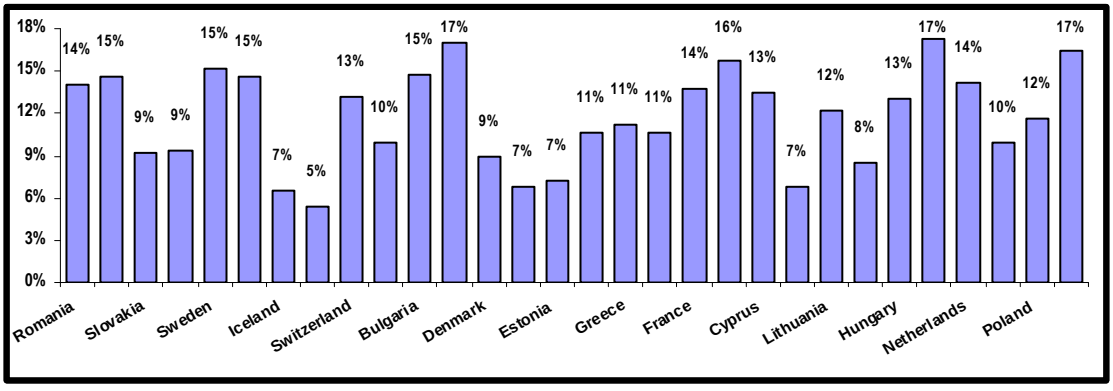

Figure 2: Pension Spending in European Union (EU) Countries, 2005
Source: EUROSTAT

Figure 2 shows total pension spending as a share of GDP in EU countries. The highest figures are 17.2%, 17% and 16.5% belonging to Sweden, Italy and Switzerland respectively whereas EU27 average is 14.1%. In the future, increase in these figures with the aging impact has been regarded as a big concern for the EU countries.

2.2.3 Generosity of Pension Systems

Another driving factor that threats the sustainability of pension systems is the generosity of the pension systems. Genorosity means that parameters of the systems such as valorization of past wages, accrual rates, averaging periods of wages, retirement age, contribution period, indexation of pensions generate results in favor of insurers and pensioners.

Gross replacement rate is the the ratio between gross pension benefit and gross pre-retirement earnings. Figure 3 shows the OECD's synthetic indicator for the gross replacement rate applying in the EU and the US over the period 1960-1995. What the graph is simply saying is that the generosity of the EU and US public pension systems have both improved over the last number of decades, with US pensioners gaining relatively more as shown by a narrowing of the generosity gap with the EU public pension system from nearly 14% points in 1960 to 6% points in the mid 1990's.

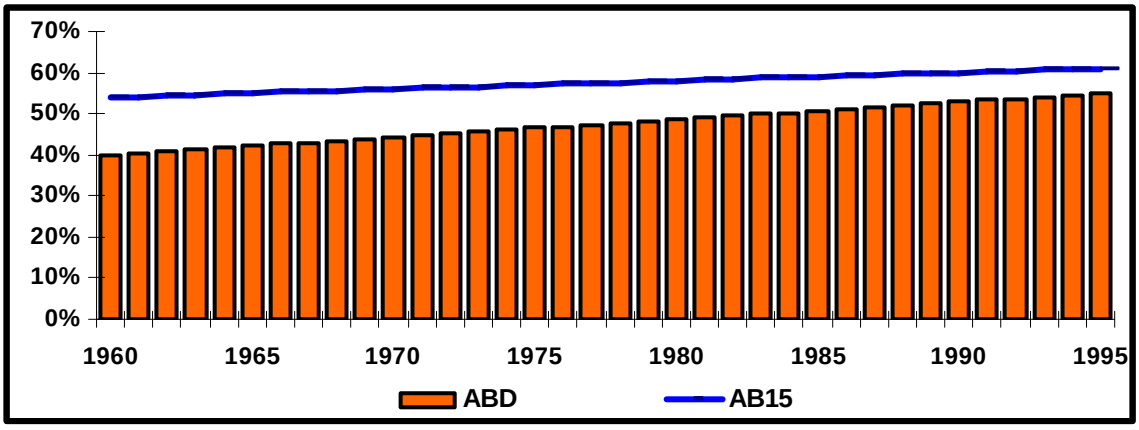

Figure 3: Gross Replacement Rate for EU15 and US, 1960–1995
Source: Mc Morrow ve Roeger, 2002

According to Latulippe (1996), in 1990 the average effective retirement age for males in OECD countries was 62.2 years, down from 68.5 years in 1950. In 2000, only the UK (63) and the US (63) have an effective retirement age above the OECD average. In France and Italy, the effective retirement age is 58; while in Germany and Spain, it is respectively 61 and 62 years.

Pension reforms since the 1990s had a strong impact on replacement rates for workers on average earnings. Table 4 shows gross replacement rates before and after the reforms for men and for women where they are different. Replacement rates for workers on average earnings are being cut by reforms in all countries except in Hungary where

they increase sharply by almost 20 percentage points. The Hungarian result, however, is strongly influenced by the tax system since Hungarian pensions used to be calculated on the basis of earnings net of income taxes. In the UK, replacement rates are the same before and after reform. The same is true for New Zealand, where the reform merely increased the pension age from 60 to 65. This change does not show up in the replacement rate since the benefit is flat rate. The largest reduction is in Mexico where replacement rates were cut by more than half for men and women. However, it should be noted that the post-reform system applies to workers who entered the labour force after 1997.

Table 4: Pre- and Post-Reform Gross Replacement Rates for Workers on Average Earnings in Selected OECD Countries

	Men		Women (Where different)	
	Before Reform	**After Reform**	**Before Reform**	**After Reform**
Austria	90.0%	80.1%	80.0%	80.1%
Finland	66.3%	63.4%		
France	64.7%	51.2%		
Germany	48.7%	39.9%		
Hungary	57.7%	76.9%	52.7%	76.9%
Italy	90.0%	67.9%	80.0%	52.8%
Japan	40.7%	34.4%		
Korea	69.3%	66.8%		
Mexico	72.5%	35.8%	72.5%	29.7%
New Zeland	39.7%	39.7%		
Poland	62.2%	61.2%	57.3%	44.5%
Portugal	90.1%	54.1%		
Slovakia	59.5%	56.7%		
Sweden	78.9%	62.1%		
Turkey*	107.6%	72.5%	102.8%	72.5%
UK	30.8%	30.8%		

* After reform data for Turkey is based on the assumption of valorization and accrual rates before Constitution Court rejected the law in 2006.
Source: OECD Pension Models

2.2.4. Socioeconomic Changes

Another factor that urges countries to reform their pension systems are socioeconomic changes. Three changes stand out as increasing female labor force participation and changing family structures, the rise in atypical employment, and the need for lifelong learning (Holzmann, 2003). In the EU countries, the labor force participation of women has increased substantially in recent decade. So far this change in female labor force participation is little reflected in the pension benefit structure. The benefit rules largely reflect the traditional image of a working husband and a childcaring housewife who needs a widow's pension for her protection in old age.

A more recent development is the rise in atypical employment, that is, the reduction in full-time salaried employment and the increase in part-time employment.

This development may be ascribed to globalization and competitive pressure that make full-time employment rarer, or it may be linked to more self-selected flexibility in the labor market. Whatever the reason, these atypically employed people do not fare well under many current pension schemes, which are based on the full-time employment fiction. Again, reform is needed.

Finally, many pension schemes still assume the strict life-stages separation of education, work, and retirement leisure. But a modern economy and the need for lifelong learning require a pension scheme that encourages rather than impedes the mixing of those three activities.

2.2.5. Other Factors

The fifth major impetus for pension reform approach resides in European economic integration and the objective of common markets for goods, services, and factors of production under a common currency (Holzmann, 2003). This objective has implications for the provision of retirement income: budgetary implications, the need for more labor market flexibility, and the need for enhanced labor supply in an aging population. The concept of a stable common currency in Europe is linked with the Maastricht fiscal criteria to keep the fiscal deficit below 3 percent and public debt below 60 percent of GDP. Unless most EU countries restructure their pension systems, it will be impossible to achieve this goal.

2.3. Types of Pension Reforms

Factors pointed out in the previous subsection urged many countries to implement new regulations on their pension systems. The structure and nature of pension reforms vary across countries. While some countries change only specific parameters of their systems without making radical changes, other countries undergo a change in the structure of their systems. The pension reforms made for the last 30 years can be grouped into two different categories: Parametric and structural reforms.

2.3.1. Parametric Reforms

A parametric reform is an attempt to rationalize the pension system by seeking more revenues and reducing expenditures in order to maintanin financial sustainability without changing the basic structure of the system. Pension systems rely on three subgroups of parameters: contribution and benefit parameters, and eligibility conditions

for receiving pensions (Schwarz, 2006). Many parametric reforms involve changes in all three subgroups. Each of these parameters has a distributive impact within the group of contributors and beneficiaries, as do the reforms. These reforms also affect the fiscal sustainability of the pension systems and the fiscal sustainability affects the redistribution from outside the pension system to the contributors and beneficiaries of the pension system.

2.3.1.1. Contribution Parameters

The only parameter that is related with contribution is contribution rate.

2.3.1.1.1. Contribution Rates

Raising contribution rates clearly lowers the take-home salaries of workers but increases contribution revenues of the pension systems. Rising labor costs may reduce or cause stagnation in the level of employment in the formal sector. These have a negative impact on workers, but may be necessary to maintain fiscal balance.

According to OECD figures, evolution of contribution rates for pensions over the period 1994-2004 remained basically unchanged over the decade at around 20% (OECD, 2007). There were relatively large increases in Canada, Italy, Japan and Korea and smaller increases in the Czech Republic and France. There were falls in five countries, including Hungary, Japan, Slovak Republic, Sweden and Netherlands. There are a number of potential explanations for this counter-intuitive finding. First, governments may have responded to rising pension costs by financing them from general revenues rather than earmarked contributions. Finally, contribution rates may have remained constant while revenues were increased by broadening the contribution base.

2.3.1.2. Benefit Parameters

Benefit parameters can be classified as accrual rate, averaging period of wages, valorization of past wages and indexation of pensions.

2.3.1.2.1. Accrual Rate

Accrual rate is one of the most important parameters while determining pension level and is expressed as a percentage of the earnings that are covered by the pension scheme. In some countries the accrual rate increases for people with a longer contribution history in order to promote them to remain in the labour force for a longer

time. For example in Finland, from 2005 the accrual rate is 1.5% of pensionable earnings at ages 18-52, 1.9% at ages 53-62 and 4.5% at ages 63-67 (Social Security Administration, 2006). In Germany, this rate is 1% per year. However, if a person wants to retire before the age of 65, his/her pension entitlement will be reduced by 3.6 % for each year of early retirement and deferring the pension after 65 earns a 6% increment for each year of additional work (European Commission, 2007). In Hungary, while for those covered by the mixed system the accrual rate is 1.22% of earnings for each year of service, for those covered by the PAYG system alone have an accrual rate of 1.65% (OECD, 2007). In Spain, after 15 years of contribution the worker gets only 50 percent of wage, accrual rate increases by 3% points for each additional year of contribution until 25 and by 2% points for each additional contribution year afterwards, up to 35 (European Commission, 2007).

2.3.1.2.2. Averaging Period of Wages

It is really fundamental how many years of past earnings are considered while calculating the benefits. Many earnings-related schemes used to calculate benefits with respect to only a few years of final or best earnings. However, with the reforms most OECD countries have extended the period over which earnings are measured since 1990. France is moving from the best 10 years to the best 25 years in the public scheme. Austria is gradually extending the averaging period from the 15 to the 40 best years with 2005 reform. Finland, Poland, Portugal and Sweden are all moving to a lifetime average earnings measure. The largest change happened in the Slovak Republic where the earnings measure used to be the best five in the final 10 years of earnings; it will now be lifetime average earnings. As a result of these reforms, most OECD countries now use a lifetime earnings measure or a close proxy for it.

2.3.1.2.3. Valorization of Past Wages

In all earnings-related public pension systems, past earnings are revalued to take account of changes in living standards between the time pension rights accrued and the time they are claimed. This process is here called valorization although it is also known as pre-retirement indexation. Valorization of past earnings plays a crucial role in determining the level of the initial pension. The majority of OECD countries with earnings-related schemes valorized past earnings in line with economy-wide wage growth. However, several OECD countries have moved away from earnings

valorization in recent years. For example, France moved to price valorization in the public scheme as early as 1985 and in the occupational schemes in 1996. Finland, Poland and Portugal valorize past earnings with a mix of wage and price growth; recent reforms have changed the weights of price and earnings inflation in the valorization formula used in Finland and Poland.

2.3.1.2.4. Indexation of Pensions

Indexation refers to the adjustment of pensions in payment to changes in prices or earnings and it preserves the purchasing power of pensions. In recent years, many OECD countries have moved away from indexation of pension benefits to earnings towards full or partial indexation to prices. Some countries such as Hungary, Poland and the Slovak Republic adjust pensions using a mixed index composed of wage growth and price inflation. Swiss pensions are increased with an equally weighted index of wage and price growth. In Italy, higher pensions are increased by less than price inflation (75% or 90%), while small and medium-level pensions are indexed to prices.

2.3.1.3. Eligibility Conditions for Receiving Pensions

Eligibility conditions can be classified as retirement age and years of service required before receiving a pension.

2.3.1.3.1. Retirement Age

The most common characteristics of the pension reforms are changes in retirement age. It is essential that pension eligibility age must be increased parallel to life expectancy change in order to improve financial sustainability and retirement incentives. The Czech Republic, Greece, Hungary, Italy, Japan, Korea and the US implemented increases in pension age that affect both men and women. For example, Australia, Belgium, Portugal and the UK equalised retirement ages for men with those of women. In Australia, while retirement age for woman is 62.5, it will increase to 65 in 2013. In Austria the retirement age will reach from 60 to 65 in 2033. After the reform implementation, most of the countries will reach a retirement age of 65. However, France, Hungary, Chech Republic and Slovak Republic still have pension eligibility age that is below 65. In Iceland, Norway and the US, the pension eligibility age is either already 67 or it is being increased to this age. Denmark, Germany and the UK are in the process of legislating increases.

2.3.1.3.2. Years of Service Required Before Receiving A Pension

Years of service are not only eligibility criteria for receiving a pension but also a parameter for calculating pensions since accrual rate is a function of years of service. While years of service for receiving a pension is 40 in France, it will rise to 41 between 2009 and 2012 and later it will be in parallel with life expectancy. In Portugal, a minimum of 15 years of contribution is required but for a full pension years of service must be 40. In Romania, minimum years of service for men (women) for a full pension was 31 (26) years in 2007 and it will rise to 35 (30) in 2014. While in Lithuania 30 years of service for full pension is required, in Bulgaria and Latvia minimum years of service is 15. Table 5 shows some EU countries that implemented parametric reforms.

Table 5: EU Countries Implemented Parametric Reforms

	Retirement Age	Years of Service	Valorization	Benefit Formula
Germany	●	●	●	
Austria	●	●	●	●
Belgium	●	●		●
Chech Republic	●	●		●
Denmark	●	●		
Estonia	●			
Finland	●	●		●
France		●		●
Cyprus	●			
UK	●			●
Irland		●		
Spain		●	●	●
İtaly	●	●		●
Latvia	●			
Lithuania	●			
Luxemburg				●
Hungary	●		●	●
Portugal	●			●
Slovakia	●	●	●	●
Slovenia	●	●		●
Greece	●		●	●

2.3.2. Structural Reforms

Structural reforms are reforms that change the fundamentals of the pension provisions typically and shift to a new system. In the recent years, as a long term solution to financial problems arose in most of the countries, some countries decided to change the paradigm in which pension systems operate that is, to move away from the monopoly of a PAYG pillar to DC systems or to shift a mixed system with both a DB component and a DC component or a multipillar system. Multipillar systems developed by WB consists of a mandatory tax-financed public pillar designed to alleviate poverty and have a primary responsibility for redistribution, a mandatory funded private pillar (of personal saving or occupational pension plans) that has primary responsibility for

saving and a supplementary voluntary pillar (again based on personal saving or occupational plans) for people who want more protection (WB, 1994). Together, the three pillars coinsure against life's risks and uncertainties.

Pension system structural reforms firstly started with Chile's movement to privatize its pension system in 1981 and later were seen Argentina, Mexico, Peru, Bolivia, Uruguay, Colombia, Costa Rica, Dominican Republic and El Salvador. Countries such as Estonia, Hungary, Poland, Latvia, Bulgaria and Croatia introduced multipillar pension plans. Sweden, Poland, Italy and Latvia transformed their old DB PAYG systems to NDC systems.

In Poland, with the pension reform launched on January 1, 1999, the system hitherto which was based on the DB rule was transformed into a system based on a NDC. Moreover, Poland introduced three pillars of a pension system (Louzek, 2008). The first pillar, the PAYG, which is financed by the full amount of employers' contributions and more than half of employees' contributions, is mandatory for everybody. The second pillar consists of a newly created pension fund system, financed by employees' contributions. The third pillar, the voluntary one, consists of additional private insurance and saving schemes. In Hungary since the 1997 pension reform the mandatory pension system consists of two pillars. The first pillar is a uniform publicly managed, PAYG financed DB social security pension scheme. It provides earnings-related old-age, disability and survivors benefits, which are financed mainly from separate pension contributions. The second pillar of the compulsory pension system is operated by fully-funded DC private pension funds. The funds accumulate and invest contributions paid by their members onto their individual accounts. There exist various forms of voluntary supplementary pension insurance which was established in 1994 (voluntary mutual pension funds, pension savings accounts, life insurance) (OECD, 2008). Structural pension reform in Italy came into effect on 1 January, 1996. The reform moved away PAYG to NDC which are at the first pillar (Hamann, 1997). Second pillar consists of supplementary, funded pension plans and third pillar involves voluntary occupational and personal plans.

Nearly half of OECD countries (13 out of 30) now have an automatic link between pensions and life expectancy in their retirement-income systems (Table 6). A

decade ago, only one country – Denmark – had such a link. The link to life expectancy has been achieved in four different ways. First, Hungary, Poland, Mexico, the Slovak Republic and Sweden introduced DC plans as a substitute for all or part of their public pensions in the late 1990s. Australia and Norway added mandatory contributions to private pensions on top of existing public provision. Denmark has long had DC plans covering nearly all workers. Secondly, Italy, Poland and Sweden have substituted NDC for traditional DB public schemes. Thirdly, some countries have kept DB public schemes while introducing a link between life expectancy and pensions. Finland, Germany and Portugal will adjust benefit levels with life expectancy. Finally, two countries will link qualifying conditions for pensions to life expectancy: the pension age in Denmark and the number of years of contributions needed for a full pension in France.

Table 6 : Four Changes To Pensions

	DC	NDC	Benefit Levels	Qualifying Conditions
Australia	●			
Denmark	●			●
Finland			●	
France				●
Germany			●	
Hungary	●			
Italy		●		
Mexico	●			
Norway	●			
Poland	●	●		
Portugal			●	
Slovakia	●			
Sweden	●	●		

Note: Covers the 13 countries OECD countries with a link to life expectancy in the pension system.
Source: Whitehouse, 2007

3. GENERAL OUTLOOK TO THE TURKISH PENSION SYSTEM

The Turkish pension system is based on DB plan with PAYG methodology, financed through collected employees/employers contributions and managed by a public institution. Contributory system is mainly financed through the insurers' contributions and based on a principle providing benefits according to contributions made.

