University of Groningen
Faculty of Spatial Sciences
Masters Population Studies
Master thesis

Population Ageing with Different Measures and Its Influences on Pension Age in Turkey

Ilker Sirin-s1941887

Supervisor: Dr. Fanny Janssen

Groningen, July 2010

Summary

This research explores influence of population ageing on pension age considering threshold ages for various measures of population ageing. In Turkey, no studies on measures that use life tables with population figures has been conducted before. Recommendations on pension age with different types of measures contribute to rethinking existing policies on retirement age and adds to societal relevance. This is a quantitative study and secondary data is used.

According to commonly used measures, population is young in Turkey. However in terms of pension regime, as eligibilty ages for pensions have been low, pensioners enter 'old age' at young ages. The average age of pensioners depict old age dependency ratios (OADRs) not lower than 30%.

Changes in mortality, intergenerational fairness and constant OADRs are used to assess pension age. Results show that ideal age for pensions is dependent on the threshold ages of different measures and way of approaching age.

Acknowledgements

I would hereby like to thank all people who contributed to accomplishment of this thesis. Firstly I would like to give thanks to Dr. Fanny Janssen for her assistance and comments which were directly to the point. I am grateful to Prof. Dr. L. J. G. van Wissen that besides his contributions with his lectures in analytical demography, he also provided the appropriate tool to graduate an abridged life table to an unabridged one which is needed in this study. Further, I would also like to express my thanks to Prof. Dr. Inge Hutter as her lectures on research process, theories and population policies equipped me with demographic knowledge that is essential for doing research in demography. And finally my special thanks to my wife Aslı Şirin for her long distance support during the year.

Abstract

This study aims to describe the trends in population ageing and its influences on pension age in Turkey within evaluation of different measures. Prospective measures that use life tables and population figures together have not been studied for Turkey before. Population figures since 1970 and life tables for 1970 to 2000 constitute the secondary data. Both are age and sex specific. Trends are descriptively analysed whereas influence of ageing on pension age via threshold ages for different measures is exploratory.

Trends indicate that population in Turkey is young. However if entry to "old age" is accepted to start with being a pensioner, the average age of pensioners depict old age dependency ratios (OADRs) not lower than 30%.

Changes in mortality, intergenerational fairness and constant OADRs are used to assess pension age. Threshold ages for remaning life expectancy (RLE) 15 years or less designate the highest pension ages for males between 1970 and 2000. Intergenerational fairness can be sustained with 60 as a unisex pension age in the same period. For an OADR less than 25%, (support ratio of more than four) pension age should be at least 50 for men up to 2000-2008 and not less than 53 in 2010. For women it is at least 50 up to 1980-1985 and not less than 55 for 2010. Thus, there is no ideal age for pensions. Ideal age is dependent on the measure of population ageing and way of approaching age.

Historical adjustment since 1970 show that pension ages could change up and down to get constant OADRs, a pension age not less than 53 for women and 56 for men as at 2010 can be recommended.

Keywords: Population ageing, social security, pension age, prospective measures, Turkey.

Table of Contents

List of Tables and figures

List of Abbreviations

ABPRS	Address Based Population Register System
DB	Defined Benefit
DC	Defined Contribution
DoC	Days of Contribution
EU	European Union
HALE	Health Adjusted Life Expectancy
MA	Median age
MDGs	Millennium Development Goals
NDC	Notional defined contribution
OADR	Old age dependency ratio
PMA	Prospective median age
POADR	Prospective old age dependency ratio
SSI	Social Security Institution
TFR	Total fertility rate
TurkStat	Turkish Statistical Institute
UN	United Nations
WHO	World Health Organisation
YoS	Years of Service

1 Introduction

1.1 Background

Population ageing can be defined as a brief term that denotes the changes in the age distribution of a population toward older ages (Gavrilov and Heuveline, 2003). The change is stimulated by events like mortality, fertility and migration.

According to Ageing Report of European Commission (2009), population structures in European Union (EU) become increasingly dominated by old people rather than young. Half of the population as at 2008 was 40 years old or more, which will increase to 48 in 2060. The old age dependency ratio (OADR) which is the ratio of population aged 65 and older to the population aged 15 to 64, is projected to more than double in the EU from 25.4% to 53.5% over the projection period. Most of the projected increase in age related public expenditure over the period 2007 and 2060 is forecasted to be on pensions, health care and long term care. The age related public spending is reported to be significant in Member States with only limited progress in reforming their pension systems. The report highlights the fact that a tightening of the eligibility for a public pension either through higher retirement age as well as reduced access to early retirement would constrain public pension expenditure in nearly every Member State.

The report of Population Division of United Nations, which was prepared for the Second World Assembly on Ageing, also touchs upon the possible affects of population ageing on health and pension funds (UN, 2002). Support of smaller number of contributors but higher number of beneficiaries resulting in rising expenditures, causes burdens on the protection schemes. United Nations (UN) expects that ageing will be more rapid with the new structure being reached sooner in developing countries (UN, 2006a).

In Turkey, the population is relatively young at present. On the other hand, address based population register data for 2009 indicate that 26% of population is below 15 and 7% is above 65. Proportion of those 65 and over indicates the second highest level in country's history as compared to %7.1 as at 31.12.2007 (TurkStat, 2010a). TDHS (2009) also shows that total fertility rate (TFR) is half done from 4.33 to 2.16 in Turkey between 1978 and 2008. Projections of Turkish Statistical Institute (TurkStat), also indicate increases in life expectancy, continuation of fertility decline, increases for old age dependency ratio. Fall in mortality combined with fertility decline prepares a ground for population ageing which has consequences such as financial burden on social security and health systems or long term care schemes.

The demographic structure and sustainability of social security schemes are closely related issues as far as one part of the population finances the system through contributions or taxes and others receive the benefits. Population ageing is an issue that changes the balance between these groups with time by increasing the number of beneficiaries compared to contributors. Adjusting the systems to these changes mainly focus on; retirement age, valorisation of past earnings, annual accrual rates for pensions or indexation of current pensions.

Ageing of populations bring out results such as longer payment periods of pensions or increasing health expenditures. Rearranging eligibility ages for pensions is the major debate in the pension world and social security schemes. Similar to adjusting pension levels for price inflation in economics, pension age can be adjusted with age inflation. According to Shoven and Goda (2008), the adjustment can be done by threshold ages in different years that corresponds to constant remaining life expectancies.

In application, population ageing is defined using different measures. Median age (MA), OADR, remaining life expectancies for different ages or measures which reflect health of

population, are some examples for different measures. Age as years since birth or time left to live is considered in various measures (Sanderson and Scherbov, 2005, 2007; Blake, 2009).
For instance, Sanderson and Scherbov (2005, 2008), Lutz et al. (2008), proposed new measures for population ageing with adjusting conventional measures considering remaining life expectancies. Also there are studies that take consequences of population ageing on social security eligibility age into account using new measures (Shoven and Goda, 2008).
Debates on pension age during pension reform processes mostly focus on how the ages are determined, which was also the case in Turkey in 2008. From the standpoint of an ordinary insured person new rules were fairly crticised.
Although the pension reform in Turkey in 2008 increased the age for pensions for future generations, experts of the field are still discussing the gradual implementation which allows for retirement at 49 for women and 51 for men as at 2008 (SSI, 2009). This results in increased undeclared working of young pensioners who are also eligible for health services without paying contributions.
The analysis of population aging in Turkey in that sense will contribute to display the trends and make interpretations regarding its consequences in other fields. A broadened study on population ageing in Turkey within evaluation of trends for different measures and discussing the consequences of ageing on pensions and retirement age, will be an acquisition in deepening in the area. As it is explicit that population ageing has consequences as financial burden on social security and health systems or long term care schemes, discussing the trends with scientific evidence reached by the research, makes the study become more important and interesting.
In this thesis, population ageing in Turkey is analysed with recently proposed measures that harmonise age and sex specific population data with life expectancies. These types of measures have not been used for Turkey before. Studies up to date focus mainly on conventional measures of ageing. Discussing trends for population ageing with recently introduced techniques adds case of Turkey to existing studies and contributes to academic relevance.
Recommendations on pension age with different types of measures contribute to existing policies on retirement age and thus adds to societal relevance. Pension age which sets a general rule for when to retire has social consequences on lives of individuals that form a population.

1.2 Research objective and research questions

The objective of this research is to describe the trends in population ageing and influences of population ageing on pension age in Turkey within evaluation of different measures since 1970. To meet the objective, the following main research question will be answered:

- What is the influence of population ageing on pension age in Turkey since 1970 when it is measured using different measures?

The main research question involves clarification of supplementary sub questions:

- What are the trends for different measures of population ageing in Turkey since 1970?
- What influence on pension age occurs when different measures of population ageing is considered?
- What would be the pension age for different years under the assumption of historical adjustments according to various measures ?

1.3 Structure

The first introductory chapter gives an overview of the research by means of background of the study, continues with the research objective and research questions and this part of structure of the paper. The second chapter deals with the theoretical framework and literature review for deepening in the research topic which lead to construction of a conceptual model. Data and methods used in this study are in the third chapter. The chapter has information on conceptualisation, study design, operationalisation, data and data quality. The fourth chapter constitutes of the results of the analysis. Descriptive analysis of conventional and prospective measures are presented. Life table information on remaining life expectancies and age, sex specific population figures are harmonised to calculate prospective measures. Tables and graphical representations give answers to research questions. Finally the fifth chapter comprises conclusion and recommendation.