Before the social security administrative reform Act No. 5502 became effective as of May 2006, the Turkish social security system was made up of three separate social security institutions: Sosyal Sigortalar Kurumu (SSK), for private and public sector workers; Emekli Sandığı (ES), for civil servants; and Bağ-Kur (BK), for self-employed workers (Act No. 1479) and farmers (Act No. 2926). With that law, the pension system has started to be managed by only SSI.

In this section, firstly current situation and financial structure of the Turkish pension system will be explained and then the problems of the pension system will be pointed out and finally the paremeters of the new reform will be expressed.

3.1. Current Situation and Financial Structure of Turkish Pension System

The coverage of social security system in Turkey consists of people contributing to the system (insurers), people receiving benefits from the system and the dependent of these groups. One of the most important indicators of the pension system is support ratio (how many contributors relative to each pensioner). The higher support ratio gets, the more the system maintains sustainability for PAYG systems. However, in Turkey this ratio was 2.1 in 2001 and it dropped to 1.95 in 2008 (SSI, 2009). At the end of 2008 number of insurers, people receiving benefits and social security coverage were 15.3, 8 and 57 million respectively. In 2004, in most of the EU countries this ratio was between 1.5 and 2.0; with the highest figures in Ireland (4.4), Cyprus (3.9), the Netherlands (3.6), Malta (2.6) and Luxembourg and the lowest numbers in Lithuania, Germany and Portugal. As the aging of the population will increase the numbers of pensioners and the numbers of the persons employed are projected to decrease, the support ratio will decline. By 2050, the support ratio is projected to come close to 1 in most countries; in some countries (Germany, Portugal, Lithuania and Slovenia) even significantly below 1 while remaining above 1.5 only in the Netherlands (2.7), Ireland (2.0), Luxembourg, Cyprus and Malta (1.6) (European Commission, 2006).

While the contribution revenues constitute the most important revenue parameter of our pension system, the most considerable expenditure parameters are pensions (old-age, disability and survivor benefits). When we examine the revenue side, total contribution revenues (TCR) of our pension system reached to %3.3 of GDP in 2008 (only %2.7 of GDP in 2000). Moreover, there has not been much change for the last 5 years. At the expenditure side, total pension expenditures as a % of GDP converged to 6.2 in 2008, nearly 2 points increase compared to 2000. This shows that pension expenditures has created a significant burden to the system for each year. The system deficit as a share of GDP was 1.3% in 2000 and in 2008 it rose to 2.9% in 2008.

Table 7: Financial Structure of the Turkish Pension System, 2000-2008

Million TL	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Total Pension Contribution Revenues	4,516	6,705	10,100	14,411	18,328	20,825	25,122	28,210	31,406
Total Pension Expenditures	6,757	10,696	16,687	25,174	30,661	38,537	45,076	52,312	59,137
Deficit/Surplus of Pension System	-2,241	-3,991	-6,587	-10,763	-12,333	-17,712	-19,954	-24,102	-27,730
GDP	166,658	240,224	350,476	454,781	559,033	648,932	758,391	843,178	950,144
Total Pension Contribution Revenues as a % of GDP	2.7%	2.8%	2.9%	3.2%	3.3%	3.2%	3.3%	3.3%	3.3%
Total Pension Expenditures as a % of GDP	4.1%	4.5%	4.8%	5.5%	5.5%	5.9%	5.9%	6.2%	6.2%
Deficit/Surplus as a % of GDP	1.3%	1.7%	1.9%	2.4%	2.2%	2.7%	2.6%	2.9%	2.9%

The coverage ratio of pension revenues to pension expenditures, one of the parameters that show the sustainability of the system, reached to 53% in 2008 with a decline of 14 points as compared to 2000. The lowest and highest ratios belong to BK and ES respectively.

Table 8: The Coverage Ratio of Pension Revenues to Pension Expenditures, 2000-2008

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
SSK	68.45%	60.79%	57.89%	54.02%	59.41%	52.48%	58.00%	57.41%	57.41%
BK	48.73%	54.33%	53.74%	40.35%	43.84%	34.99%	40.28%	31.85%	26.51%
ES	70.93%	68.58%	67.00%	71.02%	68.32%	66.64%	59.68%	59.10%	59.03%
TOTAL	66.84%	62.69%	60.53%	57.25%	59.78%	54.04%	55.73%	53.93%	53.11%

If collected contribution revenues can not cover the expenditures as it is in our country, the system will inevitably run deficits. In case of having more revenues than expenditures, there will be a fund surplus. Since in Turkey the funds of each institution were accumulated with lower interests and used purposelessly up to 1994, today this

deficit can not be covered through the equities of each institution. In Turkey the system has been running deficits since 1994 and government covers this deficit. While the budgetary transfers as a % of GDP was only 1% in 1994, it increased to around 4% in 2008. Budgetary transfers include each year's deficit of the system and billed payments (additional allowance, executive compensation, tax rebate, payments done according to Act No. 2022, retirement bonuses, and other types of payments) which are not based on contributions and covered by ES. In the light of all these figures presented in this section, it is clear that there has been a danger on the sustainability of our pension system.

Table 9: Budgetary Transfers and Deficits, 1994-2008

Years	(Million TL)			%	
	Budgetary Transfers	**Deficits**	**GDP**	**Transfers As a % of GDP**	**Deficits As a % of GDP**
1994	39	36	3,868	1.01%	0.92%
1995	108	107	7,762	1.39%	1.38%
1996	335	248	14,772	2.27%	1.68%
1997	740	621	28,836	2.57%	2.16%
1998	1,496	1,223	70,203	2.13%	1.74%
1999	2,936	2,594	104,596	2.81%	2.48%
2000	3,226	2,411	166,658	1.94%	1.45%
2001	5,523	4,470	240,224	2.30%	1.86%
2002	9,684	7,964	350,476	2.76%	2.27%
2003	15,884	13,420	454,781	3.49%	2.95%
2004	18,830	15,933	559,033	3.37%	2.85%
2005	23,322	18,692	648,932	3.59%	2.88%
2006	22,892	18,037	758,391	3.02%	2.38%
2007	33,060	25,040	843,178	3.92%	2.97%
2008	35,016	25,902	950,144	3.69%	2.73%

Source: SSI, 2009

3.2. The Problems of the Turkish Pension System

The current structure of the pension system in Turkey and its problems has been being extensively discussed in public since the beginning of 1990s. One of these problems, the ever increasing deficits of social security institutions, has come forth especially since 1994. These deficits financed by the state started creating a significant pressure on budget balances within the following few years. Hence determining the problems of the pension system and developing solution proposals to these problems have been vital. Change in the demographic structure, the negative impact of budgetary transfers on economy and financial issues are the most crutial problems of the system.

3.2.1. Change in Demographic Structure

One of the most important variables that determines whether current pension systems are financially sustainable in the long run or not is the distribution of the

population according to age groups. Increase in the population covering age 65 and over within the whole population causes the revenues of the pension system to decrease while increasing its expenses. For this reason, the rate of change of the population pyramid of a country also shows the future of the pension system and the time schedule for the measures to be taken.

Turkey currently has a young population structure. According to TurkStat (TUIK) 2008 data (2009) on population median age is 28.5 (28 and 29 for man and woman respectively). On the other hand, projections regarding the future state that this population will rapidly get older. In 2005 population over 65 years to total population was 5.6% whereas in 2050 it is expected to rise to 18.4% (Figure 4). Leave aside the problems arising from the structure of the current pension system; even the rate of aging projected for Turkey alone requires an urgent and comprehensive reform in the pension system.

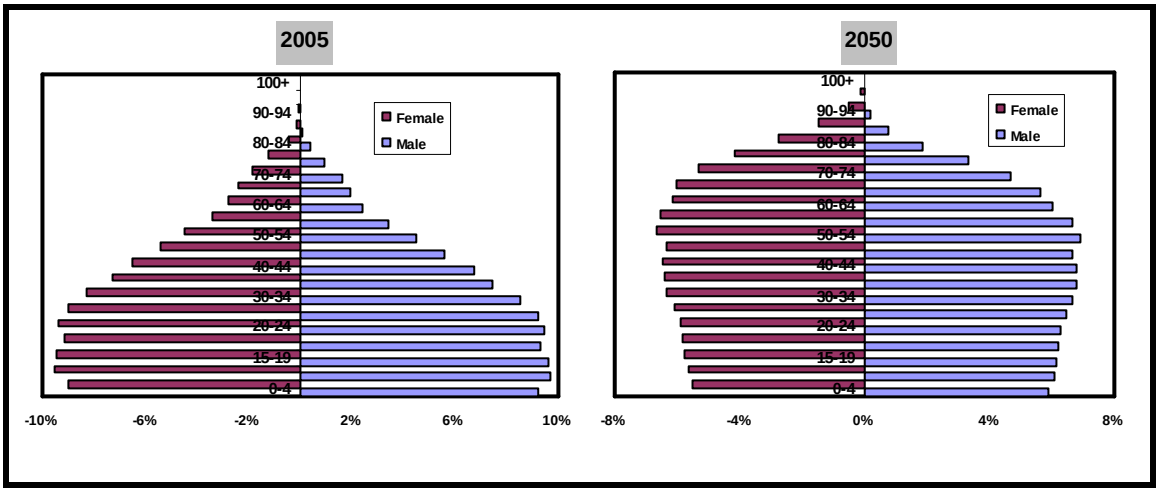

Figure 4: Population Pyramid for Male and Female in Turkey, 2005–2050
Source: UN, 2006

3.2.2. Negative Impacts of Budgetary Transfers on Economy

The financing problem experienced by the social security system is negatively affecting the key economic indicators in Turkey, especially the inflation, due to the pressure it creates on public financing. Within the last fifteen years, the social security system itself has become one of the main sources creating instability in the Turkish economy. The financing problem faced by the social security institutions increases the need for public borrowing. Current 2008 value of the total budgetary transfers (deficits) of these institutions during the period of 1994-2008, calculated by taking into account

the interest rate on Treasury bills within the same period, has reached 1,059 (879) million TL (Appendix 1). To state it differently, the total budgetary transfers of the social security system within the last 15 years, is almost 2.8 times the total consolidated debt stock of the end of November 2008. This amount, in a way, uncovers the extent of the damage caused by the incorrect organization of the social security system. When Turkey's having a young population is taken into consideration, a well-designed pension system should have contributed into the economy positively by creating fund accumulation during this period, instead of having deficits.

This increase in the public debt stock originating from the social security system, is causing interest rates to rise on one hand, and resulting in the upsurge of inflation by increasing the uncertainty on the other. In addition, all these affect investments negatively and achievement of sustainable growth rates is prevented. As a result, the rate of unemployment increases and income distribution gradually worsens. Likewise, the study conducted by TUIK related to the distribution of income shows that 20 % of the population consisting of people at the lowest income level received only 6.1% of the total income in 2005, whereas the other 20 % consisting of people at the highest income level received 44.4 % of it (Figure 5). The Gini coefficient, which is one of the leading criteria used to measure the degree of inequality in income distribution, is generally around 30% in countries (OECD and EU average 30%) where the income is more equitably distributed, whereas this figure has reached 38 % in our country (TUIK, 2006 and European Commission, 2008).

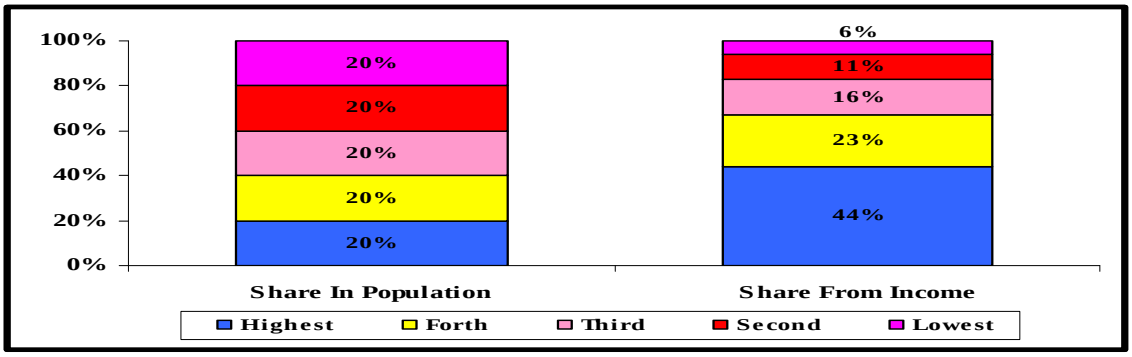

Figure 5: Income Distribution for Turkey in 2005
Source: TUIK, 2006

Nevertheless, continuation of macroeconomic stability requires the public fiscal balance to become sustainable in both the medium and the long run. This, on the other hand, depends to a great extent on the completion of the structural reforms in public

sector. Realization of a comprehensive social security reform will primarily reduce the pressure of social security institutions on public deficits. Reduction in public deficits will in return decrease the need for the primary budget surplus required for the regression of the debt stock to reasonable levels in the medium run.

3.2.3. Financial Issues

The financial problem of the Turkish pension system arises from the developments and implementations that either decrease revenues or increase expenses. The major factors that decrease revenues are the early retirement implementation, declaring the earning base for premium at a lower value, high informal employment, low contribution collection rate, decrease in contribution payment tendencies due to implementations like issuing pardons for facilitating payments, pardons applied on delay fines of unpaid contribution, low earning brackets as basis for contribution and insufficient fund revenues. Factors that increase expenses, on the other hand, are early retirement implementations, insurance payments made before the contribution are received, borrowing laws, increasing salary payments due to longer average life span and the weak relationship between the contribution revenues and retirement payments.

3.2.3.1. Early Retirement

One of the most important problems that upset the balance of finances is early retirement. The basis of this problem dates back to populist practices such as eliminating minimum retirement age, permitting retirement in some cases after less than 15 years of contributions regulated between 1986 and 1992. The current pension eligibility age in Turkey is the lowest in the OECD (Brook and Whitehouse, 2006). The age of 69% (78%) of man (woman) who retired from the SSK is below the retirement age of 65 which is the official retirement age for most of OECD countries (SSI, 2008). This clearly shows the extent of the problem.

While currently 60% of the old-age pensioners are below the minimum retirement age of 58-60, only after 2035 there will be no pensioners below this retirement age with the reform enacted in 1999 (Figure 6-7).

Higher number of young retired persons means shorter working and longer retirement periods. In 2007 with a pension eligibility age of 44, and a life expectancy (at age 44) of 76, women enjoy an average retirement period of 32 years, whereas men,

with a pension eligibility age of 47, enjoy an average retirement period of 28 years (given life expectancy of 75 at age 47). No other OECD member country has such long average periods of pension eligibility (Brook and Whitehouse, 2006). As a result of the increase in retirement age realized in 1999, period spent in retirement will gradually decrease up to 2035 (Figure 8). However, unless new arrangements are made to change the relation between the period worked and the period spent in retirement in favor of the period worked, the period spent in retirement will start to increase again after 2035, since the survival expectancy will gradually increase in future years.

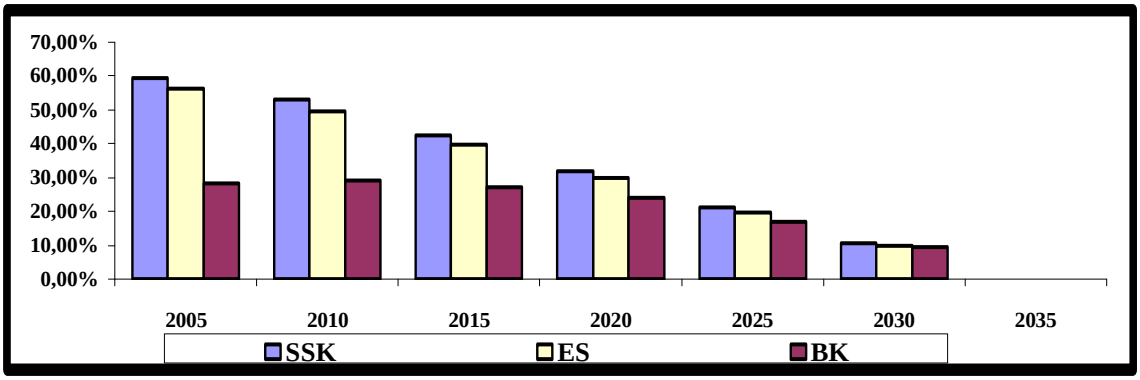

Figure 6: % of Female Old-Age Pensioners Below the Retirement Age of 58

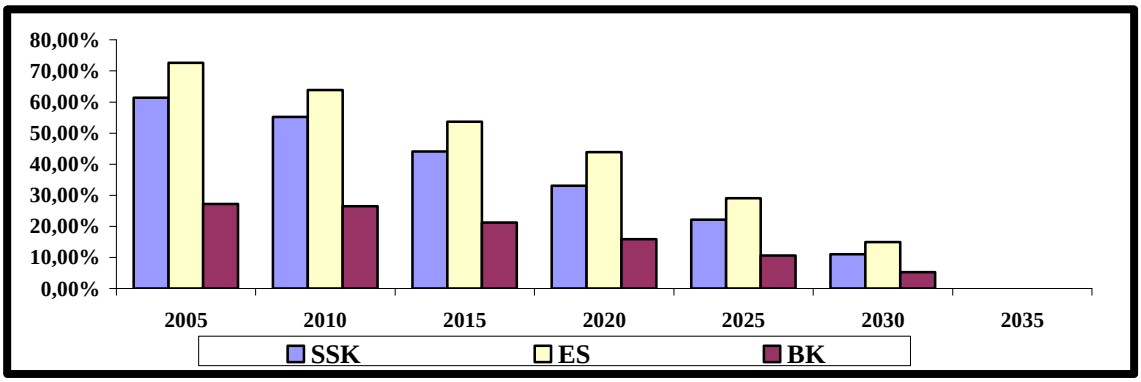

Figure 7: % of Male Old-Age Pensioners Below the Retirement Age of 60

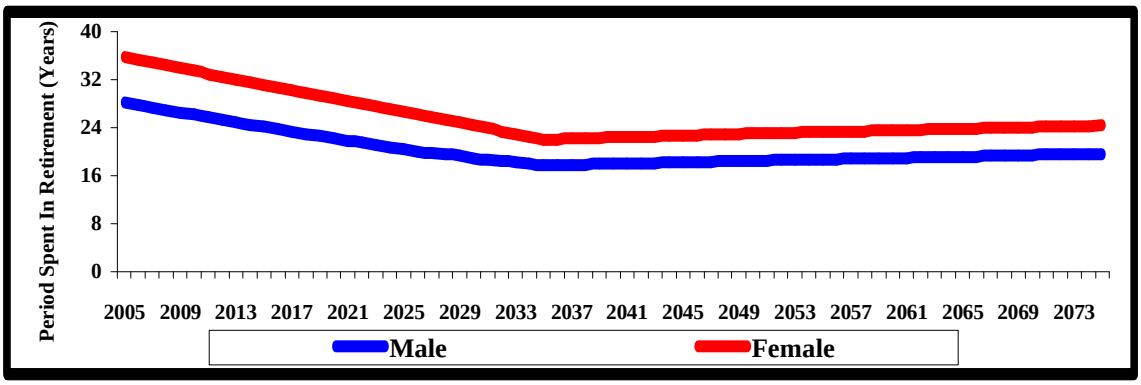

Figure 8: Period Spent In Retirement

3.2.3.2. Underreporting Earnings Base for Contributions

Currently, around 60% of employees working at private sector pay contributions based on earnings that are minimum wage and 10% more than minimum wage. However, it is for sure that number of employees earning minimum wage is much less than this amount. As a result of underreporting earnings, SSI receives less revenues.