2 Theory

Population ageing is a result of changes in demographic events; mainly fertility, mortality and migration. Population ageing theory of Robine and Michel (2004) and two grand theories which are helpful for understanding the population dynamics; demographic transition theory and epidemiologic transition theory are discussed in this chapter. Literature on population ageing and pensions constitutes a sub section of the chapter. Finally, based on theory and review of literature, the conceptual model is designed.

2.1. Theorethical framework

2.1.1 Population ageing theory

The relation between population ageing, age structure and transition is summarised in three steps by Robine and Michel (2004). Firstly, the fall of infant mortality increases the proportion of children and this brings out results such as rejuvenation of population. Afterwards, with falling fertility the number and proportion of children decrease and an increase in mean age of population is observed which is caused by higher number of young adults of high fertility periods. Finally, fast ageing of population is seen after fast rejuvenation when mortality and fertility decline simultaneously. As a result, the proportion of different age groups in population gradually increases with time. Children and teenagers are followed by young adults and elderly. There is a lag between ageing process and apperance of the elderly which as a result brings out a "window of opportunity", demographic "bonus" or "gift". Currently the rise in life expectancy at birth is attributed to the mortality decline in higher ages. This process has unknown impacts for future as changes in age structure and total health of populations (Robine and Michel, 2004; AIV, 2009).

Population health models can be summarised with different frameworks of conceptual models in the past that belong to the decade of 1970s. These are the demographic transition, the epidemiologic transition and the morbidity pressure. Similar to demographic transition and epidemilogic transition, the disability transition is also perceived as part of a general theory on population ageing (Robine and Michel, 2004).

In the following subsections, two of these theroies which prepare the base for population ageing is discussed.

2.1.2 Demographic transition theory

The demographic transition theory which was formulated in 1940s states that, as societies develop and pass through a modernisation period, they unavoidably progress from a pre modern regime of high fertility and high mortality to a post modern one in which both are low. Population change is therefore in relation with economic development and modernisation. The pioneers of the theory are Adolphe Landry who was the first to use the term 'transition' in 1934 and later in 1940s, Frank Notestein defined the concept. Before Landry and Notestein, Warren Thompson had proposed a framework for population growth in different countries (which is motivated by special patterns of mortality and fertility) in 1929 (Kirk, 1996).

Some characteristics of the transition in the second half of 20th century are: declining mortality through most of the world, fertility transition reaching different regions and its inescapable feature, non slowing fertility decline in some regions namely below replacement levels and falls in mortality firstly and fertility decline after. According to the theory, the process is irreversable and socities face different stages with certain fertility rates and mortality rates. The initial intent of theory is to locate every nation, region or population on the evolution of modernisation, fertility and mortality decline. These features make the notion of transition a universal and a predictive theory (de Bruijn, 2005; Kirk, 1996). One of the

weaknesses of transition is its inability to forecast the threshold modernisation level for fertility to fall whereas its strength is the prediction that transition will occur in every country that modernises (Coale, 1973, cited by de Bruijn, 2005, p.552).

Demographic transition theory claims that demographic changes that are probable in different countries of the world can be predicted by analysing demographic histories and experiences of western countries. Although there are versions that include additional stages, the model has three basic stages. In the first stage, both birth rates and death rates are high, the growth of population is stable. In the second phase with medical improvements, better nutrition, progress in sanitary and hygienic conditions, death rates suddenly fall. The fall in birth rates occur with a time lag. Consequently there is rapid population growth. In the last phase of transition both rates have a low level with sharp decreases for birth rates. However, considering timing and duration, different populations, even sub populations in a country may experience transition differently. That is a consequence of entangled historical, social and contextual experiences (Koç et al., 2009).

According to Kirk (1996), the transition in the preeceding fifty years indicates some common properties. The author touches upon eight issues:

- In every country mortality has fallen with socio economic developments,
- Almost every region has witnessed fertility declines,
- As fertility starts to decline, further decline is inescapable,
- Fertility fall has not slowed up as anticipated in the less developed countries in 1980s,
- There are exceptions (for instance France) but mortality decline preceded fertility decline,
- Europe has experienced fertility declines below replacement levels,
- No new balance of births and deaths as anticipated by the proponents of the theory and finally,
- Transition is observed even in at least developed nations in the world such as Bangladesh.

Stages of transition are important in discussing population ageing, as the final stage brings increased OADRs with. As mentioned in the subsection for literature review, the low dependency ratio in second phase is not only an opportunity for countries to invest on youth and grow economically but also to design policy proposals to preapare for the next phases.

The fall of fertility below the level of mortality in European countries revealed a deeper analysis on the notion of transition and a second demographic transition has been framed. Van de Kaa (1994), analyses the fast fertility decline in Europe after 1965 considering marriage rates, age at first marriage, postponement of fertility, motherhood at older ages, cohabitation and divorces. Cohabitation instead of marriage, widespreading individualism and freedom, contraceptives contributing to cohabitation and births outside marriage are some attitudes in Europe discussed under second demographic transition. Decline in marriage has resulted in fall of fertility. A regional pattern has started from north followed to west, afterwards south and finally east.

Turkey has entered a period that birth rates are relatively low around replacement levels and life expectancy has increased since 1950s (Table 2.1). Demographic transition in Turkey can be characterised as rapid and postponed (Koç et al., 2009). Societal consciousness on low fertility, improvements in socio-economic circumstances and technology are the factors behind the progress. However, there are regional differences in transition. The western part of the country is a pioneer, on the other hand eastern and south eastern regions come far behind. Fertility levels in cities of south eastern regions are similar to that of undeveloped countries whereas western regions have a pattern which is similar to European countries that have completed the transition (Yüceşahin, 2009).

2.1.3 Epidemiologic transition theory

Epidemiologic transition theory uses epidemiologic inference to track health and mortality of societies over time. Socio economic situation, life style and health behaviour, demographic factors and health care provision are some determinants that have affects on health and mortality of populations. The theory is introduced by Omran in 1971 and it has been subject to alterations since the original publication. The theory defines the transition with specific stages. The first stage is known as the age of pestilence and famine. Some of its characteristics are fluctuating but high mortality, high infant mortality which is more than 200 deaths per 1000 live births and deaths mainly as a result of infectious diseases or nutrition. The age of receding pandemics is the second stage. This stage goes back to late 18th century and mid 19th century considering mortality decline in western world. Life expectancy at birth increases to 40-50 years and mortality from tuberculosis is still high but starts to decline. Infant mortality declines to 150 deaths per 1000 live births. The third stage is the age of degenerative, stress and man made diseases. There is a gradual increase in life expectancy at birth up to 75 years. Mortality atrributable to heart diseases, cancers, diabetes increases. Surgery errors, exposure to radiation, side effects of treatments are examples of men made diseases that also become visible in the third stage. These changes are usually associated with improvements in health service provision (Omran, 1998).

There are two additional stages of the theory that is applicable in western populations. Age of declining cardiovascular mortality, ageing, life styles modification (such as exercise, diets or changing smoking habits), emerging and resurgent diseases is the fourth stage. Life expectancy at birth reaches 80 to 85 and over. Finally fifth stage which is called “futuristic stage” starting from mid 21st century will probably bring; continuation of longevity, more years of healthy life and more need for social justice in societies (Omran, 1998).

According to Omran (1998), the transition for non western countries is defined with three stages. The third stage is changed as “the age of triple health burden”. In the age of triple health burden, societies strive against unfinished set of health problems and newly rising health problems simultaneously with an unimproved health system. Omran (1998) suggests that epidemiologic transition in western and non western countries follow specific models. Two western transition models are; classical or western model and the semi-western accelerated model. The non western models are; rapid, intermediate and slow transition models.

The classical model is a summary of developments during the last 300 years in western societies. During the period, mortality and fertility shift from high levels to low, whereas gain in life expectancy is more than doubled reaching to 90 years. The semi western model designates the transition in societies that are not in Europe but pass through a similar process. Attributes of rapid, intermediate and slow behind the term ‘transition’ in non western countries is closely related with the pace of industrialisation in these countries. The group of ‘slows’ include sub-Saharan Africa, Latin America and some Asian countries as HIV/AIDS, malaria and tuberculosis constitute the major part of morbidity burden. However, more than one model can exist together in multicultural societies (Omran, 1998).

The trends for total fertility rate (children per woman), infant mortality rate (per 1000 live births), life expectancy at birth (years), crude birth and death rates (per 1000 population) are illustrated in Table 2.1. Indicators designate that Turkey is at the third stage of epidemiologic transition.

Table 2.1 Demographic indicators between 1950 and 2010 in Turkey

Years	TFR	IMR	LEB	CBR	CDR
1950-1955	6.93	233	44	51	23
1955-1960	6.57	203	48	48	20
1960-1965	6.05	176	52	44	16
1965-1970	5.67	153	54	40	14
1970-1975	5.46	138	57	38	12
1975-1980	4.72	115	60	33	10
1980-1985	3.99	93	61	32	9
1985-1990	3.28	70	63	27	9
1990-1995	2.90	54	66	25	7
1995-2000	2.57	40	69	23	6
2000-2005	2.23	31	71	20	6
2005-2010	2.13	28	72	18	6

Source: UN, 2008.

Besides, the prevalence of chronical diseases in Turkey increase with increasing age. Infectious diseases still have importance as causes of morbidity and mortality but leading cause is chronical diseases especially for adults. Hypertension, diabetes, chronical pulmonary disease is also seen in longer living adults (Yaman et al., 2008). Besides, deaths caused by cardio vascular diseases have the highest ranking as at 2008 (TurkStat, 2010b). However, the appropriate model of epidemiologic transition differs with respect to different indicators. For instance, figures for life expectancy in 1950s start from a level of 'low intermediate' and reach 'semi classical' level in 2005-2010 whereas infant mortality follows a pattern of 'slow' and total fertility falls rapidly.