3.2.3.3. High Informal Employment

According to TUIK Household Employment Survey on 15, April 2009, informal employment consists of people working but not being registered to SSI at the reference week. In Turkey informal employment is high and this not only decreases SSI contribution revenues but also makes people to be deprived of social security rights. One of the reasons for high informality is that social security contributions make up the bulk of the tax wedge on labor in Turkey. Turkey has 42% average tax wedge on labor, 7 points higher than EU15 and OECD average (Figure 9). According to TUIK Household Employment Survey in Turkey informal employment rate has been 40.8% with an increase of 0.1 points compared to last year's same month. In other words, only 50.2 % of the work force is subject to SSI.

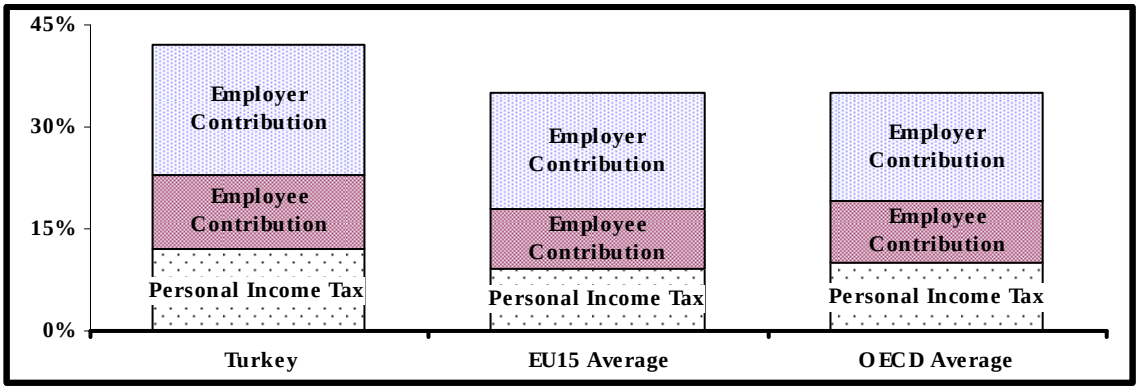

Figure 9: Average Tax Wedge on Labor
Source: EU Commission, 2008 and Brook and Whitehouse, 2006

3.2.3.4. Issuing Pardons and Low Contribution Collection Rate

In Turkey, collection rate for contributions are quite low and this cause reductions in contribution revenues. The total receivables of uncollected contributions for SSI reached to around 43 billion TL (31 billion belongs to BK and the rest to SSK) (SSI, 2009). The leading reason for low collection rate is that the contributions are unpaid on time due to implementations like issuing pardons for facilitating payments. Insurers prefer to pay their contributions when they believe that government will issue

pardons instead of paying on time because they can have the chance of installing payments and penalties are lower when a pardon is issued. Moreover, especially during the crisis period contribution payment tendencies lower.

3.2.3.5. Generosity of Pension System

Generosity of pension system causes results in favor of the pensioners generated by the parameters determining the benefit levels such as valorization of past wages, accrual rates and gross/net replacement rates. This highlights the weak relationship between the earnings obtained during working period and benefits received.

3.2.3.5.1. Higher Accrual Rates

As it was pointed out in the previous section, accrual rates calculated according to years of contribution period are one of the most significant parameters used in the calculation of pensions. In Turkey the accrual rate decreases for people with a longer contribution history. The accrual rates, which are 65 % in the SSK and BK and 75% in the ES according to the Acts No. 4447 and 5434 over the gross wage/salary for 25 years of insurance period, correspond to 2.6%, 2.6% and 3%, respectively, on annual basis. An increase of 1.5% in the SSK and BK and 1% in the ES is made in the replacement rates for each additional year. In Turkey, accrual rate per year remains relatively high by OECD standards (OECD, 2007). High level of accrual rates in Turkey promotes people to retire early, deteriorates the benefit-burden balance and avoids people to remain in the labor force for a longer time. Early retirement causes the system to pay more pensions instead of receiving more contributions.

Table 10: Levels and Changes in Gross Pension Wealth

		Change in Pension Wealth, working Age 60-65		
		Lowest Third	**Middle Third**	**Highest Third**
Level of Pension Wealth at 60	**Lowest**	Australia Belgium Canada	Ireland Mexico US	Germany Japan Poland UK
	Middle	France Portugal	Czech Republic New Zealand Norway Slovakia	Finland Iceland Korea Switzerland
	Highest	Greece Hungary Italy Luxemburg **Turkey**	Austria Spain Sweden	Denmark Holland

Source: OECD, 2008

According to a study conducted by OECD (2008) the level of pension wealth already achieved at age 60 in Turkey is in the highest third of OECD countries while the change in pension wealth that results from continuing to work upto 65 is in the lowest third. Thus, Turkey pays relatively high pensions to people who retire at age 60, and pension wealth actually falls if people remain in work after age 60. Along with Greece, Italy, Luxembourg and Hungary, therefore, Turkey's public pension system embodies the strongest incentive to retire early among OECD countries. At the other end of the spectrum, there is a low level of public pension wealth at age 60 in the UK and a relatively large increase in public pension wealth from remaining in work.

3.2.3.5.2. High Valorization Formula

Valorization of past earnings plays a crucial role in determining the level of the initial pension. In all earnings-related public pension systems, past earnings are revalued to take account of changes in living standards between the time pension rights accrued and the time they are claimed. According to Act No. 4447, past earnings are valorized by Consumer Price Index (CPI) and GDP growth for SSK and BK. If GDP growth is negative then GDP growth can not be used in the formula of valorization. In ES, there is no valorization formula since pensions solely depend on last year's earning.

While an insurer paying contributions according to minimum wage between 2000 and 2008 has average valorized earnings of 737 TL, the minimum wage at the end of 2008 is 637.8 TL. Therefore the ratio of average valorized earnings to minimum wage is 1.15. This clearly proves that valorization formula is very high for Turkey since the aim of valorization is to preserve the value of past earnings between the time pension rights accrued and the time they are claimed.

3.2.3.5.3. Gross/Net Replacement Rates

Replacement rates are also high in our country, which constitutes another important parameter of the retirement system. The gross replacement rate is defined as gross pension entitlement divided by gross pre-retirement earnings. The net replacement rate is defined as the individual net pension entitlement divided by net pre-retirement earnings, taking account of personal income taxes and social security contributions paid by workers and pensioners. The old-age pension replacement rate is a measure of how

effectively a pension system provides income during retirement to replace earnings, the main source of income prior to retirement.

When compared with the net earning amounts received while working, it is seen that the retirement salaries in the SSK are very close to these amounts, whereas they exceed the active working earning amounts in BK and the ES. The gross (net) replacement rate is 65% (91%) in the SSK, 65% (129%) in BK and 75% (106%) in the ES. Replacement rates have been calculated with the following assumptions in order to be able to make comparisons among institutions: The accrual rate is 65 % of the earning base for wage/salary income stages for 25 years in the SSK and BK; and 75 % of the amount to be determined according to the Act No. 5434 in ES. If we assume that the earning base for contribution collected by social security institutions is 100 units, and the rate of income and stamp tax paid by individuals is 15% and 0.6% respectively, the net wage/salary income received by people is 72 units in the SSK, 50 units in BK and 71 units in ES. When other variables are kept constant and it is assumed that the salaries of these persons as basis is 100 TL; the retired persons who worked for 25 years covered by the SSK, BK and ES will be paid 65, 65 and 75 TL respectively. However, since people who pay contribution to social security institutions have wages/salaries other than their wages/salaries as basis for contribution, especially in ES, the ratio of the retirement salaries they receive when they retire to the total net wage/salary income is lower than the calculated amounts.

As for December 2008, if a worker retires he/she gets at least 571.3 TL (minimum pension, social aid bonus and tax rebate are not included) whereas the minimum wage and minimum net wage (living reduction is not included) are 638.7 and 457.6 TL respectively. According to these figures, gross and net replacement rates are 89.4% and 124.4%. Therefore a person who fulfills all conditions to retire will draw his/her pension and move away from working formally since he/she gets more than the net earning if retires. This leaves little incentive for qualifying early retirees to continue working in the formal sector and affects the sustainability of the system adversely.

Table 11 shows average earning levels calculated according to Purchasing Power Parity and gross and net replacement rates in OECD countries. The calculation method for the average earning level includes economic sectors and both manual and

non-manual workers. In Turkey, there is huge difference between gross and net replacement rate since pensioners do not pay income tax or health insurance contributions. The gross and net replacement rate calculation for Turkey is based on assumptions of valorization and accrual rate regulated at the Act No. 5510 before some articles were blocked by the Constitutional Court. For workers at average earnings, the average for the OECD countries of the gross and net replacement rate from mandatory pensions is 58.7% and 70.1% respectively, whereas they are 72.5 and 104% for Turkey. Turkey is one of the most generous countries, following Greece, when comparing net replacement rates and has the 8th place at gross replacement rate category. According to average earning level Turkey has the lowest earning excluding Eastern Europe countries (Hungary, Czech Republic, Poland and Slovak Republic) and the figure is half of the OECD average.

Table 11: OECD Measures of Average Earnings, Gross and Net Replacement Rates

Countries	**Average Earnings**	**Gross Replacement Rate**	**Net Replacement Rate**
Germany	45,898	39.9	58
US	30,355	41.2	52.4
Australia	35,917	43.1	56.4
Austria	37,872	80.1	90.9
Belgium	41,151	40.4	63
Czech Republic	14,936	49.1	64.4
Denmark	37,684	75.8	86.7
Finland	32,372	63.4	68.8
France	32,199	51.2	63.1
Holland	41,300	81.9	96.8
UK	43,881	30.8	41.1
Ireland	30,321	32.5	38.5
Spain	26,215	81.2	84.5
Sweden	32,773	62.1	64
Switzerland	40,900	58.4	64.3
Italy	25,628	67.9	77.9
Iceland	29,461	77.5	84.2
Japan	37,139	34.4	39.2
Canada	31,269	43.9	57.4
Korea	34,974	66.8	71.8
Luxemburg	42,649	88.3	96.2
Hungary	13,682	76.9	102.2
Mexico	10,446	35.8	38.3
Norway	41,005	59.3	69.3
Poland	15,858	61.2	74.9
Portugal	18,344	54.1	69.2
Slovakia	11,679	56.7	72.9
Turkey	**16,788**	**72.5**	**104**
New Zealand	26,973	39.7	41.7
Greece	24,996	95.7	110.1
OECD Average	**30,156**	**58.7**	**70.1**

Source: OECD, 2007

3.2.3.6. Indexation of Pensions

While pensions have to be indexed to previous month's CPI according to the Act No. 506 and 1479, pensions started to be indexed according to discretionary increases

after the regulation adopted in 2003. For example, in 2003 pensions were increased by 75 TL in ES, BK 1479 and SSK and by 100 TL in BK 2926. According to the Act No. 5434, pensions are indexed to civil servants' salary increase. The nominal increase of minimum pensions for SSK, BK 1479, BK 2926 and ES between 2000 and 2008 has been 380%, 585%, 798% and 396% respectively, whereas cumulative CPI is only 299% in the same period. In other words, reel increases for SSK, BK 1479, BK 2926 and ES are 20%, 72%, 125% and 24% respectively. More generous indexation of pensions in payment worsens the financial sustainability of pension systems and it may pose challenges for long-term social and, thus, political sustainability.

3.2.3.7. Social Aid Bonuses

The basis for social insurance services of pension system depends on contributions paid and this means that each benefit has to be subject to some payments. Although social aid bonus is a kind of social assistance financed through taxes, it been included in the pension system since 1977. Moreover, in 1987 the payments done as social aid bonuses constituted 39% of total pension payments in SSK and it reached to 63% in 1995 (Peker, 1997). This occasion deteriorates burden-benefit balance which has to be considered in the pension systems and leads to privileges in the system. The social aid bonuses received as a fixed amount have been ranging between 4.5 and 5.85 TL since 2000.

3.3. The New Reform

With the social security reform realized in 1999, financing problem that could cause even bigger problems in the short and long-run unless urgent measures are taken, has been tried to be solved by making new regulations especially on retirement parameters. Nevertheless, the rate of increase in the deficits of the SSK and BK, has again accelerated within the last eight years, except for the temporary decrease in 2000. Deficits of the ES, on the other hand, have rapidly increased since 1994 because only retirement age parameter has been altered. One another reason is that the regression in general wage level caused by 2001 crises has dropped contribution revenues and enactment of laws that provide low interest installments and payment facilities one after another in this extraordinary environment have lowered the contribution payment tendency. This negative development has revealed that changes made only in certain

parameters of the current pension system would remain insufficient for solving the problems of the system in medium and long term.

Due to the problems of the pension system explained in this section and deficiencies of 1999 pension reform, the government implemented another social security reform in November 2002. The purpose of this reform for the pension system is the creation of a single pension regime which will ensure the provision of an equal and equitable service to all citizens covered in the current system and to achieve financially sustainable pension system. During the law preparation period, the criticism and opinion of all stakeholders has been taken into consideration and as a result the social security law was passed into law on 16, June 2006. However, the Constitutional Court blocked some articles of this law and after this, the reform practices started again and finally the new version of the law implemented on 1, October 2008.

The most important changes regarding the pension system adopted with the Act No. 5510 are materialized on retirement age, accrual rate, valorization, contribution periods, indexation of pensions, eligibility for survivor and disability benefits, contribution rates, contribution base and ceiling. Table 12 compares the before and after reform parameters. The alterations made with the new reform bring new regulations in the main parameters without changing the system type and constitute a good example for the parametric reforms explained in the second section.

One of the most important parameters of the new reform is the change in retirement age. The first reform in 1999 changed retirement age to 58 and 60 for woman and man respectively. However, this regulation affects solely the people entering the system after 1999 and the retirement age of 58-60 will be reached around 2030s. The new reform in 2008 provides in particular that the retirement age will gradually increase to 65 for both men and women by the year 2048. However, the retirement age will depend on the official retirement age of the year in which the insurer fulfills. For example, if a man entering the system at 25 in 2015 pays 20 years contribution continuously, he will fulfill the number of contribution days and will get retired at an age of 60 in 2050 although the retirement age in 2050 will be 65.

According to gradual increase in the retirement age, the retirement age will only be higher than 58-60 in late 2040s and will reach to 65 for man (woman) in 2061 (2065)

(Figure 10). With the new regulations on retirement age, in 2075 women will enjoy an average retirement period of 18 years, whereas men, with a pension eligibility age of 65, will enjoy an average retirement period of 16 years (Figure 11-12). As a result of the increase in retirement age in 2008, period spent in retirement will gradually decrease up to 2060s. However, unless new arrangements are made to increase retirement age, the period spent in retirement will start to increase again after 2060s due to increase in life expectancy.

Table 12: Comparison of Old and New System Parameters

	ENVISAGED BY THE ACT NO. 5510	**Old system**		
		SSK (Act No. 506)	**BK (Act No. 1479 and 2926)**	**ES (Act No. 5434)**
Retirement Age	The retirement age will depend on the official retirement age of the year in which the insurer fulfills the number of contribution days	Gradual transition from 38 and 43 for female and male, respectively to 58 and 60 for female and male (the Act No. 4447)	Gradual transition from 38 and 43 for female and male, respectively to 58 and 60 for female and male (the Act No. 4447)	Gradual transition from 38 and 43 for female and male, respectively to 58 and 60 for female and male (the Act No. 4447)
Accrual Rate	For new insurers 2% flat from 2008 onward, for the old ones 3% per annum until fulfills 10 years and 2 % per annum for the rest	3.5% per annum for the first 10 years, 2% per annum for the next 15 years, and 1.5% per annum for the rest	3.5% per annum for the first 10 years, 2% per annum for the next 15 years, and 1.5% per annum for the rest	3% per annum up to 25 years and 1% per annum for the rest
Valorization	100% of rate of increase in CPI and 30% of Real GDP growth	100% of rate of increase in CPI and rate of increase in Real GDP	100% of rate of increase in CPI and rate of increase in Real GDP	No uprating, depends on the last salary
Contribution Period	No change for existing participants and for new SSK entrants 7200 days (20 years)	Increased from 5,000 days to 7,000 days pursuant to the Act No. 4447	25 years of service	20 and 25 years of service for female and male, respectively
Indexation of Pensions	CPI	CPI	CPI	Rate of increase of civil servant's salary
Eligibility for Disability Benefit	Minimum 1,800 days of contribution with at least 10 years of service, if in dependent condition only 1,800 days	Minimum 1,800 days of contribution or 180 days of contribution for each year with at least 5 years of service	1,800 days of contribution	3,600 days of service
Eligibility for Survivor Benefit	Minimum 900 days of contribution with at least 5 years of service	Total 900 days of contribution with at least 5 years of service	1,800 days of contribution	3,600 days of service
Contribution Base	Minimum wage	Minimum wage	24-scale Income Schedule	Combined
Contribution Ceiling	No ceiling for civil servants and 6.5*min. Wage for others	6.5*min. Wage	-	-
Contribution Rate	20%	20%	20%	36%

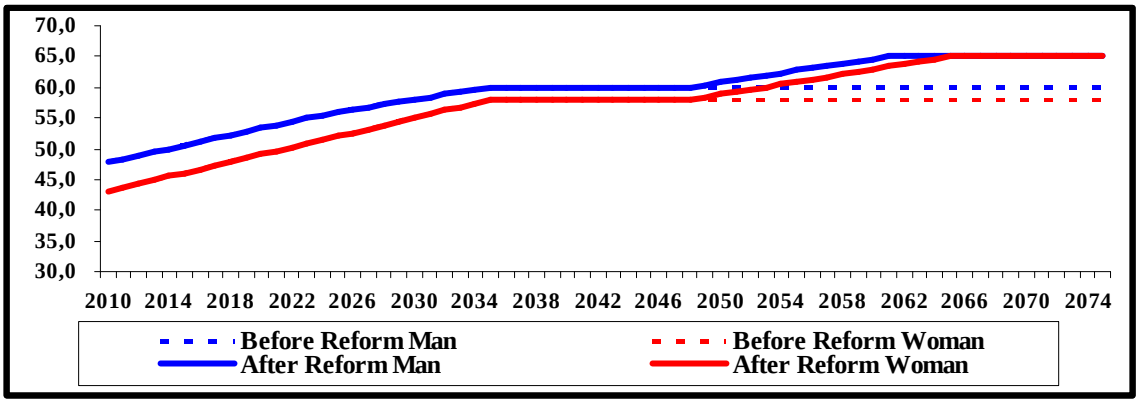

Figure 10: Before and After Reform Retirement Age for Man and Woman

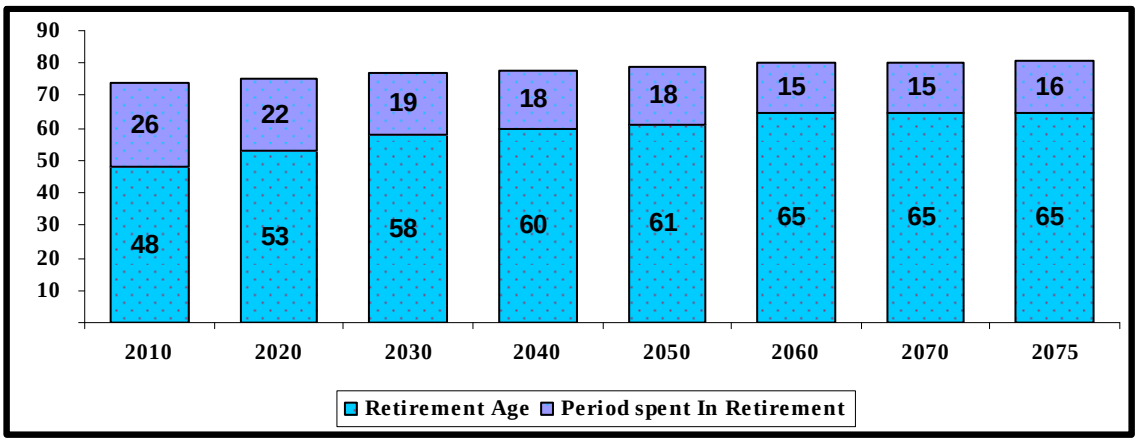

Figure 11: Retirement Age and Period Spent in Retirement for Men

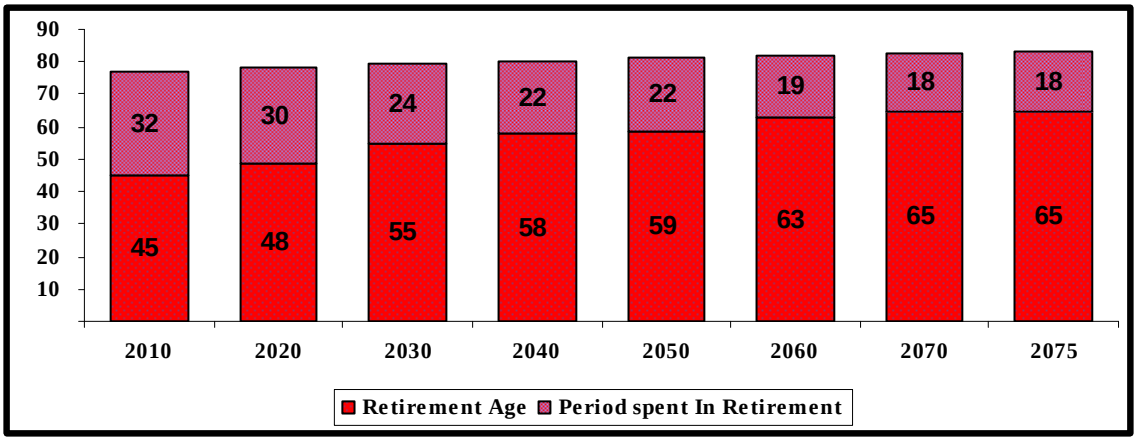

Figure 12: Retirement Age and Period Spent in Retirement for Women

Another important parameter of new reform is the accrual rate which is calculated according to years of contribution period. With the new reform, accrual rate for new insurers is 2% flat from 2008 onwards and for the old ones it is 3% per annum until fulfills 10 years and 2 % per annum for the rest except for ES old insurers.

Table 13: Accrual Rates Comparison According to Contribution Period

	Old System (%)			New System (%)
Contribution Period (Years)	**SSK**	**BK**	**ES**	
25	65	65	75	50
30	72.5	72.5	80	60
35	80	80	85	70
40	87.5	87.5	90	80

Acrrual rates for 25 years of contribution period are 65%, 65%, 75% and 50% for SSK, BK, ES and new entrants respectively (Table 13). While the most generous figures belong to ES, the accrual rates drop with the new reform. Since the accrual rates are constant for each year of contribution, it does not encourage people to work more. In countries such as Germany and Finland, accrual rates rises as contribution period increases and this promotes people to remain in the labor force for a longer period.

With the new reform, past earnings belonging to after reform period will be valorized according to 1+CPI+30% of GDP growth except for old ES insurers while calculating the pensions. The aim of this valorization method is to preserve the reel value of past earnings between the time pension rights accrued and the time they are claimed and enable insurers to get share from the wealth increase of the country.

While an insurer paying contributions according to minimum wage between 2000 and 2008 has average valorized earnings of 637 TL with the new valorization method, the minimum wage at the end of 2008 is 637.8 TL. Therefore the ratio of average valorized earnings to minimum wage is 0.99. With the change in the valorization method, average valorized earnings decreases by 16% compared to old valorization. This obviously shows that the new valorization is relatively less generous than the old one.

4. APPLICATION

Economists and policymakers increasingly use the term “actuarial” when writing about pension systems. The tendency to advocate actuarial-based pension reforms perhaps stems from the credibility that the term “actuarial” brings or appears to bring. This is probably because the actuarial profession is traditionally associated with measuring and ensuring solvency (Whitehouse and Queisser, 2006).

One way to measure the sustainability of PAYG public pension schemes is best evaluated in actuarial terms by estimating the actuarial deficit as the difference between a scheme’s liabilities and assets. If the actuarial deficit is positive and large, a scheme is financially unsustainable and will require policy remediation to increase revenues or reduce expenditures. Another way is to look at the actuarial fairness of the pension systems. An actuarially fair pension is one that equalizes lifetime individual pension entitlements to lifetime individual pension contributions. By definition, therefore, there is no redistribution towards or away from any individual: what you get out in retirement is the same as what you paid in when working, together with any interest that was earned before retirement. To examine actuarial fairness, we obviously need to measure lifetime contributions and benefits (Whitehouse and Queisser, 2006). Since in funded DC plans each member contributes into an individual retirement savings account and withdraws the balance at retirement, they are therefore actuarially fair by definition.

In this section, Pension Reform Option Simulation Tool-Kit (PROST) model and its formulation about revenues and expenditures, the definition of ACR and its formulation will be represented. Then the effects of new reform on deficits as a percent of GDP and ACR in order to maintain sustainability and actuarial fairness will be analyzed. Finally some alternative reform options ensuring actuarial fairness will be displayed and their effects on sustainability will be highlighted.

4.1. Definition and Formulizations of PROST Model and ACR

4.1.1. PROST Model

PROST model developed by WB is a simulation model that projects the pension systems revenues and expenditures. These projections give an idea about the long term sustainability of the systems. However, an important point that should be emphasized here is that the margin of mistake in projections that cover such long periods will also

be high. These projections aim to determine the direction of general tendencies towards the future rather than giving point estimations. In other words, base projections that accept the current macroeconomic structure as fixed, stipulate roughly, the results to be created in the long run by the changes that will be made in the parameters of the retirement system. The basic assumptions of the model are demographic and macroeconomic assumptions (Appendix 2).

In the light of these assumptions, TCR can be calculated as follows:

$$TCR_t = k_t * coll\%_t * \sum_a W(a,t,g) * P(a,t,g) * lfp\%(a,t,g) * [1 - u\%(a,t,g)] * cr\%(a,t,g) \quad (1)$$

$$JC(a,t,g) = EC(a,t,g) - EC(a-1,t-1,g) + CD(a,t,g) + NP(a,t,g) + ND(a,t,g) \quad (2)$$

$$CD(a,t,g) = EC(a-1,t-1,g) * m\%(a-1,t-1,g) \quad (3)$$

$$\mathrm{NP(a,t,g)} = \mathrm{EC(a-1,t-1,g)} * \mathrm{rr\%(a,t,g)} \quad (4)$$

$$\mathrm{ND(a,t,g)} = \mathrm{EC(a-1,t-1,g)} * \mathrm{ds\%(a,t,g)} \quad (5)$$

$$WB_{t+1} = \sum_a W(a,t,g) * [EC(a,t,g) - CD(a,t,g) - (NP(a,t,g) - ND(a,t,g)] * (1 + WBI_{t+1}(a,g)) + \sum_a W(a,t+1,g) * JC(a,t+1,g) \quad (6)$$

where

TCR_t *:* TCR in year t

k_t : contribution rate in year t

$coll\%_t$ *:* contribution collection rate in year t

$WB_t(a,g)$: total wage bill for each age (a) and gender (g) in year t

$W(a,t,g)$: average wage bill for each age (a) and gender (g)

$EC(a,t,g)$: number of contributors for each age (a) and gender (g)

$cr\%(a,t,g)$: contributor rate, measured as a percent of all contributors in the total employed population for each age (a) and gender (g)

$u\%(a,t,g)$: unemployment rate for each age (a) and gender (g)

$P(a,t,g)$: total population for each age (a) and gender (g)

$lfp\%(a,t,g)$: labor participation rate for each age (a) and gender (g)

$JC(a,t,g)$: number of newly joint contributors for each age (a) and gender (g)

$CD(a,t,g)$: number of death contributors for each age (a) and gender (g)

$NP(a,t,g)$: number of new old-age pensioners for each age (a) and gender (g)

$ND(a,t,g)$: number of new disabled for each age (a) and gender (g)

$m\%(a,t,g)$: probability of dying multiplier for each age (a) and gender (g)

$\mathrm{rr\%(a,t,g)}$: retirement rate, as ratio of new old age pensioners to the last year's contributors of age a-1 for each age (a) and gender (g)

$\mathrm{ds\%(a,t,g)}$: disability rate, as ratio of new disabled to the last year's contributors of age a-1 for each age (a) and gender (g)

WBI_{t+1}(a,g): wage bill increase for each age (a) and gender (g) in the year t+1

The calculation method of total old-age pension payments is as follows:

$$TPP_t = \sum_a PP(a,t,g) * EP(a,t,g) \qquad (7)$$

$$\mathrm{EP(a,t,g) = EP(a-1,t-1,g) + NP(a,t,g) - OD(a,t,g)} \qquad (8)$$

$$OD(a,t,g) = EP(a-1,t-1,g) * m\%(a-1,t-1,g) \qquad (9)$$

$$TPP_{t+1} = \sum_a PP(a,t,g) * [EP(a,t,g) - OD(a,t,g)] * (1 + PPI_{t+1}(a,g)) + \sum_a PP^{new}(a,t+1,g) * NP(a,t+1,g) \qquad (10)$$

where

TPP_t: total old-age pension payments in year t

$PP(a,t,g)$: average old-age pensions for each age (a) and gender (g)

$EP(a,t,g)$: number of old-age pensioners for each age (a) and gender (g)

$\mathrm{OD(a,t,g)}$: number of death old-age pensioners for each age (a) and gender (g)

$PPI_{t+1}(a,g)$: increase in old-age, disability and survivor pensions in year t+1

$PP^{new}(a,t+1,g)$: average old-age pensions for newly joint old-age pensioner in year t+1

The formulation for total disability pension payments is as follows:

$$TDP_t = \sum_a DP(a,t,g) * ED(a,t,g) \qquad (11)$$

$$\mathrm{ED(a,t,g) = ED(a-1,t-1,g) + ND(a,t,g) - DD(a,t,g)} \qquad (12)$$

$$DD(a,t,g) = ED(a-1,t-1,g) * m\%(a-1,t-1,g) \qquad (13)$$

$$TDP_{t+1} = \sum_a DP(a,t,g) * [ED(a,t,g) - DD(a,t,g)] * (1 + PPI_{t+1}(a,g) + \sum_a DP^{new}(a,t+1,g) * ND(a,t+1,g) \qquad (14)$$

where

TDP_t: total disability pension payments in year t

$DP(a,t,g)$: average disability pensions for each age (a) and gender (g)

$ED(a,t,g)$: number of disabled for each age (a) and gender (g)

$DD(a,t,g)$: number of death disabled for each age (a) and gender (g)

$DP^{new}(a,t+1,g)$: average disability pensions for newly joint disabled in year t+1

Total survivor pension payments are calculated as follows:

$$TSP_t = \sum_a SP(a,t,g) * ES(a,t,g) \quad (15)$$

$$\mathrm{ES(a,t,g)} = \mathrm{ES(a-1,t-1,g)} + \mathrm{CD(a,t,g)} + \mathrm{OD(a,t,g)} + \mathrm{DD(a,t,g)} - \mathrm{SD(a,t,g)} \quad (16)$$

$$SD(a,t,g) = ES(a-1,t-1,g) * m\%(a-1,t-1,g) \quad (17)$$

$$TSP_{t+1} = \sum_a SP(a,t,g) * [ES(a,t,g) - SD(a,t,g)] * (1 + PPI_{t+1}(a,g) + \sum_a SP^{new}(a,t+1,g) * NS(a,t+1,g) \quad (18)$$

$$NS(a,t,g) = CD(a,t,g) + OD(a,t,g) + DD(a,t,g) \quad (19)$$

where

TSP_t: total survivor pension payments in year t

$SP(a,t,g)$: average survivor pensions for each age (a) and gender (g)

$ES(a,t,g)$: number of survivors for each age (a) and gender (g)

$SD(a,t,g)$: number of death survivors for each age (a) and gender (g)

$SP^{new}(a,t+1,g)$: average survivor pensions for newly joint survivors in year t+1

$NS(a,t,g)$: number of newly joint survivors for each age (a) and gender (g)

The financial balance of the system can be found by subtracting total old-age, disability and survivor pension payments form total contribution revenues. The financial balance as a % of reel GDP can be found as follows:

$$PSB_t = \frac{[TCR_t - (TPP_t + TDP_t + TSP_t)]}{GDP_t^{reel}} \quad (20)$$

where

PSB_t: ratio of system balance to reel GDP in year t

GDP_t^{reel} :reel GDP in year t

4.1.2. ACR

ACR for a person is the ratio of the actuarial present value of expected contribution revenues to the actuarial present value of total expected old-age, disability

and survivor pension liabilities by using probability of dying; getting disabled for each age and the survivor data. This ratio is one of the most important parameter showing the sustainability, generosity and actuarial fairness of the system. If ACR is 1, we can say that the system is financially sustainable and actuarially fair. The assumptions used in the calculation of this ratio can be found in the Appendix 3. The formulation of ACR is as follows:

$$ACR_e^r = \frac{CR_e^r}{TL_e^r} \qquad (21)$$

where

ACR_e^r: ACR for a person starting to work at age "e" and retiring at "r"

CR_e^r: actuarial present value of contribution revenues at age "e" for a person starting to work at age "e" and retiring at "r"

TL_e^r: actuarial present value of total liabilities at age "e" for a person starting to work at age "e" and retiring at "r"

e: entrance age to the system

r: retirement age

According to Bowens (1997), we can consider an annuity that pays a unit amount at the beginning of each year that the annuitant (x) survives for n years. In the nomenclature this is called a n-year temporary life annuity-due. The present value random variable of this type annuity-due of 1 per year is:

$$Y = \begin{cases} \ddot{a}_{K+1} & 0 \le K < n \\ \ddot{a}_n & K \ge n, \end{cases} \qquad (22)$$

and the actuarial present value in the current payment form is:

$$\ddot{a}_{x:n} = E[Y] = \sum_{k=0}^{n-1} v^k *_k p_x \qquad (23)$$

where

Y: present value random variable

K: random variable which is curtate-future-lifetime of x

$_k p_x$: probability of living "k" years for "x" years old person

$v = (1+i)^{-1}$: discounted value of next year's 1 TL (i is the technical interest rate)

On the basis of equation (23), we can easily derive actuarial present value of contribution revenues, old-age, disability and survivor pension liabilities. Actuarial present value of contribution revenues can be calculated as follows:

$$CR_e^r = k * \sum_{j=e}^{r-1} \sum_{l=1}^{12} W_{j,l} * v^{\frac{l-1}{12}} * (1+CPI)^{j-e} * (1+RWI)^{j-e} * {}_j p_e * v^{j-e} \qquad (24)$$

where
k: contribution rate

$W_{j,l}$: monthly wage for year j and month l

CPI: CPI for each year

RWI : reel wage increase for each year

In order to find the actuarial present value of total liabilities for a person in the year when firstly start to work, we have to calculate actuarial present value of old-age, disability and survivor pension liabilities. The formulation of actuarial present value of total liabilities is as follows:

$$TL_e^r = TPL_e^r + TDL_e^r + TSL_e^r \qquad (25)$$

where
TPL_e^r: actuarial present value of old-age pension liabilities at age "e" for a person starting to work at age "e" and retiring at "r"

TDL_e^r: actuarial present value of disability pension liabilities at age "e" for a person starting to work at age "e" and retiring at "r"

TSL_e^r: actuarial present value of survivor pension liabilities at age "e" for a person starting to work at age "e" and retiring at "r"

Old-age pension benefit can be calculated as follows:

$$PP_e^{r,l} = \frac{AR}{12 * (r-e-1)} * \sum_{j=e}^{r-1} \sum_{l=1}^{12} W_{j,l} * \prod_{k=j+1}^{r-1} (1+\pi_k) \qquad (26)$$

where
$PP_e^{r,l}$:one month old-age pension benefit received in the month "l" for a person starting to work at age "e" and retiring at "r"

AR: accrual rate calculated according to contribution period

π_k : valorization rate for the year k

Actuarial present value of old-age pension liabilities can be calculated as follows:

$$TPL_e^r = \sum_{j=r}^{100} \sum_{l=1}^{12} PP_e^{r,l} * v^{\frac{l-1}{12}} * (1+CPI)^{j-r} *_j p_e * v^{j-e} \qquad (27)$$

Disability pension benefit can be calculated as follows:

$$DP_e^{e+m,l} = \frac{AR}{12*m} * \sum_{j=e}^{e+m} \sum_{l=1}^{12} W_{j,l} * \prod_{k=j+1}^{e+m} (1+\pi_k) \qquad (28)$$

where
m: contribution period up to getting disability pension benefit

$DP_e^{e+m,l}$: one month disability pension benefit received in the month "l" for a person starting to work at age "e" and getting disabled at "e+m".

Actuarial present value of disability pension liabilities can be calculated as follows:

$$TDL_e^r = \sum_{j=e+m}^{r-1} {}_j p_e * q_j^d \sum_{k=j}^{100} \sum_{l=1}^{12} DP_e^{k,l} * v^{\frac{l-1}{12}} * (1+CPI)^{k-j} *_k p_j * v^{k-e} \qquad (29)$$

where q_j^d : the probability of getting disabled for a "j" years old person

Actuarial present value of survivor pension liabilities can be calculated as follows:

$$TSL_e^r = \sum_{j=e+o}^{100} {}_j p_e * q_j \sum_{l=1}^{12} SP_e^{j,l} * v^{\frac{l-1}{12}} * HS_j \qquad (30)$$

where
$SP_e^{e+o,l}$: one month survivor pension benefit distributed to survivors in the month "l" for a person starting to work at age "e" and dying at "e+o"
o: contribution period up to getting survivor pension benefit
q_j : the probability of dying for a "j" years old person
HS_j :survivor matrix for a person who dies while working and fulfills the condition of survivor benefit (it includes the ages of each survivor and their survivor benefits so long as they live).