2.2 Literature review

Population ageing and pensions is a topic that is discussed with regard to various issues in recent literature. The examples of literature presented in this section constitute measures of ageing, its relations with and/or influences on pension age, sustainability of social security pensions in an ageing world and policy papers that study population ageing and thus propose solutions to the issue.

2.2.1 Longevity and measures of population ageing

Ageing studies elaborate more on longevity (i.e also mortality) rather than a deeply focus on health status (Robine and Michel, 2004; Carey, 2003). In the first half of 1980s, World Health Organisation (WHO) introduced models that do not take only life expectancy for consideration of population health but also models with morbidity and disability. The gains in life expectancy may be years spent with disability. This approach evolved to using concepts like disease free and disability free life expectancies which account for years of life spent in good health (WHO, 1984). More disability free years is anticipated in future if life expectancy increases are due to better behaviour of people. That means a life without smoking, more physical activity and better nutrition (Robine and Michel, 2004). As conventional life expectancy is insensitive to health of the population, an adjusted version of life expectancy may also be defined in order to assess quality of life rather than its quantity. Increasing life expectancies may involve more years of life lived in ill health. The measure named as HALE denotes Health Adjusted Life Expectancy and is a measure in which years of life are weighted by health status. HALE's speciality is that it gives idea on health of population while people are alive whereas other common measures (i.e. life expectancy, infant mortality) are based on death status. HALE is based on Health Utility Index which seeks for functional aspects of

health such as vision, hearing, speech and mobility (Wolfson, 1996). This in short is the general framework with regard to morbidity.

The recent trends in mortality are differently interpreted by demographers and biologists. There are two camps; pessimists and optimists. According to pessimists, life expectancy has a limit and humankind is reaching the limits. The future life expectancy is believed to have an upper limit of 85. The pessimism is based on the belief that improvements in life expectancy are achieved by means of declines in child and young adult mortality. Therefore, immutable character of old age mortality prevents further increase. On the other hand optimists reject a limit and argue that improvements without limits are expected (Bongaarts, 2006).

In 1975 Norman Ryder (1975) as a forerunner, considered that the point to the entry to old age started when remaining life expectancy falls below 10 years. Taking remaining life expectancy into consideration, Sanderson and Scherbov (2005) also propose a new measure of ageing; they standardize MA of the population for expected remaining life expectancy. People are assumed to have two different ages. Age is represented not only as years since birth but also as years left to live. Chronological age represents retrospective way of looking to age with years already lived whereas prospective age concept is concerned about the future. The proposed measures are defined to be supplementer but not supplanter. With this approach, analysing past and future trends, ageing is measured with standardised median age (SMA) rather than using conventional MA. Under the new concept, different perspectives or cases such as populations 'simultaneously growing younger and older' for some periods, is discussed. The results indicate that MAs and SMAs behave differently between 1960 and 2100 in Germany, Japan and United States. The authors start to use the term 'prospective age' instead of 'standardised age' since 2007 (Sanderson and Scherbov, 2007). Newly proposed term is believed to be more appropriate to depict two different ways of defining age.

Shoven and Goda (2008) use the term "age inflation" to emphasize the time effect in changes of the value of a particular age which is measured by years since birth. The authors propose to take consideration of relative changes in real ages rather than nominal ages, similar to that inflation is used for interpreting price differences between periods. They critisise the fixed retirement ages in social security system of United States which do not reflect mortality improvements since the legislation was enacted in 1935. Government policies seem to disregard that with every additional year, age is associated with higher remaining life. Using different definitions of mortality equivalence; remaining life expectancy, mortality risk, or percent of expected life expectancy at age zero and at age 20, they indicate that legislative amendments regarding the eligibility age for public programs is needed to maintain constant real ages. The analysis is conducted with the period life tables of social security administration. They reach to a conclusion that historical adjustment of eligibility ages would result with approximately 0.15 years annual increase. As a next step, they project future adjustments until 2050. Constant retirement ages redistribute the payments from those with low remaining life expectancy to those with higher life expectancies. Race, region or sex specific retirement ages can be a solution to heterogenity in mortality within the society but it is hard to implement and administer (Shoven and Goda, 2008).

Combining forward and backward looking measures together, Lutz et al. (2008) analyse population ageing in a broader sense. Lutz et al. question what is old and what is young considering the increased life expectancy of humankind. They define three new measures; proportion of the people that have a remaining life expectancy of 15 years or less, standardized or prospective MA and adjusted version of the average age-population average remaining years of life. These measures are compared with MA, average age and proportion of those 60 and older. Population ageing in eight regions of the world between 2000-2100 is analysed using both conventional and proposed measures. Although world's population is ageing dramatically with a MA of 45.6 years in 2100, adjusted MA is only 32.9 in 2100. On

the other hand all measures indicate an ageing process for the world's population. However, the magnitude of ageing can still be different depending on the way of defining ageing.
Sanderson and Scherbov (2008), firstly discuss the changes in life expectancy between 1850 and 2000 and then compare population ageing in major world regions with respect to different measures using prospective age between 2005 and 2045. With prospective age, a 65 year old person is not treated as at same age in 2005 and 2045 while the remaining years left to live for the person is different in these years. Findings of the study show that countries may be depicted older or younger when prospective version of a measure is used. However, use of chronological or prospective age still depends on the context. For instance, despite the increased life expectancies in overall, years of fecundity for women has not changed in the past.
The authors also designate the evolution of pension plans and retirement decisions in the United States which is a consequence of increasing longevity. The trends indicate that there is a shift from defined benefit (DB) plans to defined contribution (DC) plans. In DB plans, the plan provider has a promise for the benefit which is defined at the beginning of entrance to the plan and is paid to the retiree until death (also to survivors thereafter). On the other hand, the amount of payment after retirement in DC plans is directly related to contributions until retirement. The contributions are invested until retirement according to the choice of employee. The risk in investment returns over time is under responsibility of the employee as well. Longevity risk which can result in outliving resources after retirement is likely to lead DC plan participants retire later.
According to Blake (2009), although different measures exist and old age becomes meaningful with the measure, it is commonly defined with reference to the age of entitlement for state pension benefits. Therefore old age implicitly starts with retirement. But this definition is in line with pension regimes having an age requirement of 65. On the other hand, the pension reform in Turkey in 2008 introduced new eligibility criterion for pensions. A gradual increase of eligibility age to 65 is postponed until 2048.

2.2.2 Social security and population ageing

In recent years, local authorities have paid more attention to get infirmation on the composition of older people in their district in relation to health and other social services that should be provided (Blake, 2009). Blake (2009) touches upon changes in age composition of population at sub national level with use of conventional measures of population ageing. Her results show that southern coast part of United Kingdom is oldest and urban cities like London or Oxford have a younger profile. Number of people aged 65 and over has also increased in Scotland and Northern Ireland between 1997 and 2007.
According to Carone et al. (2005), there is an indirect link between gross gross domestic product (GDP) growth and an ageing population. The rising pension expenditures has macroeconomic consequences and may involve rises in social security contributions as well. Increased labor costs may reduce employment rates and have impacts on economic decisions. Fiscal problems faced by pension systems is sometimes perceived as a result of failure of adjustements between contribution and entitlement to the plans in an environment of increased life expectancies. Ageing has also impacts on economy, labour market and GDP growth. Thus, a rise in taxes or contributions or an increase in pension age, which means a reduction in aggregate pension payments, are some measures to avert these negative developments. However, rising taxes or contributions as indirect labour costs affects employability of disadvantaged groups in the society. Considering the ageing populations, more spending on health and pensions is irresistable especially in the developed world. Population ageing not only results in more elderly in the population but also less younger people to take part in the labour force. This makes pension reforms indispensible. Migration

to some extent be a solution to bolster the sustainability of public pensions in case that migrants are employed in the formal economy as regular tax payers (Carone et al., 2005).

There is also literature on sustainability and affordability of social security schemes via reforms. The main underlying reason for reforms is population ageing. Rationing health care expenditures in an ageing population is in agendas as well. Reducing the benefits is another recommendation within the expenditure reducing approaches to pensions. France and Italy are examples that have changed the rule of averaging past earnings via prolonging the years of averaging. State earnings related pensions in United Kingdom also started to use life long earnings as the basis for retirement benefits. Sweden reduced cash benefits including housing allowances and increased social security contributions which is a measure to increase the incomes of the scheme. These are some examples for parametric reforms which do not change the system fundamentally. Gradually increasing the pension age is one of the policy options under parametric reforms. Other options include shifting from a pay-as-you-go system to funded pension schemes with systematic pension reforms. In pay-as-you-go systems current working generation finances the benefits of the pensioners by contributions or social security taxes whereas people save for their retirement in funded pension schemes (Grant et al., 2004).

Sustainability of social security is stressed by Hurd et al. (2004) and Kurek (2007). Future expenditures of pensions systems and fiscal liability of social security programmes are being influenced by the level and distribution of remaining life expectancies of the beneficiaries (Hurd et al., 2004). Kurek (2007), expresses the circumstances in a society where the phase of old age is phased. Rising cost of public services, economic and social issues and social security demand are some characterisitics that are mentioned. Frątczak also discusses the consequences of population ageing touching upon its affects on health care, social security, housing market and living standarts (Frątczak, 2002, cited by Kurek, 2007, p.31).

Lin and Tian (2003), stress concerns over social security reforms via an income sided perspective. An income raising approach is to increase consumption tax rather than payroll tax and thus let for intergenerational transfer considering the population growth. This policy increases the tax burden of older people as payroll tax is only paid by young generations but consumption tax is for every consumer in the society.