The calculation method for HS_j is as follows:

$$HS_j = \sum_{k=0}^{100} {}_j S_k^{partner} * H_j^{partner} \sum_{z=k}^{100} {}_z p_k^{partner} * v^{j+z-k-e} * (1+CPI)^{z-k}$$

$$+\sum_{k=0}^{100} {}_{j}S_{k}^{d} * H_{j}^{d} \sum_{y=k}^{100} {}_{y}p_{k}^{d} * v^{j+y-k-e} * (1+CPI)^{y-k} \qquad (31)$$
$$+\sum_{k=0}^{100} {}_{j}S_{k}^{s} * H_{j}^{s} \sum_{x=k}^{100} {}_{x}p_{k}^{s} * v^{j+x-k-e} * (1+CPI)^{x-k}$$

where

${}_{j}S_{k}^{partner}$: number of k years old wife/husband of a person dying at "j"

${}_{z}p_{k}^{partner}$: probability of living "z" years for "k" years old wife/husband

$H_{j}^{partner}$: ratio showing how much the wife/husband will receive survivor benefit for a person dying at "j"

${}_{j}S_{k}^{d}$: number of "k" years old daughter of a person dying at "j"

H_{j}^{d} : ratio showing how much daughter will receive survivor benefit for a person dying at "j"

${}_{y}p_{k}^{d}$: probability of living "y" years for "k" years old daughter

${}_{j}S_{k}^{s}$: number of "k" years old son of a person dying at "j"

H_{j}^{s} : ratio showing how much son will receive survivor benefit for a person dying at "j"

${}_{x}p_{k}^{s}$: probability of living "x" years for "k" years old son

The actuarial present value of contribution revenues, old-age, disability and survivor pension liabilities are calculated for the year 2009 when the person firstly starts to work.

4.2. The Effects of New Reform on Sustainability

4.2.1. The Effect on Deficit As a % of GDP

According to the calculations made by using PROST model, revenues and expenditures of the pension system has been projected up to 2075 and deficits of the old and new systems are shown in Figure 13. With the implementation of the new reform, it is estimated that the share of the system deficit in 2075 will drop to 1% of GDP from 5% with a decrease of 4 points. Moreover, the cumulative value of the old system deficit over 2010-2075 will be 294% of GDP whereas with the new reform it will only be 140% of GDP. In other words, the new reform will enable the system to save 154% of GDP. This saving points out a significant development on achieving financial sustainability of the pension system.

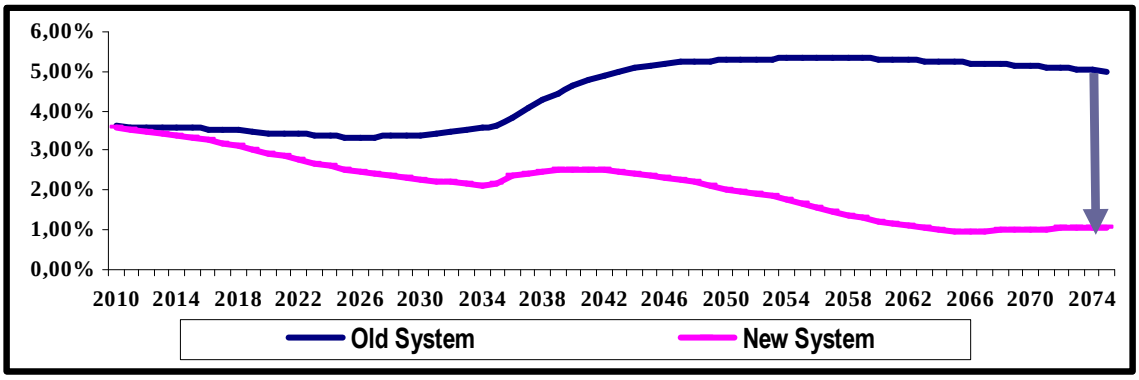

Figure 13: The Deficits of Old and New System as a % of GDP

When we examine the effects of the reforms on deficits implemented by other countries, we can see similar results as in our country. Projections indicate that, in the absence of reform, the pension scheme in Bulgaria will have generated deficits equivalent to 3.4% of GDP by 2050, whereas with the reform implementation in 2000 and 2002 the pension system is projected to generate deficits reaching 2.3% of GDP. In Croatia as a result of the 1998 and 2002 reforms, the deficits of the pension scheme will grow progressively smaller by 2040 and stay in balance in 2050. With the new regulations on the pension system of the Czech Republic, the gap between revenues and expenditures is projected to gradually widen, leading to a deficit equivalent to 2.5% of GDP by 2050 with a decrease of one point compared to old system. In Poland long-term projections suggest that the aging of the population will eventually drive the deficits of the pension system to 6.25% of GDP in the absence of the reform. However, with the transition to a multi-pillar system the pension system is expected to generate a deficit of about 0.8% of GDP in the long term, down from about 6.1% in 2004 (Holzmann and Guven, 2009)

The report of the Economic Policy Committee (2002) prepared by the Working Group on Ageing Populations presents a number of simulations on the quantitative impact of certain changes (parametric reforms) of the basic parameters of public pension systems on pension expenditure. According to this report, the first simulation tries to assess the potential impact on pension expenditure of a reduction in the indexation of pensions by half a percentage point per year. In earnings-related systems such a measure will absorb, on average, approximately 30% of the expected increase in pension expenditure by 2050 (corresponding to a 0.5-2.0 percentage-point decrease in the share of GDP in 2050). In flat-rate systems, the effect of indexation is much greater

than in earnings-related systems (0.6-3.0 percentage points in the share in GDP in 2050).

The results of second simulation shows that a one-year increase in the effective retirement age will on average absorb approximately 20% of the expected increase in pension expenditure by 2050 (assuming no increase in the replacement rate). Roughly speaking, if workers were to work one additional year before retiring, the increase in public expenditure on pensions over the period to 2050 would be reduced, on average, by 0.6 to 1% of GDP. Moreover, the last simulation shows that on average; approximately 45% of the expected increase in pension expenditure in 2050 will be the result of the increased life expectancy**.**

Table 14 shows the overview of the impact of the decomposed factors in terms of percent changes in the Turkish pension system deficits between 2010 and 2075. In 2075, aging alone will push the deficits upwards by 49%, while changes in the retirement age, accrual rate, valorization and other factors will cause 24%, 30%, 57% and 6% cuts respectively. Moreover, the total effect will be 68% reduction in the deficits in 2075.

Table 14: Factors that Change the Deficit of Pension System as a % of GDP in Turkey

Years	Deficit as a % of GDP		% Change	Impact of Decomposed Factors				
	Old System*	New System		Aging	Retirement Age	Accrual Rate	Valorization	Others
2010	3.59%	3.57%	-0.62%	0.7%	0.0%	-0.2%	-1.7%	0.5%
2020	3.31%	2.95%	-11.12%	3.9%	0.0%	-4.0%	-12.0%	1.0%
2030	3.06%	2.26%	-26.20%	10.3%	0.0%	-8.4%	-24.3%	-3.7%
2040	3.94%	2.52%	-36.09%	17.4%	0.0%	-13.6%	-34.7%	-5.2%
2050	4.12%	2.04%	-50.63%	27.9%	-2.0%	-20.4%	-45.0%	-11.1%
2060	3.85%	1.23%	-68.12%	38.2%	-27.3%	-26.3%	-52.5%	-0.2%
2070	3.52%	1.02%	-71.12%	46.0%	-31.4%	-29.3%	-56.1%	-0.4%
2075	3.34%	1.06%	-68.28%	49.1%	-23.9%	-30.1%	-57.0%	-6.4%

*The deficit of the old system based on the assumption of constant fertility rates and probability of dying

According to another paper reviewing the projections of the Economic Policy Committee and the European Commission on age-related expenditure carried out in 2005, public pension spending accounted for an average of about 10.6% of GDP in the EU Member States, though with a wide variation from the lowest – 4.6% in Ireland – to the highest – 14.3% in Italy at the starting point 2004 (Table 15). In the EU15 Member States, public pension spending is projected to rise by 2.3% points of GDP on average and to rise in all countries except in Austria, on account of its reforms since 2000. Very small increases in spending on pensions are projected in Italy and Sweden due to their

NDC schemes. Relatively moderate increases (between 1.5% and 3.5% points of GDP) are projected in most other EU countries, with the largest increases projected for Ireland (6.4% points), Spain (7.1% points), Luxembourg (7.4% points) and Portugal (9.7% points). The projected decreases in Poland, Estonia and Latvia, as well as small projected increases in Lithuania and Slovakia, stem partly from pension reforms enacted during the last 10 years which involve a partial switch of the public old-age pension scheme into private funded schemes.

Table 15 shows an overview of the impact of the decomposed factors in terms of percent changes in public pension expenditure between 2005 and 2050 in EU countries. In almost all countries, the aging weighs on the increase in pension spending by far more than the projected total increase of pensions, while the other factors offset part of the increase coming from the aging of the population. On average, if there were no offsetting factors, demographic pressure alone would push public pension spending upwards by 76% in real terms in the EU25. Public pension expenditure will double from the current level in Spain, Ireland, the Czech Republic, Poland and Slovakia. With the contribution of the offsetting factors, the adverse effect of aging is decreased by around 70% and the total effect is an increase of 21% for EU25.

Table 15: Contribution of the Decomposed Factors to Change in all Public Pensions (2004-2050)

Countries	Public Pension expenditures as a % GDP in 2004	Change in 2004-2050 (%)	Contributions (%)				Deviation (%)
			Aging	Employment	Eligibility	Benefit	
Belgium	10.40%	49.70%	61.60%	-8.20%	-2.40%	-8.10%	6.90%
Denmark	9.60%	33.30%	65.10%	-3.70%	-24.10%	-4.60%	0.60%
Germany	11.10%	17.40%	65.80%	-10.30%	-5.60%	-29.60%	-2.80%
Spain	8.70%	81.40%	105.00%	-19.70%	-17.50%	-1.30%	14.90%
France	12.80%	15.40%	63.60%	-7.00%	-12.90%	-25.70%	-2.70%
Ireland	4.60%	141.90%	107.00%	-9.90%	-20.70%	19.50%	46.00%
Italy	14.30%	2.80%	78.50%	-13.80%	-21.40%	-35.30%	-5.10%
Luxemburg	10.00%	73.70%	56.30%	-31.10%	16.20%	16.80%	15.60%
Holland	7.40%	51.40%	71.90%	-2.10%	-19.30%	-4.30%	5.10%
Austria	13.20%	-7.50%	84.50%	-10.10%	-43.30%	-32.30%	-6.40%
Portugal	11.50%	80.30%	88.50%	-0.90%	-3.90%	-20.10%	16.60%
Finland	10.40%	32.00%	72.90%	-7.70%	-25.20%	-6.00%	-1.90%
Sweden	10.40%	8.50%	45.60%	-6.20%	-2.00%	-26.70%	-2.20%
Cyprus	7.00%	183.50%	94.40%	-16.20%	12.40%	19.80%	73.00%
Czech Republic	8.50%	65.90%	109.30%	-3.60%	-36.80%	-9.10%	6.10%
Estonia	7.10%	-41.40%	60.30%	-7.70%	-26.80%	-73.10%	5.80%
Hungary	10.70%	60.10%	79.40%	-10.30%	-33.40%	16.30%	8.10%
Lithuania	6.70%	28.50%	72.10%	-16.00%	-27.30%	0.10%	-0.40%
Latvia	6.40%	-13.40%	62.70%	-11.10%	-20.60%	-40.70%	-3.70%
Malta	7.50%	-6.40%	80.80%	-13.60%	-10.50%	-53.60%	-9.50%
Poland	13.70%	-41.70%	108.30%	-26.70%	-54.50%	-68.00%	-0.80%
Slovakia	7.40%	20.30%	122.00%	-19.00%	-34.00%	-40.60%	-8.20%
Slovenia	11.00%	66.20%	99.70%	-8.50%	-26.80%	-7.50%	9.30%
EU25*	**10.60%**	**20.90%**	**76.10%**	**-10.70%**	**-20.20%**	**-22.70%**	**-1.90%**

* All EU countries excluding Greece.
Source: Salomaki, 2006

4.2.2. The Effect on ACR

Table 16 compares ACRs for the old and new systems according to gender and different entrance ages to the Turkish pension system by using Commissioners Standard Ordinary (CSO) 2001 life table. ACRs for a male (female) in the old system that enters the system when 20, 25 and 30 years old are 14.5% (16%), 14.9% (16.5%) and 15.4% (16.8%) respectively whereas with the new reform that changes retirement age, valorization and accrual rate parameters explained in the previous section ACRs are 31% (38.3%), 31.5% (39%) and 32.1% (39.7%) respectively.

Table 16: Comparison of ACR for Old-New System

TL	**Entrance Age**		
	Male		
Old System	**30**	**25**	**20**
TCR	72,356	91,888	114,411
TPL	234,883	304,696	392,356
TDL	62,482	80,981	104,776
TSL	171,875	232,755	291,057
ACR	15.42%	14.86%	14.52%
New System	**30**	**25**	**20**
TCR	84,849	106,207	130,843
TPL	90,029	113,259	140,528
TDL	55,885	72,726	92,531
TSL	118,611	150,934	189,254
ACR	32.08%	31.52%	30.98%
	Female		
Old System	**30**	**25**	**20**
TCR	67,137	86,124	108,067
TPL	294,196	384,187	497,640
TDL	53,988	70,462	91,940
TSL	50,949	66,797	86,157
ACR	16.82%	16.52%	15.99%
New System	**30**	**25**	**20**
TCR	85,736	107,499	132,660
TPL	110,956	139,962	174,120
TDL	66,549	86,899	110,985
TSL	38,496	49,052	61,044
ACR	39.69%	38.96%	38.32%

TCR increase in the new system as a result of an increase in the retirement age (65) compared to the old system for both males and females. The reasons for huge decreases in the total old-age pension liabilities (TPL) in the new system stem from shorter retirement periods due to increase in retirement age and cuts in pension levels because of less generous valorization and accrual rates. Despite moving to a less generous system while calculating total disability pension liabilities (TDL) in the new system, there are little reductions due to longer period of getting disabled (7 years more for females and 5 years more for males). Moreover, total survival pension liabilities (TSL) drop in the new system because of less generous pension calculation method. The ACRs in the new system rises by 16 and 22 percentage points for males and females respectively.

In the previous subsection, it is proved that aging will deteriorate the deficits of the pension system. In order to show the adverse effect of aging ACRs have been calculated by using CSO 1958, 1980 and 2001 life tables (Table 17). The probability of dying for each age and gender is the lowest in CSO 2001 life table compared to the other life tables. Therefore all ACRs calculated according to CSO 2001 life table have the lowest figures compared to other life tables. Decrease in probability of dying results in more TCR. However, increase in liabilities offset this positive effect and as a result ACRs shrink. For example, ACRs calculated by using CSO 1958 for a female entering the system when 20, 25 and 30 years old are 50%, 51% and 51.5% in the new system respectively, whereas these figures drop to 38%, 39% and 40% when CSO 2001 is used in the calculations. In other words, ACRs decreases by around 12 percentage points. This clearly shows the adverse effect of aging on sustainability.

Table 17: ACRs for Different CSO Life Tables

	Entrance Age		
	Male		
Old System	**30**	**25**	**20**
CSO 1958	18.39%	17.94%	17.41%
CSO 1980	17.03%	16.57%	16.10%
CSO 2001	15.42%	14.86%	14.52%
New System	**30**	**25**	**20**
CSO 1958	38.62%	38.04%	37.45%
CSO 1980	35.51%	34.96%	34.41%
CSO 2001	32.08%	31.52%	30.98%
	Female		
Old System	**30**	**25**	**20**
CSO 1958	21.08%	20.77%	20.16%
CSO 1980	18.71%	18.41%	17.86%
CSO 2001	16.82%	16.52%	15.99%
New System	**30**	**25**	**20**
CSO 1958	51.49%	50.72%	50.02%
CSO 1980	44.93%	44.21%	43.55%
CSO 2001	39.69%	38.96%	38.32%

While comparing the old and new systems, the factors that contribute to the change in ACRs calculated by using CSO 2001 life table are the new regulations in retirement age, accrual rate and valorization amended by the new law (Table 18). The effects of retirement age and accrual rate lower but the effects of valorization increases as contribution periods get higher. Moreover, the greatest contribution is caused by valorization. For example, ACR for a male entering the system at an age of 20 increases by 113%; 13, 9 and 92 points come from the changes in retirement age, accrual rate and valorization respectively.

The effects caused by the changes in retirement age, accrual rate and valorization are different among males and females. The effect of all parameters for

females stays higher than males. However, the effect of retirement age on ACRs for females is nearly two times higher than those of the males since retirement age increase for females which is 7 years is more than the increase in males. Moreover, the increase in retirement age for females causes more reductions in TPL than males due to higher period spent in retirement for females.

Table 18: The Factors that Contribute to the Changes in ACR

Entrance Age	ACR		Change (%)	Impacts (%)		
	Old System	New System		Retirement Age	Accrual Rate	Valorization
Male						
30	15.42%	32.08%	108.02%	14.18%	20.37%	73.47%
25	14.86%	31.52%	112.16%	14.85%	14.17%	83.14%
20	14.52%	30.98%	113.44%	12.79%	9.04%	91.61%
Female						
30	16.82%	39.69%	135.98%	27.73%	25.22%	83.03%
25	16.52%	38.96%	135.89%	26.98%	16.92%	91.99%
20	15.99%	38.32%	139.64%	26.59%	14.27%	98.79%

The technical interest rate assumption (5%) is increased by one percentage point in order to measure the sensitivity of ACRs to technical interest rate. As a consequence of this change, ACRs for different entrance ages of males and females calculated by using different life tables increase around 30-40% (Table 19). This significantly shows the importance of technical interest rate on the calculations.

Table 19: ACR for 6% Technical Interest Rate

	Entrance Age		
	Male		
Old System	**30**	**25**	**20**
CSO 1958	24.09%	23.96%	23.65%
CSO 1980	22.49%	22.32%	22.05%
CSO 2001	20.60%	20.28%	20.10%
New System	**30**	**25**	**20**
CSO 1958	50.83%	50.92%	50.96%
CSO 1980	47.13%	47.19%	47.23%
CSO 2001	43.06%	43.03%	42.99%
	Female		
Old System	**30**	**25**	**20**
CSO 1958	27.11%	27.22%	26.89%
CSO 1980	24.28%	24.35%	24.03%
CSO 2001	22.08%	22.09%	21.76%
New System	**30**	**25**	**20**
CSO 1958	66.51%	66.65%	66.80%
CSO 1980	58.47%	58.52%	58.58%
CSO 2001	52.22%	52.12%	52.08%

4.3. Alternative Options That Maintain Actuarial Fairness

In the previous subsection, the calculations show that the new reform will maintain more sustainable pension system than the old one but can not achieve actuarial fairness. However, in order to provide actuarial fairness ACR for a person must be 1 which means that the actuarial present value of TCR covers total actuarial present value of TPL, TDL and TSL.