Taking UN-European region into account, Marin and Zaidi (2007) mention that Europe not only includes countries that are rich and facing population ageing but also countries that will age before coming rich. North-western countries are in the rich group whereas poorer regions include Eastern and South-eastern Europe, Central Asia and Caucasia. According to the authors, although the demographic challenge is well known, even the richest nations are unable and unwilling to combat with the negative affects of population ageing with suitable knowledge and resources. On the other hand, the issue is becoming harder to solve as longevity of elderly results in more demand for health care, long term care and pensions. It is more dramatic when these issues arise simultaneously with unemployment and poverty.

Bongaarts (2006) focuses on 16 high income countries with longevity, for which reliable data is available. The author calls the burden of longevity on public finances as “skyrocketing costs” of pension and healthcare demand of the elderly. He decomposes mortality two three parts, juvenile, background and senescent mortality. “Juvenile” is considered to be age below 25. Removing the effect of first two components and smoking related mortality, he analyses the trends in senescent mortality. The author suggests that future trends in life expectancy will be determined by this component. The results of the analysis are in line with the optimists’ approach designating no proof of limits to longevity. Life expextancy is expected to increase on average 7.5 years over the coming 50 years.

In Cutler et al. (2006), optimal social security retirement age is studied reflecting the changes in health of the population. Self-reported health status and annual bed days of people with heart diseases are taken into consideration for measurement of health status over time. The

findings with regard to health estimates indicate that 70 year old males in 2000 are as healthy as 62 year old males in 1961.

2.2.3 Policy literature and embeddedness of research in policies

In August 1982, it was the first time that member states of the UN discussed challenges with regard to ageing at international level and adopted an action plan. The first World Assembly on Ageing in Vienna introduced ageing as an issue being taken into account in policies. It served as a springboard for discussion of issues related to human rights for the elderly. The second international meeting on ageing was held with representatives of UN member states in Madrid in April 2002. It ended with the Political Declaration and Madrid International Plan of Action on Ageing. The report addresses population ageing as an issue also for developing countries and stresses that a rapid process is anticipated in the first half of the century. The diversity of challenges between developed and developing countries is emphasised while the first are trying to cope with sustainability of pension systems, ageing and unemployment with a gradual ageing procedure whereas the latter face development and population ageing simultaneously. When circumstances allow, consideration of reform strategies for achieving sustainable pension systems is a recommendation for action that is mentioned. These remarks point out the need for institutional building in developing countries in the period before ageing becomes a major problem (UN, 2002).

Older persons and development, advancing health and wellbeing into old age and ensuring and enabling supportive environments are three priorities that are directed in the Madrid plan. The highlighted issues are diverse and they include; the ageing labour force, intergenerational solidarity, eradication of poverty, social security, equal access to healthcare, older persons and disabilities, housing and the living environment. One of the issues that is taken into account under the first priority topic is; issue number seven on income security, social protection/social security and poverty prevention. Together with fiscal constraints and globalisation and a higher proportion of elderly, increased restraints on the official schemes for social protection system are experienced. This highlights the importance of sustaining a system which provides adequate income security for the society. The seventh issue has an objective which is promotion of programmes (including pensions) for working population. One of the proposed actions in achieving the objective is striving for sustainability and solvency of pension schemes. UN (2002) designates the need to encourage diversified and detailed research on ageing especially in developing countries.

In that sense, it is necessary to take policy measures in pension systems, for instance pension age considering future challenges. That brings one to further analyse population ageing using different measures and inspect how these measures would provide different policy options for retirement age. Then evidence for effective policies can be discussed. The policy paper of UN also denotes research as a tool for this purpose.

In his study on the topic “population ageing and cost of pensions”, Bongaarts (2004) as the vice president of Policy Research Division of Population Council, designates the need for policy changes in achieving sustainable pensions in seven developed countries. He points out the need for future pension reforms in these countries considering both current demographic indicators of ageing and future trends until 2050. He looks to the problem from point of view of institutions and stresses that the systems will face fiscal imbalance without reforms. The objective of the study is indicated as; demonstrating how unsustainable current policies are considering public debt and thus calculating effects of various policy options. The approach is “reducing expenditures” on public finances.

The author focuses on three types of burden which simultaneously affect the schemes, these are; more generous benefits, earliear ages for retirement and ageing populations. As a result, a rise in cost of public pensions is observed in the developed world. The probable solution for

the issue is increasing the level of contributions or taxes if revenue strengthening policies are considered. Other ways of approaching the issue include reducing the benefits or increasing the age of eligibility for pensions.

One of the suggested policies by Bongaarts is raising the retirement age. The other proposed policy is "demographic policy option" and under heading "counteract population ageing". It is summarised with two suggestions; encouraging higher fertility by means of child allowances or parental leave systems and permitting more immigration. These measures are seen as beneficial by the author while they change the composition of people receiving pensions and people that are in the workforce. As the migrants in the productive age group will contribute through taxes or premiums to social security, income and expenditure relation of public finances will be positively affected (Bongaarts, 2004). As a result, the article is an example for challenges faced by developed countries and gives ideas for policy options to handle with the issues that arise in public finances. This gives idea of the framework for future challenges that Turkey will probably face.

The report prepared by Advisory Council on International Affairs (AIV) is another document that touches upon population ageing in some developing regions. "Ageing and poverty" is indicated as one of the urgent themes as well. The document on population and development cooperation was prepared in the first half of 2009 with regard to the request of advice of Dutch Minister for Development Cooperation. The report elaborates on answers to questions raised by the Minister. The first question is for examination of the circumstances, pros and cons that are provided by current demographic trends in achieving Millennium Development Goals (MDGs). Furthermore, the second question asks for investigation of new aprroaches or policy instruments that a deeper attention on attainment of MDGs is paid by Dutch government (AIV, 2009).

According to AIV (2009), although the population increase is taking place in almost all developing countries, another trend of progressive ageing of the population will become an important element by 2030-2035. Two major driving forces for ageing at population level are fertility decline and increasing life expectancies. On the other hand the demographic transition denotes a shift from a situation of high fertility and mortality to one that both are low, thus the phase of transition brings out consequences on age composition. The second phase which is also known as the era of low dependency ratio, is ensued by the final phase; an ageing population. Therefore, as indicated by AIV, every phase of the transition has intrinsic specialities and should be handled with specific government policies. Preparations for the coming future by means of legislative amendments, reform agendas, institutional capacity and governance improvements are a substantial part of policy priorities. As a result, this second phase is named in a summary term "demographic dividend" or "window of opportunity" and brings out opportunuties which can only be realised with good governance. AIV puts emphasis on this prerequisite and designates that the negative probable impacts of ageing can be avoided by investing on labour, education, a better health care regime and improved pension system (AIV, 2009).

As it is presented in the Background, current indicators show that Turkey has a young population at present. Projections indicate increases in life expectancy, continuation of fertility decline, and a higher old age dependency ratio. A window of opportunity is anticipated until all the cohorts of high fertility periods quit the labour force. That means a time span approximately until 2035-2040 (Koç et al., 2009).

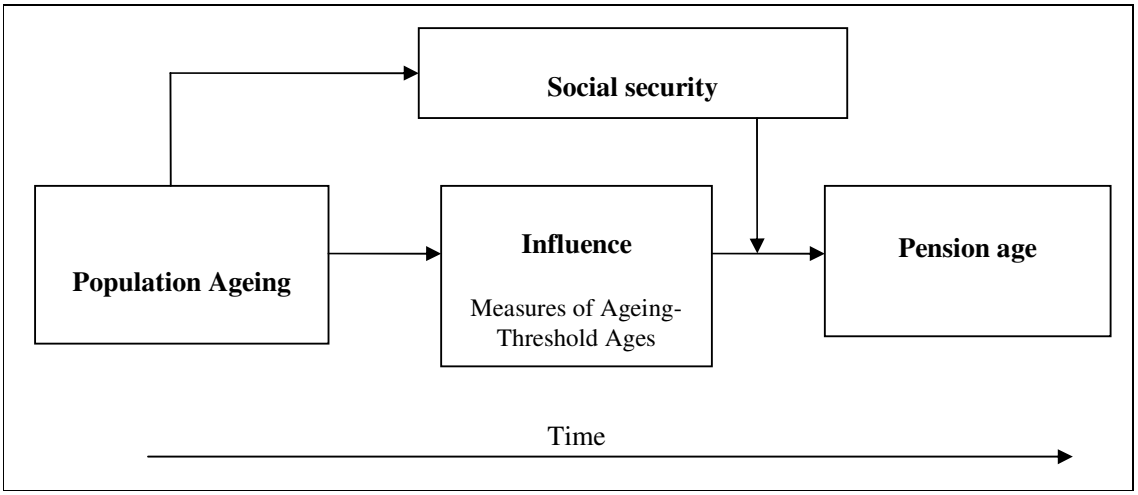
On the other hand, this research deals with trends since 1970 and describes importance of different measures on measuring ageing. Firstly the indicators of ageing at population level with different measures are discussed. Secondly, influence of population ageing on pension age is studied. Changes in mortality, intergenerational fairness and constant level of OADRs

are three ways of assessing a pension age in this study. Thirdly, historical adjustment of pension age is also evaluated.
Thus, discussing the trends with scientific evidence reached by the research will be useful in evaluating the pension reform in 2008 that gradually increased the pension eligibility age. Interpreting the pace of the gradual increase of eligibility age to 65 which is postponed until 2048 can open room for a debate on reconsideration of current policies[1]. Then a higher level of benefiting from demographic dividend will be possible which is a topic that AIV report touchs upon. A pension scheme that is affordable and that can guarantee the payment of accrued rights of current working population in future is possible when right interventions are implemented at the right time.

2.3 Conceptual framework

The theory with regard to population ageing and review of literature on ageing, social security and pensions brings one to the conceptual model in Figure 2.1. Population ageing theory which defines the relationship between demographic transition, epidemiologic transition and ageing framework are the processes at macro level that are behind population ageing. Population ageing has consequences in a broad scope. Economical (changes in production, saving or consumption patterns), cultural and political (changes in age structure of electorates) consequences are some examples (Sanderson and Scherbov, 2008). This research deals with consequences of population ageing on social security pensions via the influence of population ageing on pension age.
A conceptual model for the research as in Figure 2.1 is therefore structured. The relation between concepts is shown with arrows. As stressed in literature review, studies on consequences of population ageing on social security are abundant. In chapter three, conceptualisation of social security is presented and additional approaches of various authors on this relationship (such as Sanderson and Scherbov (2005); Bongaarts (2004); Miller (2001); CoE (2005); Golini (2001); Lee and Tuljapurkar (1997)) are presented. Thus, the arrow between population ageing and social security in Figure 2.1 depicts this relationship between the concepts which is broader than only pensions and pension age.

Figure 2.1 The conceptual model



As mentioned in background, the objective of this research is to describe the trends in population ageing and influences of population ageing on pension age in Turkey within

[1] Law 5510-Social Insurances and Universal Health Insurance Law-Article Nr. 28

evaluation of different measures. In recent literature, prospective or conventional measures are used to measure population ageing. However threshold ages for different measures or ages that corresponds to constant level of measures can define entrance to old age and consequently pension age differently. For instance, if proportion of those with remaining life expectancy 15 years or less is used as a measure of population ageing, threshold age for this measure can be proposed as a pension age. If conventional OADR is used as a measure of population ageing, threshold age that keeps OADR below a determined level can also be recommended as a pension age.

Thus, the influence of population ageing on pension age is dependent on the measurement method. Eventually, Figure 2.1 depicts this framework of studying pension age in this study. On the other hand, changes or reforms in social security system that are done to combat negative aspects of population ageing may also affect pension age indirectly. For instance, a system that promotes working in older ages has affects on pension age although it is not directly in implementation like an increment in pension age.

Further assessment of the concepts in the model is in chapter three of the thesis.

3 Data and methods

In this chapter, data and methods that are used in the study is discussed. The chapter starts with the study design, conceptualisation and the operationalisation of the concepts. Afterwards follows detailed information on data, issues of quality and finally data analysis. As presented in background, the research questions in this study are about; the trends for different measures of population ageing in Turkey since 1970, influence of population ageing on pension age when it is measured with different measures of population ageing and pension age proposals for different years under the assumption of historical adjustments according to various measures.

3.1 Study design

In Babbie (2007) three purposes of research; exploration, description and explanation is discussed. Description is defined as the measurement and reporting of the characteristics of a special phenomenon or population. In that sense, part of the research in relation to the trends in population ageing is a descriptive study which aims to describe the situation and present the trends with different measures. This study is quantitative and secondary data is used. Data consists of age and sex specific population figures since 1970 as well as age and sex specific period life tables for 1970 to 2000.

Exploration of different ways of measuring ageing for the purpose of giving recommendations for policy making with regard to pension age, constitutes the exploratory part of the study. If a new subject of study is under interest, the approach is exploratory for the researcher (Babbie, 2007). As it is mentioned in below sections, concepts like “age inflation” or “prospective age” is introduced to the debate of ageing. This new approach helps to understand ageing with definition of age as years left to live rather than years since birth. Thus, the link of population ageing and determination of the age for start of pensions is discussed also with recently introduced measures.

3.2 Conceptualisation

Babbie (2007), defines conceptualisation as a mental process, whereby imprecise concepts and particular terms are specified and meaning of them in the research is clarified. Therefore, the process results in definition of terms not in a general scope but with specific reference to the research. As presented in the conceptual model, the concepts of this research are population ageing and its influence considering measures of population ageing, social security and pension age.

3.2.1 Population ageing and measures of population ageing

Ageing as a term has two dimensions. In general it designates the increase in the median or average age of the population and secondly the increase in the proportion of elderly (Blake, 2009). As stressed by Gavrilov and Heuveline (2003) the concept is about a shift toward older ages. Some measures are known as conventional measures, the term “conventional” respecting the way of approaching ageing in the sense that age is defined as years since birth. On the other hand recent literature (Sanderson and Scherbov, 2005, 2007, 2008; Lutz et al. 2008; Shoven and Goda, 2008) propose another way of considering the issue. The new approach puts the concept “age inflation” and “prospective age” forward which highlights the relativity of age. Just as prices; say a dollar 20 years ago is not same as a dollar as of 2010 beacuse of inflation, ages are also subject to depreciation and age of 60 in 1975 is not same as 60 in 2010.

In the following section for opeartionalisation, various measures with regard to both approaches, age as years since birth and age as remaining years to live is presented. Looking both types of measures allows one to better understand and interpret population ageing.

3.2.2 Social security

The impacts of ageing on social security; pensions, health care costs and rising need for long term care services are touched upon by various authors (Sanderson and Scherbov, 2005; Bongaarts, 2004; Miller, 2001). Social security can be perceived as an umbrella definition that includes branches such as old age/retirement, disability, survivors, long term care and unemployment (ISSA, 2008). Highlighting the grey pressure on costs for pensions and health care, CoE (2005) presents the multidimensional effects of ageing on a broader sense, social protection including pensions and healthcare as well as education. Golini (2001), argues the link between longevity and survivor benefits. As the focus is commonly on retirement pensions, the remaining survivors of the beneficiary (pensioner) is usually ignored. On the other hand, as a side effect of longevity, a longer period of payment to the survivor is introduced because of higher ages of the survivor at death. Lee and Tuljapurkar (1997) discuss the affects of mortality improvements on the long run finances of social security; old age, disability and survivors but they do not include the health regime-Medicare in their study.

Consequently the concept "social security" or "social security pensions" has a wide range of meaning which needs to be specified. For instance, social security system in Turkey constitutes of two parts; the contributory one which is financed through employee, employer and state contributions, plus the social allowance scheme that is not contributory and financed through taxes. The insurance branches under contributory social security regime is old age pensions, disability, suvivors insurance, sickness, work injuries and occupational diseases. The noncontributory pension scheme provides pension allowance to those who are aged 65 and over and are without any accrued rights for retirement under the contributory regime. The allowance does not require a work history but proof of indigence. However, this study focuses on the impacts of population ageing on social security pensions under the contributory regime with special attention on retirement pensions. As a result, the concept social security is used to indicate the contributory pension scheme in this research. Although recent literature suggests raising contributions, rearranging the level of benefits or increasing pension age to combat against the negative affects of ageing, only the pensions with specific reference to age adjustment is under interest for the thesis.

3.2.3 Pension age

Pension age is the official age required for full retirement from a public pension scheme. The official age is determined by national legislation in the country. It is expressed by completed age of a person fulfilling conditions of retirement as at date of requesting pension. The condition of age is usually accompanied by rules that are set for days of contribution or completed years of service (ISSA, 2008). In this research, firstly official pension age for the period under consideration is presented. The new approaches taking remaining life expectancies or mortality improvements also play a crucial role in building the relation with ageing and pension age in this study.

3.3 Operationalisation

In this section the operationalisation of the relevant concepts are provided. The conceptualisation above is extended and details on measurement of the concepts; population ageing measures and pension age are presented.

Conventional measures of ageing in which data of total population is used are MA, OADR and proportion of older people.

Median age
Median age is the age that divides the population in two parts. It defines the age at which half of the population is younger, half of the population is older and shows whether the population is becoming older over time or not (UN, 2008; Blake, 2009).

Old age dependency ratio
Old age dependency ratio is the ratio of the population aged 65 years or over to the population aged 15-64 (UN, 2008). When start of old age or retirement is implicitly assumed as 65, the measure disregards early retirement. This definition considers age 15 as the entrance age to workforce. This study introduces other old age dependency ratios which assumes 20 as entrance or 60 as exit age to the workforce. Therefore, the former uses the concept of age 15 as reference and is denoted as *OADR (65+,15-64)* whereas the others are defined as *OADR (65+,20-64)*, *OADR (60+,15-59)* and *OADR (60+,20-59)*.

In that sense, $OADR\ (65+,15\text{-}64) = \frac{\sum_{x=65}^{\omega} N_x}{\sum_{x=15}^{64} N_x}$ where, N_x is the total population at age x and ω is the last age group. Similarly, $OADR\ (65+,20\text{-}64) = \frac{\sum_{x=65}^{\omega} N_x}{\sum_{x=20}^{64} N_x}$, $OADR\ (60+,15\text{-}59) = \frac{\sum_{x=60}^{\omega} N_x}{\sum_{x=15}^{59} N_x}$ and $OADR\ (60+,20\text{-}59) = \frac{\sum_{x=60}^{\omega} N_x}{\sum_{x=20}^{59} N_x}$. In addition, *OADR (..+,15-..)* or *OADR (..+,20-..)* can be formulated accordingly to analyse other upper limits.