In this subsection, we will try to find accrual rates for each age of males and females that satisfy actuarial fairness. Firstly, we will calculate accrual rates for a person given the entrance age fixed according to each age that makes equation (21) equal to 1. Moreover, we will also find accrual rates that makes ACR equal to 1 for each age assuming that the person pays only the contribution on that age and gets old-age, disability and survival pension benefits based on that contribution.

4.3.1. First Option

In order to calculate accrual rates for each age of a person, we have to formulate accrual rates. Accrual rates for each age can be calculated as follows:

$$ {}_aAR_e^r = \frac{{}_aCR_e^r}{{}_aTPL_e^r + {}_aTDL_e^r + {}_aTSL_e^r} \tag{32} $$

$$ {}_aCR_e^r = k * \sum_{l=1}^{12} W_{e,l} * v^{\frac{l-1}{12}} * (1+CPI)^{a-e} * (1+RWI)^{a-e} * {}_ap_e * v^{a-e} \tag{33} $$

$$ {}_aTPL_e^r = \frac{\sum_{j=r}^{100}\sum_{l=1}^{12}\sum_{n=1}^{12} W_{e,n} * (1+CPI)^{a-e} * (1+RWI)^{a-e} \prod_{k=a+1}^{r-1}(1+\pi_k) * v^{\frac{l-1}{12}} * (1+CPI)^{j-r} {}_jp_e * v^{j-e}}{12} \tag{34} $$

$$ {}_aTDL_e^r = \sum_{j=e+m}^{r-1} {}_jp_e * q_j^d \sum_{k=j}^{100}\sum_{l=1}^{12} {}_aDP_e^{k,l} * v^{\frac{l-1}{12}} * (1+CPI)^{k-j} * {}_kp_j * v^{k-e} \tag{35} $$

$$ {}_aDP_e^{e+m,l} = \frac{1}{12}\sum_{n=1}^{12} W_{e,n} * (1+CPI)^{a-e} * (1+RWI)^{a-e} \prod_{k=a+1}^{e+m}(1+\pi_k) \tag{36} $$

$$ {}_aTSL_e^r = \sum_{j=e+o}^{100} {}_jp_e * q_j \sum_{l=1}^{12} {}_aSP_e^{j,l} * v^{\frac{l-1}{12}} * HS_j \tag{37} $$

$$ {}_aSP_e^{e+o,l} = \frac{1}{12}\sum_{n=1}^{12} W_{e,n} * (1+CPI)^{a-e} * (1+RWI)^{a-e} \prod_{k=a+1}^{e+o}(1+\pi_k) \tag{38} $$

where $e \le a <$r

${}_aAR_e^r$: annual accrual rate calculated considering wages at age “a” only, of a person aged “a”, entering the system at age “e” and retiring at age “r”

${}_aCR_e^r$: actuarial present value of contribution revenues calculated considering wages at age “a” only, of a person aged “a”, starting to work at “e” and retiring at “r”

${}_aTPL_e^r$: actuarial present value of old-age pension liabilities calculated considering wages at age “a” only, of a person aged “a”, starting to work at “e” and retiring at “r”

${}_aTDL_e^r$: actuarial present value of disability pension liabilities calculated considering wages at age “a” only, of a person aged “a”, starting to work at “e” and retiring at “r”

${}_aTSL_e^r$: actuarial present value of survivor pension liabilities calculated considering wages at age "a" only, of a person aged "a", starting to work at "e" and retiring at "r"

${}_aDP_e^{e+m,l}$: one month disability pension benefit received in the month l calculated considering wages at age "a" only, of a person aged "a", starting to work at "e" and getting disabled at "e+m"

${}_aSP_e^{e+o,l}$: one month survivor pension benefit distributed to survivors in the month l calculated considering wages at age "a" only, of a person aged "a", starting to work at "e" and dying at "e+o"

Table 20: Accrual Rates For Each Age of a Male

Ages	Entrance Age 20			Entrance Age 25			Entrance Age 30		
	CSO 1958	CSO 1980	CS0 2001	CSO 1958	CSO 1980	CS0 2001	CSO 1958	CSO 1980	CS0 2001
20	0.61%	0.55%	0.47%						
21	0.61%	0.56%	0.48%						
22	0.62%	0.56%	0.48%						
23	0.62%	0.57%	0.48%						
24	0.63%	0.57%	0.49%						
25	0.63%	0.58%	0.49%	0.63%	0.57%	0.51%			
26	0.64%	0.58%	0.50%	0.64%	0.58%	0.52%			
27	0.65%	0.59%	0.50%	0.64%	0.59%	0.53%			
28	0.65%	0.59%	0.51%	0.65%	0.59%	0.53%			
29	0.66%	0.60%	0.51%	0.65%	0.60%	0.53%			
30	0.66%	0.60%	0.52%	0.66%	0.60%	0.54%	0.67%	0.62%	0.55%
31	0.67%	0.61%	0.52%	0.67%	0.61%	0.55%	0.68%	0.62%	0.55%
32	0.68%	0.62%	0.53%	0.67%	0.62%	0.55%	0.68%	0.63%	0.56%
33	0.69%	0.63%	0.54%	0.68%	0.62%	0.56%	0.69%	0.63%	0.56%
34	0.70%	0.63%	0.54%	0.69%	0.63%	0.56%	0.69%	0.64%	0.57%
35	0.70%	0.64%	0.55%	0.69%	0.64%	0.57%	0.70%	0.64%	0.57%
36	0.71%	0.65%	0.55%	0.70%	0.64%	0.57%	0.71%	0.65%	0.58%
37	0.72%	0.65%	0.56%	0.71%	0.65%	0.58%	0.71%	0.65%	0.58%
38	0.73%	0.66%	0.57%	0.72%	0.66%	0.59%	0.72%	0.66%	0.59%
39	0.74%	0.67%	0.57%	0.73%	0.67%	0.60%	0.73%	0.67%	0.60%
40	0.74%	0.68%	0.58%	0.74%	0.67%	0.60%	0.74%	0.67%	0.60%
41	0.75%	0.69%	0.59%	0.75%	0.68%	0.61%	0.75%	0.68%	0.61%
42	0.76%	0.69%	0.59%	0.76%	0.69%	0.62%	0.75%	0.69%	0.62%
43	0.77%	0.70%	0.60%	0.76%	0.70%	0.63%	0.76%	0.70%	0.62%
44	0.78%	0.71%	0.61%	0.77%	0.71%	0.63%	0.77%	0.71%	0.63%
45	0.79%	0.72%	0.61%	0.78%	0.72%	0.64%	0.78%	0.72%	0.64%
46	0.80%	0.72%	0.62%	0.79%	0.73%	0.65%	0.79%	0.73%	0.65%
47	0.80%	0.73%	0.63%	0.80%	0.73%	0.66%	0.80%	0.73%	0.66%
48	0.81%	0.74%	0.63%	0.81%	0.74%	0.66%	0.81%	0.74%	0.66%
49	0.82%	0.75%	0.64%	0.82%	0.75%	0.67%	0.82%	0.75%	0.67%
50	0.83%	0.75%	0.65%	0.83%	0.76%	0.68%	0.83%	0.76%	0.68%
51	0.83%	0.76%	0.65%	0.84%	0.77%	0.69%	0.84%	0.77%	0.69%
52	0.84%	0.77%	0.66%	0.85%	0.78%	0.69%	0.85%	0.78%	0.69%
53	0.85%	0.77%	0.67%	0.86%	0.78%	0.70%	0.86%	0.78%	0.70%
54	0.85%	0.78%	0.67%	0.86%	0.79%	0.71%	0.86%	0.79%	0.71%
55	0.86%	0.78%	0.68%	0.87%	0.80%	0.71%	0.87%	0.80%	0.71%
56	0.86%	0.78%	0.68%	0.87%	0.80%	0.72%	0.88%	0.80%	0.72%
57	0.86%	0.78%	0.68%	0.88%	0.80%	0.72%	0.88%	0.80%	0.72%
58	0.85%	0.78%	0.68%	0.87%	0.80%	0.72%	0.88%	0.80%	0.72%
59	0.84%	0.77%	0.67%	0.87%	0.80%	0.72%	0.87%	0.80%	0.72%
60	0.83%	0.76%	0.67%	0.85%	0.79%	0.71%	0.86%	0.79%	0.72%
61	0.80%	0.74%	0.65%	0.83%	0.77%	0.70%	0.84%	0.77%	0.70%
62	0.78%	0.72%	0.63%	0.81%	0.75%	0.68%	0.81%	0.75%	0.69%
63	0.74%	0.68%	0.61%	0.77%	0.72%	0.66%	0.78%	0.72%	0.66%
64	0.60%	0.65%	0.58%	0.73%	0.68%	0.63%	0.74%	0.68%	0.63%
TOTAL	**33.36%**	**30.49%**	**26.31%**	**30.51%**	**27.97%**	**25.11%**	**27.39%**	**25.12%**	**22.55%**

Table 21: Accrual Rates For Each Age of a Female

Ages	Entrance Age 20			Entrance Age 25			Entrance Age 30		
	CSO 1958	CSO 1980	CS0 2001	CSO 1958	CSO 1980	CS0 2001	CSO 1958	CSO 1980	CS0 2001
20	0.80%	0.68%	0.59%						
21	0.80%	0.69%	0.60%						
22	0.81%	0.70%	0.60%						
23	0.82%	0.70%	0.61%						
24	0.82%	0.71%	0.61%						
25	0.83%	0.72%	0.62%	0.82%	0.71%	0.62%			
26	0.84%	0.72%	0.63%	0.84%	0.72%	0.63%			
27	0.84%	0.73%	0.63%	0.84%	0.73%	0.63%			
28	0.85%	0.74%	0.64%	0.85%	0.74%	0.64%			
29	0.86%	0.74%	0.64%	0.86%	0.74%	0.65%			
30	0.87%	0.75%	0.65%	0.87%	0.75%	0.65%	0.88%	0.76%	0.66%
31	0.88%	0.76%	0.66%	0.87%	0.76%	0.66%	0.89%	0.77%	0.67%
32	0.89%	0.77%	0.67%	0.88%	0.76%	0.67%	0.90%	0.78%	0.67%
33	0.90%	0.78%	0.67%	0.89%	0.77%	0.67%	0.90%	0.78%	0.68%
34	0.91%	0.79%	0.68%	0.90%	0.78%	0.68%	0.91%	0.79%	0.68%
35	0.92%	0.80%	0.69%	0.91%	0.79%	0.69%	0.92%	0.80%	0.69%
36	0.93%	0.81%	0.70%	0.92%	0.80%	0.69%	0.93%	0.80%	0.70%
37	0.94%	0.82%	0.71%	0.93%	0.80%	0.70%	0.93%	0.81%	0.70%
38	0.95%	0.82%	0.72%	0.94%	0.81%	0.71%	0.94%	0.82%	0.71%
39	0.96%	0.83%	0.73%	0.95%	0.83%	0.72%	0.95%	0.82%	0.72%
40	0.97%	0.84%	0.73%	0.96%	0.84%	0.73%	0.96%	0.83%	0.72%
41	0.99%	0.86%	0.74%	0.98%	0.85%	0.74%	0.97%	0.84%	0.73%
42	1.00%	0.87%	0.75%	0.99%	0.86%	0.75%	0.99%	0.85%	0.74%
43	1.01%	0.88%	0.76%	1.00%	0.87%	0.76%	1.00%	0.86%	0.75%
44	1.02%	0.89%	0.77%	1.01%	0.88%	0.77%	1.01%	0.88%	0.76%
45	1.03%	0.90%	0.78%	1.03%	0.89%	0.78%	1.02%	0.89%	0.77%
46	1.05%	0.91%	0.79%	1.04%	0.90%	0.79%	1.04%	0.90%	0.78%
47	1.06%	0.92%	0.80%	1.05%	0.91%	0.80%	1.05%	0.91%	0.79%
48	1.07%	0.93%	0.81%	1.07%	0.92%	0.81%	1.06%	0.92%	0.80%
49	1.08%	0.94%	0.82%	1.09%	0.94%	0.82%	1.08%	0.93%	0.82%
50	1.10%	0.95%	0.83%	1.10%	0.95%	0.83%	1.10%	0.95%	0.83%
51	1.11%	0.96%	0.84%	1.11%	0.96%	0.84%	1.11%	0.96%	0.84%
52	1.12%	0.97%	0.86%	1.13%	0.97%	0.86%	1.12%	0.97%	0.85%
53	1.13%	0.99%	0.87%	1.14%	0.99%	0.87%	1.14%	0.99%	0.86%
54	1.15%	1.00%	0.88%	1.15%	1.00%	0.88%	1.15%	1.00%	0.87%
55	1.16%	1.01%	0.89%	1.17%	1.01%	0.89%	1.16%	1.01%	0.89%
56	1.17%	1.02%	0.90%	1.18%	1.02%	0.90%	1.17%	1.02%	0.90%
57	1.17%	1.03%	0.91%	1.18%	1.03%	0.91%	1.18%	1.03%	0.91%
58	1.18%	1.03%	0.92%	1.19%	1.04%	0.92%	1.19%	1.04%	0.92%
59	1.17%	1.04%	0.92%	1.19%	1.04%	0.93%	1.19%	1.04%	0.92%
60	1.16%	1.03%	0.92%	1.18%	1.04%	0.93%	1.18%	1.04%	0.92%
61	1.14%	1.02%	0.91%	1.16%	1.03%	0.92%	1.16%	1.03%	0.92%
62	1.11%	1.00%	0.90%	1.13%	1.01%	0.90%	1.13%	1.01%	0.90%
63	1.07%	0.97%	0.88%	1.09%	0.98%	0.88%	1.09%	0.98%	0.88%
64	1.02%	0.93%	0.84%	1.03%	0.94%	0.85%	1.04%	0.94%	0.85%
TOTAL	**44.64%**	**38.93%**	**34.09%**	**40.60%**	**35.32%**	**31.06%**	**36.43%**	**31.73%**	**27.82%**

After using the above equations 30-6, we found accrual rates for both a male and female who enter the system at 20, 25 and 30 by using different life tables (Table 20-21). For example if a male enters the system at an age of 20 and retires at 65, total accrual rate he gains will be 26.31% under CSO 2001, whereas he will get 90% of his valorized average wages as he pays 45 years contribution in the new system. Therefore we can say that accrual rates drop around 64% points compared to the new system. Moreover, by maintaining actuarial fairness, accrual rates are differentiated by each age

and gender. For example a male (female) gets 0.47% (0.59%) when contributing at an age of 20. However, he (she) gets 0.68% (0.92%) at an age of 58.

4.3.2. Second Option

In the second option we try to find accrual rates for different people who have different ages and they only contribute to the system at that age only. In order to calculate accrual rates for different ages, we have to formulate accrual rates. Accrual rates for each age can be calculated as follows:

$$ {}_aAR^r = \frac{{}_aCR}{{}_aTPL^r + {}_aTDL^r + {}_aTSL^r} \tag{39} $$

$$ {}_aCR = k * \sum_{l=1}^{12} W_{a,l} * v^{\frac{l-1}{12}} \tag{40} $$

$$ {}_aTPL^r = \frac{\sum_{j=r}^{100}\sum_{l=1}^{12}\sum_{n=1}^{12} W_{a,n}\prod_{k=a+1}^{r-1}(1+\pi_k) * v^{\frac{l-1}{12}} * (1+CPI)^{j-r}\ {}_jp_a * v^{j-a}}{12} \tag{41} $$

$$ {}_aTDL^r = \sum_{j=a+m}^{r-1} {}_jp_a * q_j^d \sum_{k=j}^{100}\sum_{l=1}^{12} {}_aDP^{k,l} * v^{\frac{l-1}{12}} * (1+CPI)^{k-j} *_k p_j * v^{k-a} \tag{42} $$

$$ {}_aDP^{a+m,l} = \frac{1}{12}\sum_{n=1}^{12} W_{a,n}\prod_{k=a+1}^{a+m}(1+\pi_k) \tag{43} $$

$$ {}_aTSL^r = \sum_{j=a+o}^{100} {}_jp_a * q_j \sum_{l=1}^{12} {}_aSP^{j,l} * v^{\frac{l-1}{12}} * HS_j \tag{44} $$

$$ {}_aSP^{a+o,l} = \frac{1}{12}\sum_{n=1}^{12} W_{a,n}\prod_{k=a+1}^{a+o}(1+\pi_k) \tag{45} $$

where $20 \le a <$r

${}_aAR^r$: annual accrual rate calculated considering wages at age “a” only, for a person aged “a” and retiring at age “r”

${}_aCR^r$: actuarial present value of contribution revenues calculated considering wages at age “a” only, of a person at an age of “a” and retiring at age “r”

${}_aTPL^r$: actuarial present value of old-age pension liabilities calculated considering wages at age “a” only, of a person at an age of “a” and retiring at age “r”

${}_aTDL^r$: actuarial present value of disability pension liabilities calculated considering wages at age “a” only, of a person at an age of “a” and retiring at age “r”

${}_aTSL^r$: actuarial present value of survivor pension liabilities calculated considering wages at age “a” only, of a person at an age of “a” and retiring at age “r”

${}_aDP^{a+m,l}$: one month disability pension benefit received in the month "l" calculated considering wages at age "a" only, of a person at an age of "a" and getting disabled at "a+m" and retiring at age "r"

${}_aSP^{a+o,l}$: one month survivor pension benefit distributed to survivors in the month "l" calculated considering wages at age "a" only, of a person at an age of "a" and dying at "a+o" and retiring at age "r"

Table 22: Accrual Rates For Each Age

Ages	Male			Female		
	CSO 1958	CSO 1980	CS0 2001	CSO 1958	CSO 1980	CS0 2001
20	0.61%	0.55%	0.47%	0.80%	0.68%	0.59%
21	0.62%	0.56%	0.48%	0.80%	0.69%	0.60%
22	0.62%	0.57%	0.48%	0.81%	0.70%	0.60%
23	0.63%	0.57%	0.49%	0.82%	0.71%	0.61%
24	0.64%	0.58%	0.49%	0.83%	0.72%	0.62%
25	0.64%	0.58%	0.50%	0.84%	0.72%	0.62%
26	0.65%	0.59%	0.50%	0.85%	0.73%	0.63%
27	0.66%	0.60%	0.51%	0.86%	0.74%	0.64%
28	0.67%	0.61%	0.51%	0.87%	0.75%	0.65%
29	0.68%	0.61%	0.52%	0.88%	0.76%	0.65%
30	0.68%	0.62%	0.53%	0.89%	0.77%	0.66%
31	0.69%	0.63%	0.53%	0.90%	0.78%	0.67%
32	0.70%	0.64%	0.54%	0.91%	0.79%	0.68%
33	0.71%	0.65%	0.55%	0.93%	0.80%	0.69%
34	0.72%	0.66%	0.55%	0.94%	0.81%	0.70%
35	0.73%	0.66%	0.56%	0.95%	0.83%	0.71%
36	0.74%	0.67%	0.57%	0.97%	0.84%	0.72%
37	0.75%	0.68%	0.58%	0.98%	0.85%	0.73%
38	0.77%	0.70%	0.59%	1.00%	0.86%	0.74%
39	0.78%	0.71%	0.60%	1.01%	0.88%	0.75%
40	0.79%	0.72%	0.60%	1.03%	0.89%	0.77%
41	0.81%	0.73%	0.61%	1.05%	0.91%	0.78%
42	0.82%	0.74%	0.63%	1.07%	0.92%	0.79%
43	0.84%	0.76%	0.64%	1.09%	0.94%	0.81%
44	0.85%	0.77%	0.65%	1.12%	0.96%	0.83%
45	0.87%	0.79%	0.66%	1.15%	0.99%	0.85%
46	0.89%	0.81%	0.68%	1.18%	1.02%	0.88%
47	0.91%	0.83%	0.70%	1.22%	1.05%	0.91%
48	0.94%	0.85%	0.72%	1.26%	1.09%	0.94%
49	0.97%	0.88%	0.74%	1.30%	1.13%	0.98%
50	1.00%	0.90%	0.77%	1.36%	1.18%	1.02%
51	1.03%	0.93%	0.79%	1.41%	1.23%	1.07%
52	1.07%	0.97%	0.82%	1.47%	1.28%	1.12%
53	1.10%	1.00%	0.85%	1.53%	1.34%	1.17%
54	1.13%	1.03%	0.88%	1.59%	1.39%	1.23%
55	1.16%	1.06%	0.90%	1.64%	1.44%	1.28%
56	1.17%	1.06%	0.91%	1.63%	1.43%	1.27%
57	1.18%	1.07%	0.91%	1.61%	1.41%	1.26%
58	1.18%	1.07%	0.91%	1.58%	1.39%	1.24%
59	1.17%	1.06%	0.90%	1.55%	1.36%	1.21%
60	1.16%	1.06%	0.89%	1.51%	1.32%	1.17%
61	1.17%	1.06%	0.90%	1.47%	1.28%	1.14%
62	1.17%	1.06%	0.90%	1.41%	1.23%	1.09%
63	1.16%	1.05%	0.89%	1.35%	1.17%	1.04%
64	1.12%	1.02%	0.86%	1.19%	1.04%	0.92%

After using the above equations 37-43, we found accrual rates for both a male and female by using different life tables (Table 22). For example if a male enters the

system at an age of 20 (30), only contributes at that age and the benefits are calculated considering the wages at that age by using CSO 2001, he will get only 0.47% (0.53). The accrual rate gained by contributing at 58 nearly doubles compared to 20 for both males and females. Since the benefits get lower when entering at older ages, accrual rates gets higher.