Proportion of older people
The proportion of older people is operationalised with different types of measures. Old age with reference to various threshold ages such as 65, 60 or 55. For instance, proportion of those 65 and older (*Prop.65+*) and 60 and older (*Prop.60+)* in a year can be defined as: $Prop.65+ = \frac{\sum_{x=65}^{\omega} N_x}{\sum_{x=0}^{\omega} N_x}$ and $Prop.60+ = \frac{\sum_{x=60}^{\omega} N_x}{\sum_{x=0}^{\omega} N_x}$.
Similarly, additional conventional measures are defined hereby such as the proportion of females 55 and older combined with males 60 and older as well as females 50 and older combined with males 55 and older. These measures reflect the initial rules and other implemented age criterion during the study period. As an example, the measure for 55 and 60 is formulated as follows:

$$(Prop.F55+,M60+) = \frac{\sum_{x=55}^{\omega} N_x^f + \sum_{x=60}^{\omega} N_x^m}{\sum_{x=0}^{\omega} N_x}.$$

Life expectancy by sex

"The average number of years of life expected by a hypothetical cohort of individuals who would be subject during all their lives to the mortality rates of a given period" (UN, 2006b).

Prospective age

As it is touched upon in section 3.2.1 of this thesis, some demographers introduced the concept of prospective age in the field of ageing. Prospective age needs a reference year or period to reconsider age. In this study 1970-1975 life table is used as reference life table which denotes 1970-1975 as the reference period. Prospective age depends on the remaining life expectancy relation between the reference year and the year under interest.

The term 'prospective' suggests to conceive age not chronologically or retrospectively. Prospective age is also known as real age (Sanderson and Scherbov 2007; Shoven and Goda 2008). 'Prospective' does not refer to reference year and describe if it is in future or in the past but way of defining age.

To make the concept more understandable it is relevant in this point to give an example. Suppose the reference year is 1975 and a women at age 45 in 1975 has a remaining life expectancy of 30 years. If a women at age 50 in 2000 and a women at age 52 in 2010 has the same remaining life expectancy; it can be concluded that the prospective age of a 50 year old women in 2000 is 45. Similarly the prospective or real age of 52 year old women in 2010 is 45 (when life table for 1975 is used for adjustment). Although the women in 2010 has a chronological age of 52 in 2010, her prospective age is 45. She is as young as a 45 year old women in 1975.

Prospective median age

Sanserson and Scherbov (2005) characterise life expectancy at MA as an indicator of ageing that is easy to calculate which is also comparable across countries. But the authors indicate that life expectancy at MA is not comparable to MA. Another probable way of calculating MA with using remaining life expectancies can be done with a PMA.

In this study, similar to Sanderson and Scherbov (2005, 2008) and Lutz et al. (2008), conventional MA is redefined with prospective age and PMA is used to denote the concept.

PMA is the prospective age at MA. It is also known as adjusted version of MA. Firstly the MA for the year of interest is calculated. For instance, MA in Turkey for females in 1997 is 24. Then, the remaining life expectancy for a female aged 24 is found in the life table 1995-2000 which is 54.30 years. The reference period is 1970-1975, therefore the age in life table for 1970-1975 which corresponds to 54.30 years of remaining life is the PMA. In life table 1970-1975, a 19 year old women had 54.47 years to live, whereas a 20 year old women had 53.52 remaining years to live, 54.30 years is in between. As a result PMA in 1997 is 19 years where there is at least 54.30 years to be lived in 54.47 years.

Prop.RLE 15-

Prop.RLE 15- is "The proportion of the population in age groups that have a remaining life expectancy of 15 years or less" (Lutz et al. 2008, p. 716). This measure implicitly assumes that entry to old age starts when remaining life expectancy reaches 15 years. Entry to old age

also includes a perception of entitlement to retirement which brings one to interpret the trend of this measure also for the pension age.

Prop.RLE 15- is formulated as; $Prop.RLE\ 15\text{-} = \frac{\sum_{x=x_T^m}^{\omega} N_x^m + \sum_{x=x_T^f}^{\omega} N_x^f}{\sum_{x=0}^{\omega} N_x}$. In the equation, N_x^m is number of males at age x in a year, N_x^f is number of females at age x, x_T^m and x_T^f are threshold ages of males and females for entrance to remaining life expectency 15 years or less. Finally, ω is the last age group.

In Turkey, pension age has been changed in the past. For instance in 1950 it was 60, in 1965 it was decreased 5 years for women and after 1970 different rules including no rules for age, 55 or 60 for men has been implemented. This study also uses *Prop.RLE 20-*. When threshold age for *Prop.RLE 20-* is taken into account, it is closer to the initial intent for pension age when the retirement system was built. Similarly, *Prop.RLE 20-* is the proportion of the population in age groups that have a remaining life expectancy of 20 years or less.

Prospective old age dependency ratio

Prospective age can also be implemented to old age dependency ratios. Conventionally old age is assumed to start at age 60 or 65. Recent literature suggests dependency ratios that accounts for changes in life expectancy (Sanderson and Scherbov, 2008). The age at which life expectancy falls below 15 years or 20 years is the threshold age to enter 'old age'. The number of men and women above the threshold divided by number of people aged 15 to (or 20 to) threshold is the prospective old age dependency ratio (POADR). Four types of POADR are used in this study. These are *POADR (15-,15+)*, *POADR (15-,20+)*, *POADR (20-,15+)* and *POADR (20-,20+)*. The POADRs are formulated as follows:

$$POADR\ (15\text{-},15+) = \frac{\sum_{x=x_T^m}^{\omega} N_x^m + \sum_{x=x_T^f}^{\omega} N_x^f}{\sum_{x=15}^{x_T^m-1} N_x^m + \sum_{x=15}^{x_T^f-1} N_x^f},\quad POADR\ (15\text{-},20+) = \frac{\sum_{x=x_T^m}^{\omega} N_x^m + \sum_{x=x_T^f}^{\omega} N_x^f}{\sum_{x=20}^{x_T^m-1} N_x^m + \sum_{x=20}^{x_T^f-1} N_x^f},$$

In the equation, similar to *Prop.RLE 15,* N_x^m and N_x^f are number of people in two sexes, x_T^m and x_T^f are threshold ages of males and females for entrance to remaining life expectency 15 years or less. Finally, ω is the last age group. *POADR (20-,15+)* and *POADR (20-,20+)* are calculated in the same manner but x_T^m and x_T^f are threshold ages of males and females for entrance to remaining life expectency 20 years or less.

In addition, pension age is operationalised with mortality equivalence definitions similar to those of Shoven and Goda (2008). The authors use 65 as their reference and define four types of mortality equivalence. Constant remaining life expectancy at age 65, constant mortality risk at age 65, constant percent of expected life at age zero and age 20. Considering the official retirement age for Turkey under the study period, 60 and 55 for men, 60, 55 and 50 for women is used in section for historical adjustment.

Constant remaining life expextancy

Two ages in different years are equivalent if they have the same remaining life expectancy.

Costant mortality risk

Two ages in different years are equivalent if they have the same mortality risk.

Constant percent of expected life (at age x)

Two ages in different years are equivalent if they have the same percent of remaining life expectancy measured at birth, at age 20 or any other age. For instance, life expectancy at birth for a female in for 1970-1975 is 63.99 years. In life table for 1970-1975 age 55 for a female means 86% of life expectancy at birth (55/63.99). Keeping 86% constant for the study period and multiplying it by the life expectancy at birth for other years, age recommendation for other years is calculated. For 1975-1980 one gets age recommendation for women as 56 which is 86% multiplied by life expectancy of 65.30 years for that year. If constant percent of expected life at age 20 is used, logic of calculation is similar.

Life expectancy at 20 for a female in life table 1970-1975 is 53.52 years. 55 corresponds to 74.4% which is 55/(53.52+20) and it is kept constant for other years. Therefore, equivalent age for 1980-1985 is 74.4% multiplied by (55.48+20). 55.48 is the remaning life expectancy at 20 in 1985. The result is 56 years, meaning one year increase in pension age for this measure under historical adjustment assumption.

For these four measures, under the assumption that the rules for pension age are set by keeping the value of measures constant with time, the progress of pension age is discussed.

3.4 Description of data

This research uses data from three primary sources. National population census results, Address Based Population Register System (ABPRS) and life tables are used for the study. Trends for conventional measures of population ageing such as MA, OADR and proportion of specific age groups in population is calculated with census data. Other measures that take remaining life expectancies into consideration need a harmonisation of population data and life table figures. Therefore lifetables are used in order to get prospective ages in different years. For historical inspection of official pension ages, on the assumption that pension age is increased in line with improvements in mortality, life table data is used.

A set of six period life tables for 1970-1975, 1975-1980, 1980-1985, 1985-1990, 1990-1995, 1995-2000 is available for Turkey from a study conducted in SSI (Gjonca, 2006). Life tables are sex specific. Both abridged and single aged versions are available except males 1985-1990. Consequently the single age life tables are produced again in this study. For this purpose, United Nations soft ware package Mortpak is used. Mortpak is designed for demographic measurement in developing countries (UN, 2003).

The UNABR function of Mortpak graduates the ${}_nq_x$ values of age groups 0-1, 1-5, 10-15, ... to single age probabilities. A formula proposed by Heligman and Pollard (1980) with eight parameters is used in UNABR function.

The period lifetables in this research indicate a two state model which involves one either to be dead or alive. In other words, concepts like disability free life expectancy/health adjusted life expectancy (Shoven and Goda, 2008; Wolfson, 1996) are not considered. Trends for the measures are also analysed with age and sex specific census data since 1970.

Census data in Turkey has a relatively old history. First census was conducted in the initial years of the young republic in 1927. Between 1935 and 1990 censuses were regularly carried out every five years. After 1990 the five year rule was changed as ten years. The most recent census was held in 2000. TurkStat is the competent institution for collecting and disseminating census data.

TurkStat provides population figures also in their website but data is structured in age groupings. Unabridged single age grouped data is only available in the library of TurkStat in the books that were prepared for census results. These data are copied from the books and entered manually in excel for the necessary calculations (TurkStat, 1977, 1982, 1984, 1989, 1993, 2003). In addition, population register data for 2008, 2009 and 2010 is included.