As a result, as we calculate accrual rates that ensure actuarial fairness, we easily notice that cumulative accrual rates fall but it starts to increase when continuing to work more. Therefore, this will enable people to work formally for longer periods.

All these calculations are done by using the assumptions explained in Appendix 3. If these assumptions change all these accrual rates will also differ. Therefore each year, SSI has to revise these rates based on the new variables such as new life tables, new dependent data, new CPI, new probabilities of getting disabled, new technical interest rate and GDP growth. For example, if probability of getting disabled decreases, so do disability pension liabilities and so forth accrual rate increases.

5. CONCLUSION

Since the early 1980s, pension reform has been high on the agenda in many OECD countries. Governments have either undertaken far-reaching structural pension reforms or adopted a series of smaller parametric reforms which affect future pension entitlements substantially. These reforms, like pension systems themselves, have had many diverse and complex features. They have included increases in pension ages, changes in the way that benefits are calculated and smaller real pension increases than in the past. However, despite the different approaches, there is a clear underlying trend towards a reduced pension promise for today's workers, when compared with past generations. This is necessary to ensure the financial sustainability of pension systems for both current and future retirees.

In Turkey, pension reform is a subject of hot debate as it has been all around the world. Moreover, it has been stated by the most of the public that the system could not have been sustainable as long as it had gone on existing situation and so it has to be restructured. In fact, as a consequence of the problems explained in the third section, Turkey felt the need to carry out a reform on the pension system in 1999. Due to the inefficiencies of that reform on sustainability, another reform called Social Insurance and Universal Health Insurance Law has been enacted on 1 October 2008.

In order to show the effects of new reform on sustainability, some projections have been made by using PROST model. These projections state that the cumulative value of the saving over 2010-2075 will be 154% of GDP as a result of this new reform. This saving points out a significant development on achieving financial sustainability in the pension system. Projections also show that aging alone will push the deficits upwards by 49% in 2075. This clearly shows the adverse effect of aging on sustainability. Moreover, in the new system ACRs showing the actuarial fairness of the pension system improve by more than 50% compared to the old system. However, it is not enough to achieve actuarial fairness since the individual contribution revenues can not cover the future pension liabilities.

Accrual rates for each age of a person ensuring actuarial fairness were calculated and it is estimated that the accrual rate for a male and a female working 45 years drops by 64% and 56% points respectively compared to the new system. Furthermore, the

results obtained by calculating accrual rates for different people who have different ages point out that the older the person enters the system the more accrual rate he/she gets. For example, the accrual rate gained by contributing at 58 nearly doubles compared to 20 for both males and females. Since the benefits get lower when entering at older ages, accrual rates gets higher.

It has been accepted by most of the public that pension reform legislations in nearly all countries are politically difficult for governments since they exert great political pressure. However, most of the countries implement these reforms according to their specific needs and as occasion may require they can apply the new rules to all groups without taking into consideration the gradual transition. Some countries put into practice structural reforms on behalf of adopting one regulation in order to respond demographic changes. Therefore, they get rid of making new regulations in the forthcoming years.

Since the latest pension reform in Turkey achieves financial sustainability to some extend (in 2075 the pension system will still run deficits) but not actuarial fairness, it is inevitiable to implement new reforms in the near future. Moreover, accrual rates calculation method based on ensuring actuarial fairness will enable the system to get less generous and urge people working formally more to receive higher benefits. As a result, it will be of great importance for Turkey to carry out new reforms in the future so as to maintain financial sustainability and actuarial fairness, build automatic link between pensions and life expectancy and promote people to work formally for longer periods.

REFERENCES

Barr N. and P. Diamond, 2006, The Economics of Pensions, Oxford Review of Economic Policy, Volume 22 No:1, pp 16-20

Bonoli G., 1997, Classifying Welfare State: A Two-dimension Approach, Journal of Social Policy, 26, 3, pp 351-372, Cambridge University Press

Bonoli, G., 2000, The Politics of Pension Refornm: Institutions and Policy Change in Western Europe, Cambridge, U.K., Cambridge University Press.

Bowers L. N., H. U. Gerber, J. C. Hickman, D. A. James and C. J. Nesbitt, 1997, Actuarial Mathematics, Society of Actuaries, pp. 143-4

Brook A., and E. Whitehouse, 2006, The Turkish Pension System: Further Reforms To Solve the Informality Problem, OECD Economics Department Working Papers, No:529, OECD Publishing

Economic Policy Committee and the European Commission, 2006, The Impact of Ageing on Public Expenditure: Projections for the EU-25 Member States on Pensions, Health Care, Long-Term Care, Education and Unemployment Transfers (2004-2050), European Economy, Special Reports, No 1/2006

European Commission, 2007, Pension Schemes and Projections in EU-25 Member States, European Economy, Occasional Papers, No:35

European Commission, 2008, Living Conditions In Europe Data 2003-06

Hamann A. J., 1997, The Reform of Pension System in Italy, Working Paper, No: 97/18, International Monetary Fund, Washington, DC

Holzmann, R., L. MacKellar and M. Rutkowski, 2003, Accelerating the European Pension Reform Agenda: Need, Progress, and Conceptual Underpinnings, Pension Reform in Europe: Process and Progress, World Bank, Washington, pp.1-45

Holzmann, R. and U. Güven, 2009, Adequacy of Retirement Income After Pension Reforms in Central, Eastern and Southern Europe, World Bank, Washington

ILO, 1944, The Twenty-Sixth Session of the International Labor Conference, Philadelphia, April-May 1944, International Labor Review 50(1/July), pp. 1-39

Latulippe, D., 1996, Effective Retirement Age and Duration of Retirement in the Industrial Countries between 1950 and 1990, ILO Issues in Social Protection Discussion Paper No. 2

Louzek M., 2008, Pension System Reform in Central and Eastern Europe, Post Communist Economies, Volume 20, No:1, pp 121-122

Mc Morrow, K. and W. Roeger, 2002, EU Pension Reform- An Overview of the Debate and an Emprical Assessment of the Main Policy Reform Options, Economic Papers, European Commission Directorate-General for Economic and Financial Affairs, No.162; pp. 1-20

OECD, 2007, Pensions At A Glance Public Policies Accross OECD Countries, Paris

OECD, 2008, Pension Reform: Providing Old-Age Income Security in the Face of Population Ageing, Reforms for Stability and Sustainable Growth, Paris

Orenstein M., 2003, Mapping the Diffusion of Pension Innovation, Pension Reform in Europe: Process and Progress, World Bank, Washington, pp. 171-193

Peker A., 1997, Sosyal Güvenlik Sisteminin Yeniden Yapılandırılması Tartışmaları ve Çözüm Önerileri, Discussion Papers, Research and Monetary Policy Department, Central Bank of Republic of Turkey, pp 1-4

Salomaki, A., 2006, Public Expenditure in the EPC and the European Commission Projections: an Analysis of the Projection Results, European Economy, Economic Papers, No.268

Schwarz A. M., 2006, Pension Systems Reforms, Social Protection Discussion Paper No: 0608, World Bank

Social Security Administration, 2006, Social Security Programs Throughout the World: Europe, SSA Publication, No:13-11801, Washington

SSI, 2008, 2007 Yılı İstatistik Bülteni

SSI, 2009, SGK 2009 Mart İstatistik Bülteni

TÜİK, 2006, 2005 Gelir Dağılımı Sonuçları

TÜİK, 2009, Adrese Dayalı Nüfus Kayıt Sistemi 2008 Nüfus Sayımı Sonuçları

TÜİK, 2009, Hanehalkı İşgücü Araştırması 2009 Ocak Dönemi Sonuçları

United Nations, Population Projections, Economic and Social Relations Department, Population Unit, 2006

Werding, M., 2003, After Another Decade of Reform: Do Pension Systems in Europe Converge?, CESifo DICE Report 1/2003

Whiteford, P. and E.R. Whitehouse, 2006, Pension Challenges and Pension Reforms in OECD Countries, Oxford Review of Economic Policy, Vol. 22, No. 1, pp. 78–94.

Whitehouse E. R. and M. Queisser, 2006, Neutral or Fair? Actuarial Concepts and Pension System-Design, Social, Employment and Migration Working Paper, No: 60, OECD, Paris

Whitehouse E. R., 2007, Pension Panorama: Retirement-Income Systems in 53 Countires, World Bank, Washington

Whitehouse E. R., 2007, Life-expectancy Risk and Pensions: Who Bears the Burden?, Social, Employment and Migration Working Paper, No: 60, OECD, Paris

World Bank, 1994, Adverting the Old Age Crisis, New York, Oxford University Press

APPENDIX

Appendix 1: Current 2008 Value of Budgetary Transfers

Table 23: Budgetary Transfers and Interest Rate on Treasury Bills

Years	Budgetary Transfers (Million YTL)	Interest Rate	1+Interest Rate	Valorization	Current 2008 Value (Million YTL)
1994	39	158.0%	2.58	2,135.54	83,307
1995	108	123.2%	2.23	827.60	89,546
1996	335	134.2%	2.34	370.83	124,340
1997	740	124.5%	2.25	158.34	117,174
1998	1,496	115.5%	2.16	70.53	105,513
1999	2,936	109.6%	2.10	32.72	96,078
2000	3,226	36.2%	1.36	15.61	50,377
2001	5,523	99.6%	2.00	11.46	63,314
2002	9,684	62.7%	1.63	5.74	55,619
2003	15,884	46.0%	1.46	3.53	56,071
2004	18,830	24.7%	1.25	2.42	45,528
2005	23,322	16.3%	1.16	1.94	45,219
2006	22,892	18.1%	1.18	1.67	38,165
2007	33,060	18.4%	1.18	1.41	46,670
2008	35,016	19.2%	1.19	1.19	41,749
TOPLAM	**173,093**				**1,058,669**

Appendix 2: Basic Assumptions of PROST Model

Demographic assumptions of PROST model are population structure for males and females, fertility rates for each age of females, probability of dying multiplier for each age and gender and life expectancy (Table 24). Population projections based on TUIK's 2007 population figures are calculated by considering fertility rates and probability of dying for each age.

Macroeconomic assumptions consist of nominal and reel GDP, CPI, GDP growth, reel wage increase, labor participation and unemployment rates (Table 25). Model assumes that CPI is zero for all years. It is also assumed that labor participation rate will increase by 10% for males and 50% for females between 2010 and 2075. Moreover, unemployment is forecasted to decrease by 50% and 37% for 20-30 years old females.

Table 24: Demographic Assumptions of PROST Model

	2007	2015	2030	2045	2060	2075
Total Population (Thousands)	70,586	76,835	86,768	93,708	97,690	100,010
Female	35,210	38,292	43,382	47,134	49,388	50,696
Male	35,377	38,542	43,386	46,574	48,303	49,314
0-14 Population/ Total Population	26.41%	24.07%	21.61%	19.99%	19.25%	18.83%
Female	25.76%	23.61%	21.24%	19.52%	18.69%	18.22%
Male	27.05%	24.52%	21.99%	20.47%	19.83%	19.46%
15-64 Population/ Total Population	66.51%	68.43%	67.16%	64.07%	61.64%	60.69%
Female	66.14%	67.96%	66.46%	63.03%	60.42%	59.41%
Male	66.87%	68.91%	67.87%	65.12%	62.88%	62.00%
65+ Population/ Total Population	7.08%	7.50%	11.23%	15.94%	19.11%	20.48%
Female	8.09%	8.43%	12.30%	17.45%	20.88%	22.37%
Male	6.08%	6.57%	10.15%	14.41%	17.29%	18.53%
Gross Birth Rate	1.99%	1.68%	1.52%	1.36%	1.31%	1.26%
Gross Death Rate	0.65%	0.66%	0.76%	0.94%	1.08%	1.07%
Life Expectancy (Year)						
Female						
At Birth	72.6	74.0	76.3	78.0	79.4	80.7
At 65	14.4	14.9	15.8	16.5	17.3	17.9
Male						
At Birth	68.1	69.4	71.8	73.4	74.8	76.1
At 65	12.7	13.1	13.7	14.4	15.0	15.5

Table 25: Macroeconomic Assumptions of PROST Model

	2007	2015	2030	2045	2060	2075
Nominal GDP (Million TL)	853,636	1,168,260	2,103,970	3,789,132	6,824,013	12,289,661
Reel GDP (Million YTL)	853,636	1,168,260	2,103,970	3,789,132	6,824,013	12,289,661
CPI	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
GDP Growth	4.6%	4.0%	4.0%	4.0%	4.0%	4.0%
Reel Wage Increase	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%

Appendix 3: Assumptions of ACR

The factors determining the change in ACR consist of retirement age, accrual rate and valorization, whereas most significant assumptions used in the calculation of ACR are technical interest rate, GDP growth, CPI and reel wage increase. Technical interest rate is used for converting liabilities and assets of the system into a specified year and is taken 5% for each year. Moreover, CPI not only determines the pension level but also is used for calculating the wage increase and is assumed 5% for each year. Reel wage increase is forecasted to stay constant at 3%. GDP growth used in the benefit calculation is estimated to be 4% (Table 26).

The ages of each insurer's dependents and the shares received used in the calculation of ACR is found according to death data for SSK between 2002 and 2007 (Table 28-9). Moreover, probability of leaving the system except dying for sons and daughters are calculated according to SSK data. Probability of dying multiplier for males and females are included in the calculation based on CSO 1958, 1980 and 2001 life tables. Probability of getting disabled for each age is obtained from Heubeck-Fisher 1949 Disability Tables (Table 27).

Table 26: Basic Assumptions Used in the Calculation of ACR

Years	Technical Interest Rate	CPI	Reel Wage Increase	GDP Growth	Minimum Wage Level (TL)
2009	5%	5%	3%	4.00%	691
2010	5%	5%	3%	4.00%	747
2011	5%	5%	3%	4.00%	808
2012	5%	5%	3%	4.00%	874
2013	5%	5%	3%	4.00%	945
2014	5%	5%	3%	4.00%	1,022
2015	5%	5%	3%	4.00%	1,105
2016	5%	5%	3%	4.00%	1,195
2017	5%	5%	3%	4.00%	1,293
2018	5%	5%	3%	4.00%	1,398
2019	5%	5%	3%	4.00%	1,512
2020	5%	5%	3%	4.00%	1,635
2021	5%	5%	3%	4.00%	1,769
2022	5%	5%	3%	4.00%	1,913
2023	5%	5%	3%	4.00%	2,069
2024	5%	5%	3%	4.00%	2,237
2025	5%	5%	3%	4.00%	2,420
2026	5%	5%	3%	4.00%	2,617
2027	5%	5%	3%	4.00%	2,830
2028	5%	5%	3%	4.00%	3,061
2029	5%	5%	3%	4.00%	3,310
2030	5%	5%	3%	4.00%	3,580
2031	5%	5%	3%	4.00%	3,872
2032	5%	5%	3%	4.00%	4,187
2033	5%	5%	3%	4.00%	4,529
2034	5%	5%	3%	4.00%	4,898
2035	5%	5%	3%	4.00%	5,297
2036	5%	5%	3%	4.00%	5,728
2037	5%	5%	3%	4.00%	6,195
2038	5%	5%	3%	4.00%	6,700
2039	5%	5%	3%	4.00%	7,246

(Cont.)					
2040	5%	5%	3%	4.00%	7,837
2041	5%	5%	3%	4.00%	8,476
2042	5%	5%	3%	4.00%	9,166
2043	5%	5%	3%	4.00%	9,913
2044	5%	5%	3%	4.00%	10,721
2045	5%	5%	3%	4.00%	11,595
2046	5%	5%	3%	4.00%	12,540
2047	5%	5%	3%	4.00%	13,562
2048	5%	5%	3%	4.00%	14,668
2049	5%	5%	3%	4.00%	15,863
2050	5%	5%	3%	4.00%	17,156
2051	5%	5%	3%	4.00%	18,554
2052	5%	5%	3%	4.00%	20,066
2053	5%	5%	3%	4.00%	21,702
2054 and onwards	5%	5%	-	-	-

Table 27: Probability of Dying, Getting Disabled and Leaving the System Except Dying