This study also uses population figures for some intercensal periods such as 1995 or mid periods for the available life tables (1972 to 1997). Under constant age and sex specific growth rate assumption, population for intercensal periods is calculated. For instance, population in 1990 and 2000 with age specific growth rate in the intercensal period is used to estimate the population in 1995.

Let g_x denote the average annual age specific growth rate between 1990 and 2000, it can be written as $g_x = \frac{\ln\left[\frac{{}^{2000}N_x}{{}^{1990}N_x}\right]}{10}$ (Preston et al. 2001, p. 12). Then, age specific population in 1995 is ${}^{1995}N_x = \left({}^{1990}N_x\right)\left(e^{5g_x}\right)$. Thus, ${}^{1995}N_x$ is calculated for both sexes with age and sex specific growth rates.

It is worth to emphasise an additional remark on the context of information included in the census data. The information includes rural and urban population size, distribution of population, age and gender structure, employment (data since 1980), fertility (data since 1980), infant and child mortality (data since 1970), education and internal migration (data since 1970). But all the mentioned indicators are not available in detail for all census years (some of them since 1935 or since 1975). Migration data is available for internal migration. Immigration by countries is the only international migration figure which is available for 2000 population census results. Starting from 2007, ABPRS was introduced in Turkey. Since then TurkStat provides age and sex specific population figures anually as at December 31.

3.4.1 Data quality

For calculating death rates and constructing life tables, reliable data on deaths is crucial. TurkStat provides age and sex specific death figures for years 1960 to 2007. Death statistics which are published by TurkStat is produced from information received through hospitals, Directorates of Health, dispenseries and municipality health units. Information on deaths that are in civil registration database of General Directorate of Population and Citizenship Affairs (GDPCA) is not included in death figures especially because of registration problems based on deaths of elderly and infants.

GDPCA is the competent institution in collecting information on life events. A central population administration system is set up and every citizen has a unique ID number. Information sharing with other public institutions was introduced in 2004 and the main aim of the system is to collect real time population and life statistics. In October 2009, TurkStat published birth statistics for 2001-2008 that are derived from civil registration system (TurkStat, 2010c). However, death statistics are still at preparation and test phase. Infant deaths which are exposed by those newborns who have not received ID numbers need to be received from hospital data. Collaborations with other institutions such as Ministry of Health is carried on (N. Uysal-TurkStat Expert, personal communication, March 22, 2010).

Bogue et al. (1993) touchs upon incompleteness of civil registration systems in developing countries which is also a case for Turkey. Indirect estimation methods are usually implemented to cover the incompleteness and make adjustments on the events that are already registered. If there exists long time between the occurance of the event and registration, that causes errors (Bogue et al. 1993, p. 3-3).

In 2006, during a study on preparing a life table for Turkey in SSI, it was observed once more that death registration in the country was incomplete especially in rural areas. The published statistics by TurkStat cover only provinces and district centers. Poor death registration in Turkey has been a drawback for construction of national life tables. On the other hand according to experts of TurkStat, GDPCA civil registration information will be used after

reliability of information is sustained (N. Uysal-TurkStat Expert, personal communication, September 28, 2009 and March 22, 2010).

In that sense, it is not possible to get death rates by age and sex directly. Therefore in SSI, the life tables are constructed with an indirect method proposed by Bennett and Horiuchi in 1981 (Appendix II). This method helps to calculate completeness coefficients for deaths using population data within two censuses and deaths within the period. The estimation model is based on an assumption of closed population i.e. zero net migration. As a result, the set of six life tables for the country was estimated using the aforementioned method. Lack of quality considering death registration data and use of estimated life tables will probably have impacts on final conclusions about pension age. For instance, although life expectancy at birth increases within time for males, other age categories imply decreases in life expectancies for some years. This affect is probably due to the assumptions of the indirect estimation method. More reliable conclusions can be drawn if death register is rehabilitated in future and directly used in calculating the death rates.

As touched upon in description of data, ${}_nq_x$ values of abridged age groups are graduated to single age probabilities by a formula of Heligman and Pollard (1980). The formula proposed by the authors is: $\frac{q_x}{p_x} = A^{(x+B)^C} + De^{-E(\ln x - \ln F)^2} + GH^x$, where $p_x = 1 - q_x$, x is the exact age, q_x is the probability of dying within a year. There are eight parameters to be estimated in the right side of the equation. *A*, *B* and *C* are the parameters that reflect the early childhood mortality. Heligman and Pollard (1980) indicate that *A* is close to q_1, *B* accounts for infant mortality and *C* reflects the rate of decline in mortality in childhood. *G* represents the base level of adult mortality and *H* reflects increase in adult mortality. *D*, *E* and *F* are parameters for accident mortality.

After graduation process, in abridged life tables, life expectancy at birth (e_0) for females is slightly higher than e_0 in graduated life tables. Adversely, in abridged life tables for males, e_0 is lower than it is in single life tables. Maximum absolute difference for males is almost a year in life table of 1975-1980 (Table 3.1).

Table 3.1 Difference in e_0 of abridged and single life tables

	Sex composition	
Years	Female	Male
1970-1975	0.18	-0.63
1975-1980	0.13	-0.99
1980-1985	0.37	-0.87
1985-1990	0.24	-0.82
1990-1995	0.04	-0.56
1995-2000	0.12	-0.73

Source: Gjonca, 2006 and author's calculations

Two additional issues have been observed about data which can be discussed under quality. The estimated lifetables used in this study designates a mortality pattern that brings out life expectancies at birth for men and women which are higher in various years of the study period when compared to UN data. The difference for men is three to eight years whereas it is two to five years for women (UN 2008; Appendix I). The second issue is about remaining life expectancies for males in the abridged life tables. Although life expectancy at birth is increasing, for some age categories, males have less years to live in subsequent years which is not an ordinary pattern for the study period.

And lastly, age and sex specific population figures of TurkStat include a category "unknown" for people whose age is not known. This category has not been higher than 0.37% of total population (1980) and it is not included in this study. Therefore there can be a minor difference between total population for the study period in this study and that is published by TurkStat. The reason is exclusion of the category "unknown". Consequently, results should be perceived under aforementioned drawbacks and restrictions.

3.5 Data analysis

This study is a combination of description and exploration. The research question on trends for different measures of population ageing is descriptively analysed. Conventional measures as well as other measures proposed in recent literature is analysed with use of population register and census data and life table techniques. No regional, ethnical or other specific elaboration is considered and census information on total population is under study. Thus, total population is the unit of analysis for conventional measures. Summary descriptions of population that are mentioned in the section for operationalisation are created.

Each measure is part of a univariate analysis describing ageing in Turkey in the study period. For instance, MA denotes calculation of a measure of central tendency for the variable "age" which is useful to get information on trend of ageing at population level. Also old age dependency ratio and proportion of older people denote calculation of frequency distribution of specific age groups in the population.

In terms of time dimension this is a trend study examining changes in Turkey's population over time.

Besides description, the additional research questions have an exploratory aspect. These are the affect of measures on determination of pension age and examining pension age for different years between 1970, 2000 and also 2010. Under assumption of historical adjustments according to improvements in mortality, involves introduction of life tables in the analysis. In that sense, use of life tables for drawing conclusions on pension age denotes use of a social artifact as unit of analysis.

The operationalised measures will be presented in graphs to let the trends for ageing be visible over time. The change in the age distribution between start and end period gives information on shift of age groups in time. Taking intercensal periods and official pension ages into account, the main concentration is on exploring the changes in the indicators of ageing. On the other hand, tables comparing the official pension age and age proposed within evaluation of threshold ages for various measures will be presented. Interpretation of the results will lead the ground for recommendations on the age for the start of pension payments.

4 Results

This chapter presents the results with regard to measures of population ageing and influences on pension age. Figures and tables depict the trends for the study period. The chapter gives answers to the research questions. Following sections provide information on size and age structure of population, recent pension eligibility rules and their implications, trends for conventional as well as other measures of ageing and influences on pension age. Under historical adjustment assumption of pension age, changes in mortality between 1970 and 2000 leads to pension age proposals for prospective approaches. Conventional population ageing measures such as old age dependency ratio or proportion of specific age groups in population can be calculated with census and register data for the period 1970-2010. Thus, interpretation of conventional measures also lead to reflections on pension age for a wider interval. The operationalised measures in chapter three play a crucial role in interpreting the relation between indicators showing how 'old' the country is and at which age to retire.

4.1 Size and structure of population

Total population of Turkey was slightly more than 35.5 million people in 1970 which increased with an average growth rate around 2.5% in the first half of 1980s. After 1990, the pace of growth dropped under 2% and total population in 2000 was more than 67.5 million people. Population register data for January 1st of 2010 indicates 72.5 million people (Table 4.1). Consequently, the population in Turkey increased almost 37 million people in 40 years which is more than doubling. The figure indicates a 1.45% annual growth compared to 2009 (TurkStat, 2010d). As it is clear, Turkey's population is increasing with a decreasing growth rate.