Age	**Probability of dying (%)**						**Probability of getting Disabled (%)**		**Probability of leaving the system except dying (%)**	
	CSO 1958		**CSO 1980**		**CSO 2001**		**Heubeck Fisher 1949**			
	Female	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Daughter**	**Son**
0	0.62%	0.71%	0.29%	0.42%	0.05%	0.10%	-	-	0.00%	0.00%
1	0.17%	0.18%	0.09%	0.11%	0.04%	0.06%	-	-	0.00%	0.00%
2	0.14%	0.15%	0.08%	0.10%	0.03%	0.04%	-	-	0.00%	0.00%
3	0.13%	0.15%	0.08%	0.10%	0.02%	0.03%	-	-	0.00%	0.00%
4	0.13%	0.14%	0.08%	0.10%	0.02%	0.02%	-	-	0.00%	0.00%
5	0.12%	0.13%	0.08%	0.09%	0.02%	0.02%	-	-	0.00%	0.00%
6	0.12%	0.13%	0.07%	0.09%	0.02%	0.02%	-	-	0.00%	0.00%
7	0.11%	0.13%	0.07%	0.08%	0.02%	0.02%	-	-	0.00%	0.00%
8	0.11%	0.12%	0.07%	0.08%	0.02%	0.02%	-	-	0.00%	0.00%
9	0.11%	0.12%	0.07%	0.07%	0.02%	0.02%	-	-	0.00%	0.00%
10	0.11%	0.12%	0.07%	0.07%	0.02%	0.02%	-	-	0.00%	0.00%
11	0.11%	0.12%	0.07%	0.08%	0.02%	0.03%	-	-	0.00%	0.00%
12	0.11%	0.13%	0.07%	0.09%	0.03%	0.03%	-	-	0.00%	0.00%
13	0.12%	0.13%	0.08%	0.10%	0.03%	0.04%	-	-	0.00%	0.00%
14	0.12%	0.14%	0.08%	0.11%	0.03%	0.05%	-	-	0.00%	0.00%
15	0.13%	0.15%	0.09%	0.13%	0.04%	0.06%	-	-	0.00%	0.00%
16	0.13%	0.15%	0.09%	0.15%	0.04%	0.07%	-	-	0.00%	0.00%
17	0.14%	0.16%	0.10%	0.17%	0.04%	0.09%	-	-	0.00%	0.00%
18	0.15%	0.17%	0.10%	0.18%	0.04%	0.09%	-	-	17.36%	70.68%
19	0.15%	0.17%	0.10%	0.19%	0.05%	0.10%	-	-	0.00%	0.00%
20	0.16%	0.18%	0.11%	0.19%	0.05%	0.10%	0.10%	0.10%	12.57%	18.94%
21	0.17%	0.18%	0.11%	0.19%	0.05%	0.10%	0.10%	0.10%	15.39%	0.32%
22	0.17%	0.19%	0.11%	0.19%	0.05%	0.10%	0.10%	0.10%	16.98%	8.83%
23	0.18%	0.19%	0.11%	0.19%	0.05%	0.10%	0.10%	0.10%	18.71%	14.32%
24	0.18%	0.19%	0.11%	0.18%	0.05%	0.11%	0.11%	0.11%	20.24%	24.87%
25	0.19%	0.19%	0.12%	0.18%	0.05%	0.11%	0.11%	0.11%	18.91%	90.31%
26	0.19%	0.20%	0.12%	0.17%	0.06%	0.11%	0.11%	0.11%	0.00%	0.00%
27	0.19%	0.20%	0.12%	0.17%	0.06%	0.12%	0.12%	0.12%	13.52%	2.06%
28	0.19%	0.20%	0.13%	0.17%	0.06%	0.12%	0.12%	0.12%	11.40%	0.98%
29	0.20%	0.21%	0.13%	0.17%	0.07%	0.12%	0.12%	0.12%	9.16%	0.62%
30	0.20%	0.21%	0.13%	0.17%	0.07%	0.11%	0.12%	0.12%	0.00%	0.00%
31	0.20%	0.22%	0.14%	0.18%	0.07%	0.11%	0.13%	0.13%	4.95%	0.87%
32	0.21%	0.23%	0.14%	0.18%	0.08%	0.11%	0.14%	0.14%	4.09%	2.75%
33	0.21%	0.23%	0.15%	0.19%	0.08%	0.12%	0.15%	0.15%	1.83%	3.90%
34	0.22%	0.24%	0.16%	0.20%	0.09%	0.12%	0.17%	0.17%	4.43%	3.04%
35	0.22%	0.25%	0.17%	0.21%	0.10%	0.12%	0.19%	0.19%	1.42%	2.22%
36	0.23%	0.26%	0.18%	0.22%	0.10%	0.13%	0.21%	0.21%	2.62%	3.79%
37	0.24%	0.28%	0.19%	0.24%	0.11%	0.13%	0.24%	0.24%	0.00%	3.26%
38	0.25%	0.30%	0.20%	0.26%	0.12%	0.14%	0.26%	0.26%	0.54%	2.48%
39	0.26%	0.32%	0.22%	0.28%	0.12%	0.15%	0.28%	0.28%	0.00%	2.91%
40	0.28%	0.35%	0.24%	0.30%	0.13%	0.17%	0.31%	0.31%	0.00%	2.09%
41	0.30%	0.38%	0.26%	0.33%	0.14%	0.18%	0.34%	0.34%	0.14%	1.80%

(Cont)

42	0.32%	0.42%	0.29%	0.36%	0.15%	0.20%	0.37%	0.37%	0.00%	1.88%
43	0.35%	0.45%	0.31%	0.39%	0.16%	0.22%	0.40%	0.40%	0.00%	3.20%
44	0.38%	0.49%	0.33%	0.42%	0.17%	0.24%	0.43%	0.43%	0.00%	0.00%
45	0.42%	0.53%	0.36%	0.46%	0.19%	0.27%	0.47%	0.47%	0.00%	1.98%
46	0.45%	0.58%	0.38%	0.49%	0.21%	0.29%	0.52%	0.52%	0.00%	2.65%
47	0.49%	0.64%	0.41%	0.53%	0.23%	0.32%	0.60%	0.60%	0.00%	1.99%
48	0.53%	0.70%	0.43%	0.57%	0.25%	0.33%	0.68%	0.68%	0.00%	1.01%
49	0.58%	0.76%	0.46%	0.62%	0.28%	0.35%	0.78%	0.78%	0.00%	4.69%
50	0.64%	0.83%	0.50%	0.67%	0.31%	0.38%	0.91%	0.91%	0.00%	3.12%
51	0.70%	0.91%	0.53%	0.73%	0.34%	0.41%	1.08%	1.08%	0.00%	2.27%
52	0.76%	1.00%	0.57%	0.80%	0.38%	0.45%	1.30%	1.30%	0.00%	9.26%
53	0.83%	1.09%	0.61%	0.87%	0.42%	0.49%	1.55%	1.55%	0.00%	2.92%
54	0.91%	1.19%	0.66%	0.96%	0.46%	0.55%	1.86%	1.86%	0.00%	5.54%
55	1.00%	1.30%	0.71%	1.05%	0.51%	0.62%	2.25%	2.25%	0.00%	7.62%
56	1.09%	1.42%	0.76%	1.15%	0.56%	0.69%	2.72%	2.72%	0.00%	2.81%
57	1.19%	1.55%	0.80%	1.25%	0.62%	0.76%	3.29%	3.29%	0.00%	5.42%
58	1.30%	1.70%	0.85%	1.36%	0.68%	0.83%	3.94%	3.94%	0.00%	6.58%
59	1.42%	1.86%	0.89%	1.48%	0.74%	0.90%	4.70%	4.70%	0.00%	0.00%
60	1.55%	2.03%	0.95%	1.61%	0.80%	0.99%	5.45%	5.45%	0.21%	7.16%
61	1.70%	2.22%	1.01%	1.75%	0.87%	1.09%	6.17%	6.17%	2.25%	2.04%
62	1.86%	2.43%	1.10%	1.92%	0.94%	1.23%	7.04%	7.04%	0.19%	6.41%
63	2.03%	2.66%	1.20%	2.11%	1.01%	1.37%	7.91%	7.91%	0.77%	8.73%
64	2.22%	2.90%	1.33%	2.31%	1.10%	1.52%	8.81%	8.81%	1.12%	3.89%
65	2.43%	3.18%	1.46%	2.54%	1.19%	1.69%	9.75%	9.75%	2.09%	6.58%
66	2.66%	3.47%	1.60%	2.79%	1.28%	1.85%	-	-	2.36%	6.05%
67	2.90%	3.80%	1.74%	3.04%	1.39%	2.01%	-	-	1.00%	1.30%
68	3.17%	4.17%	1.88%	3.32%	1.51%	2.19%	-	-	2.41%	5.53%
69	3.47%	4.56%	2.04%	3.62%	1.64%	2.36%	-	-	2.68%	6.56%
70	3.80%	4.98%	2.21%	3.95%	1.78%	2.58%	-	-	1.28%	8.88%
71	4.17%	5.42%	2.42%	4.33%	1.95%	2.82%	-	-	3.19%	4.27%
72	4.56%	5.86%	2.69%	4.77%	2.13%	3.13%	-	-	2.88%	14.90%
73	4.98%	6.33%	3.01%	5.26%	2.33%	3.46%	-	-	3.98%	3.57%
74	5.42%	6.81%	3.39%	5.82%	2.55%	3.81%	-	-	4.27%	7.06%
75	5.87%	7.34%	3.82%	6.42%	2.79%	4.19%	-	-	4.04%	12.79%
76	6.33%	7.92%	4.30%	7.05%	3.05%	4.61%	-	-	1.27%	11.76%
77	6.81%	8.57%	4.80%	7.71%	3.34%	5.09%	-	-	2.81%	22.95%
78	7.34%	9.31%	5.35%	8.39%	3.66%	5.66%	-	-	0.20%	10.15%
79	7.92%	10.12%	5.94%	9.11%	4.01%	6.31%	-	-	3.43%	11.61%
80	8.57%	11.00%	6.60%	9.88%	4.39%	7.01%	-	-	4.54%	32.56%
81	9.31%	11.93%	7.36%	10.75%	4.91%	7.82%	-	-	0.00%	0.00%
82	10.12%	12.92%	8.24%	11.73%	5.50%	8.65%	-	-	0.00%	0.00%
83	11.00%	13.94%	9.25%	12.83%	6.08%	9.55%	-	-	0.00%	0.00%
84	11.94%	15.00%	10.38%	14.03%	6.73%	10.54%	-	-	0.00%	0.00%
85	12.92%	16.11%	11.61%	15.30%	7.45%	11.66%	-	-	0.00%	0.00%
86	13.94%	17.28%	12.93%	16.61%	8.10%	12.89%	-	-	0.00%	0.00%
87	15.00%	18.51%	14.33%	17.96%	9.08%	14.24%	-	-	0.00%	0.00%
88	16.11%	19.82%	15.82%	19.33%	10.11%	15.67%	-	-	0.00%	0.00%
89	17.28%	21.25%	17.39%	20.73%	11.20%	17.19%	-	-	0.00%	0.00%
90	18.51%	22.81%	19.08%	22.18%	12.19%	18.77%	-	-	0.00%	0.00%
91	19.83%	24.58%	20.89%	23.70%	12.69%	20.24%	-	-	0.00%	0.00%
92	21.25%	26.59%	22.88%	25.35%	13.69%	21.78%	-	-	0.00%	0.00%
93	22.81%	28.93%	25.15%	27.21%	15.16%	23.40%	-	-	0.00%	0.00%
94	24.58%	31.67%	27.93%	29.59%	17.03%	25.11%	-	-	0.00%	0.00%
95	26.59%	35.12%	31.73%	33.00%	19.37%	26.92%	-	-	0.00%	0.00%
96	28.93%	40.06%	37.57%	38.46%	21.57%	28.56%	-	-	0.00%	0.00%
97	31.67%	48.84%	47.50%	48.02%	23.85%	30.32%	-	-	0.00%	0.00%
98	35.12%	66.81%	65.59%	65.80%	24.22%	32.19%	-	-	0.00%	0.00%
99	40.06%	100.00%	100.00%	100.00%	25.52%	34.19%	-	-	0.00%	0.00%
100	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	-	0.00%	0.00%

Table 28: Dependent Data for Females

Age	Age of Dependent			Share Received			
	Husband	Daughter	Son	Husband	Daughter	Son	Total
25	31	2	2	2%	0%	1%	3%
26	30	4	5	3%	1%	1%	5%
27	30	4	4	3%	2%	1%	6%
28	31	5	4	5%	2%	1%	8%
29	33	6	5	6%	3%	4%	12%
30	34	5	5	7%	3%	3%	13%
31	34	4	7	9%	4%	5%	17%
32	35	6	7	11%	4%	5%	20%
33	37	9	7	11%	6%	5%	22%
34	37	8	9	8%	6%	5%	18%
35	38	9	9	16%	9%	10%	35%
36	39	10	10	14%	8%	9%	31%
37	41	11	11	16%	11%	10%	38%
38	42	12	11	17%	12%	11%	40%
39	41	13	12	19%	12%	11%	42%
40	44	13	12	18%	12%	10%	40%
41	45	14	13	21%	13%	11%	45%
42	46	15	13	20%	12%	11%	43%
43	46	15	14	21%	13%	9%	42%
44	47	16	15	21%	13%	8%	42%
45	49	17	14	20%	12%	8%	40%
46	50	17	15	20%	11%	8%	39%
47	51	20	14	25%	13%	7%	44%
48	51	20	17	24%	11%	5%	41%
49	46	16	14	24%	36%	25%	84%
50	54	20	16	27%	11%	5%	42%
51	54	22	17	29%	12%	6%	46%
52	56	23	16	23%	10%	4%	36%
53	56	24	18	26%	9%	3%	39%
54	58	25	19	26%	8%	2%	36%
55	59	25	18	25%	9%	2%	35%
56	60	27	20	24%	7%	1%	33%
57	61	29	19	25%	7%	1%	33%
58	62	29	20	25%	8%	2%	35%
59	63	30	20	25%	7%	1%	33%
60	64	30	21	26%	8%	1%	34%
61	65	32	20	28%	8%	1%	38%
62	66	33	25	25%	9%	0%	35%
63	66	34	26	27%	10%	1%	38%
64	68	36	27	28%	10%	1%	38%
65	68	36	28	26%	8%	0%	34%
66	69	37	29	25%	10%	0%	36%
67	70	39	31	28%	11%	0%	39%
68	70	40	32	24%	12%	0%	37%
69	71	40	33	26%	10%	1%	37%
70	72	41	34	23%	12%	1%	35%
71	72	42	35	23%	13%	0%	37%
72	74	44	36	22%	13%	0%	35%
73	75	44	37	17%	9%	1%	27%
74	75	44	38	17%	11%	0%	28%
75	75	45	39	16%	12%	0%	28%
76	77	45	40	14%	10%	0%	24%
77	77	48	42	13%	12%	0%	25%
78	78	48	43	12%	10%	0%	22%
79	77	48	44	9%	11%	0%	20%
80	78	49	45	8%	9%	0%	17%
81	79	51	46	8%	8%	0%	16%
82	80	52	47	7%	8%	0%	15%
83	82	53	48	7%	8%	0%	14%
84	83	54	49	7%	7%	0%	14%
85	84	55	50	6%	7%	0%	13%
86	85	56	51	6%	6%	0%	12%
87	86	57	53	5%	6%	0%	11%
88	88	58	54	5%	5%	0%	10%
89	89	59	55	4%	5%	0%	9%
90	90	60	56	4%	4%	0%	9%
91	91	62	57	4%	4%	0%	8%
92	92	63	58	3%	4%	0%	7%

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93	94	64	59	3%	3%	0%	6%
94	95	65	60	2%	3%	0%	5%
95	96	66	61	2%	2%	0%	4%
96	97	67	62	2%	2%	0%	3%
97	98	68	64	1%	1%	0%	3%
98	100	69	65	1%	1%	0%	2%
99	101	70	66	0%	0%	0%	1%
100	102	71	67	0%	0%	0%	0%

Table 29 : Dependent Data for Males

Age	Age of Dependent			Share Received			
	Wife	Daughter	Son	Wife	Daughter	Son	Total
25	24	2	2	9%	4%	3%	16%
26	24	3	2	14%	5%	6%	25%
27	25	3	3	17%	7%	8%	33%
28	26	3	3	21%	10%	11%	42%
29	26	4	4	25%	14%	13%	52%
30	27	4	5	28%	15%	16%	60%
31	29	5	5	29%	16%	17%	61%
32	29	6	6	28%	17%	17%	62%
33	30	7	7	30%	16%	17%	63%
34	31	7	7	30%	17%	18%	64%
35	32	8	8	30%	17%	17%	65%
36	33	9	8	31%	17%	18%	66%
37	34	9	9	34%	21%	20%	75%
38	35	10	10	35%	21%	21%	78%
39	36	11	10	35%	21%	21%	76%
40	37	11	11	37%	23%	24%	84%
41	38	12	11	43%	26%	26%	94%
42	39	12	12	39%	24%	23%	86%
43	40	13	12	40%	24%	22%	86%
44	41	14	12	41%	24%	20%	85%
45	42	14	13	39%	20%	17%	76%
46	43	15	13	38%	19%	15%	72%
47	44	15	13	43%	21%	16%	79%
48	45	16	14	42%	19%	13%	74%
49	46	16	14	43%	18%	12%	73%
50	47	17	14	44%	18%	11%	72%
51	48	18	14	46%	17%	10%	73%
52	48	18	14	47%	16%	9%	73%
53	49	19	15	49%	16%	9%	73%
54	50	20	15	49%	16%	8%	73%
55	51	20	15	51%	15%	7%	73%
56	52	21	15	51%	15%	7%	73%
57	53	21	15	52%	14%	6%	72%
58	54	22	15	53%	14%	5%	72%
59	55	23	15	54%	13%	5%	73%
60	56	23	15	55%	13%	5%	73%
61	57	24	15	56%	13%	4%	73%
62	58	25	16	58%	12%	4%	74%
63	59	26	15	57%	13%	3%	73%
64	59	27	16	58%	12%	3%	73%
65	60	27	16	58%	12%	3%	72%
66	61	28	16	58%	12%	2%	72%
67	62	29	16	57%	11%	2%	71%
68	63	30	17	59%	11%	2%	72%
69	64	32	17	59%	11%	2%	72%
70	65	33	17	59%	11%	2%	72%
71	65	33	17	58%	12%	2%	71%
72	66	34	18	59%	11%	1%	71%
73	67	36	18	58%	11%	1%	70%
74	68	37	19	55%	10%	1%	67%
75	69	38	20	56%	10%	1%	67%
76	70	39	20	55%	11%	1%	67%
77	71	41	20	53%	10%	1%	65%
78	71	41	21	52%	10%	1%	63%
79	72	42	22	52%	10%	1%	63%
80	73	43	24	50%	10%	1%	61%
81	73	44	25	47%	10%	1%	58%

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82	74	44	26	45%	9%	1%	55%
83	75	45	28	43%	9%	0%	52%
84	75	46	29	40%	8%	0%	49%
85	76	46	31	38%	8%	0%	46%
86	76	47	32	36%	7%	0%	43%
87	77	47	33	33%	7%	0%	40%
88	78	48	35	31%	6%	0%	38%
89	78	49	36	28%	6%	0%	35%
90	79	49	38	26%	5%	0%	32%
91	79	50	39	24%	5%	0%	29%
92	80	50	40	21%	4%	0%	26%
93	81	51	42	19%	4%	0%	23%
94	81	52	43	17%	3%	0%	20%
95	82	52	45	14%	3%	0%	17%
96	82	53	46	12%	2%	0%	14%
97	83	53	47	9%	2%	0%	12%
98	84	54	49	7%	1%	0%	9%
99	84	55	50	5%	1%	0%	6%
100	85	55	52	2%	0%	0%	3%