Table 4.1 Age and sex specific population (1000 people) between 1970 and 2010

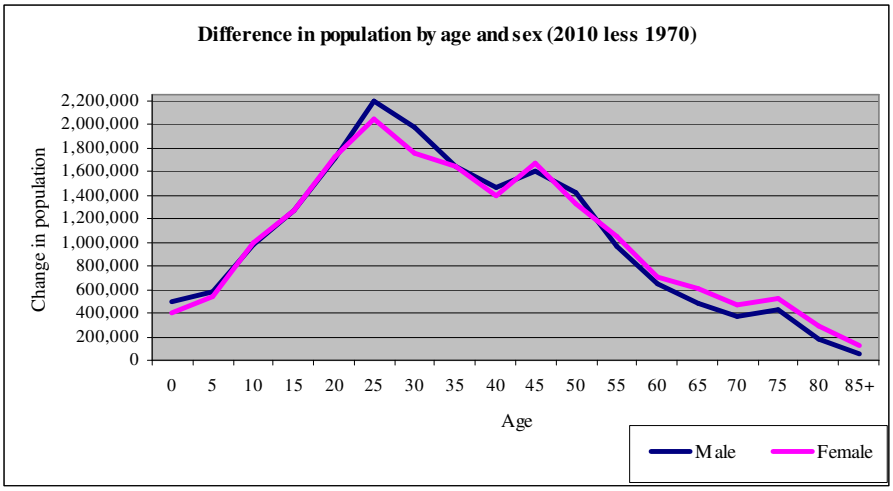
	1970			2000			2010		
Age	**Men**	**Women**	**Total**	**Men**	**Women**	**Total**	**Men**	**Women**	**Total**
0	2,661	2,594	5,255	3,397	3,188	6,585	3,161	2,994	6,155
5	2,610	2,483	5,093	3,486	3,271	6,757	3,184	3,018	6,202
10	2,363	2,167	4,530	3,571	3,308	6,879	3,337	3,165	6,502
15	1,924	1,770	3,695	3,691	3,518	7,209	3,197	3,037	6,235
20	1,496	1,355	2,851	3,427	3,263	6,690	3,205	3,075	6,280
25	1,108	1,154	2,262	2,976	2,919	5,895	3,307	3,202	6,509
30	1,019	1,165	2,184	2,552	2,457	5,010	2,998	2,913	5,911
35	1,117	1,097	2,214	2,454	2,401	4,854	2,765	2,740	5,505
40	921	900	1,821	2,084	1,985	4,069	2,379	2,297	4,676
45	645	564	1,209	1,711	1,658	3,369	2,242	2,228	4,470
50	457	516	973	1,356	1,361	2,717	1,878	1,847	3,726
55	497	440	937	1,016	1,042	2,058	1,462	1,484	2,946
60	476	530	1,006	864	965	1,829	1,125	1,237	2,361
65	322	319	641	795	851	1,646	803	921	1,724
70	221	265	486	518	655	1,173	587	737	1,324
75	82	110	192	254	323	578	517	629	1,146
80	48	91	139	99	148	247	229	383	612
85+	35	73	108	84	133	217	87	191	278
Total	**18,003**	**17,593**	**35,596**	**34,334**	**33,446**	**67,781**	**36,462**	**36,099**	**72,561**

Source: TurkStat, 1977, 2003, 2010d.

Although this research focuses only on the recent 40 years, it is hereby noteworthy to point out that there were only 13.6 million people in the country in 1927 after four years when

Turkish Republic was constructed in 1923. In the post war period after the liberation, the population of the country increased steadily until reaching its current levels (TurkStat, 2008). Figure 4.1 illustrates the age and sex detailed change in population between 1970 and 2010. There is an increase in all age categories however it is more visible in young adults in both sexes. According to AIV (2009), high number of young adults provide a"window of opportunity" which is not forever. Its advantages can be attained with good governance, institutional building, investing on many areas including pensions (AIV, 2009).

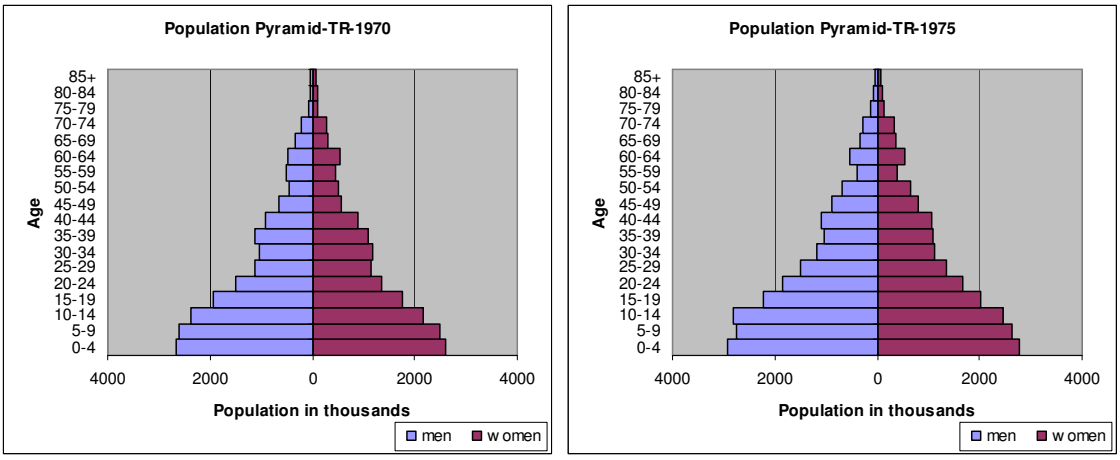
Figure 4.1 Difference in population between 1970 and 2010

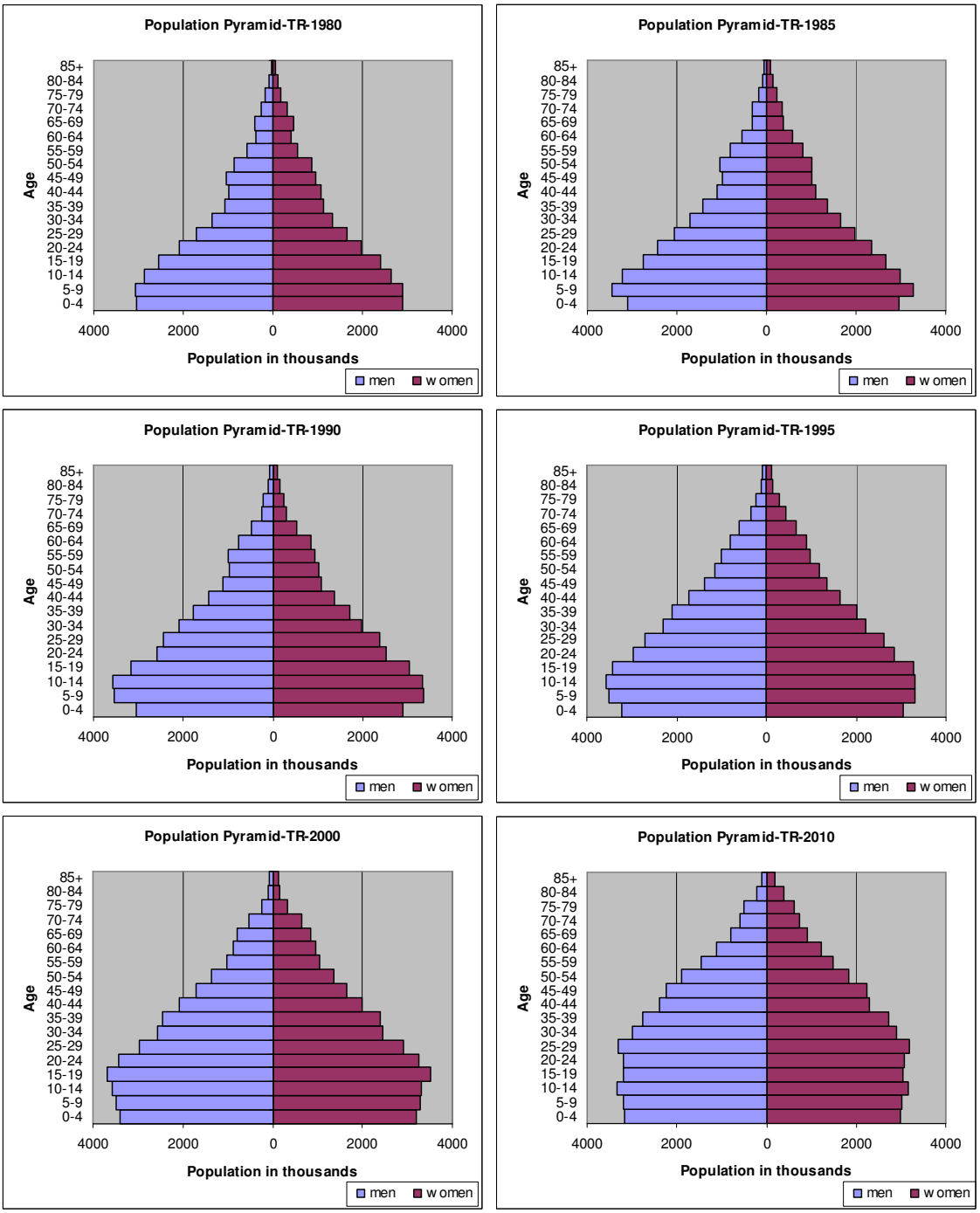


Source: TurkStat, 1982, 2003

Age group 45 to 49 also indicates a peak depicting the higher difference in middle aged adults. Older ages, especially starting from age category 55, for all categories increase in females is slightly higher than males. A rise for age group 75 to 79 compared to other age groups for 60 and over or 65 and over is visible as well.
From 1970 to 2010 especially in the last 30 years, number of people in age groups younger than 15 is decreasing (Figure 4.2). For instance, as the population pyramid for 2010 and 2000 is taken into account, there are fewer people in age group 0-4 compared to 5-9, fewer people in age group 10-14 and the same applies for the comparison between 10-14 and 15-19.

Figure 4.2 Change in age structure of population between 1970 and 2010





Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, 2010d and author's calculations

Population pyramids provide summary information on sex specific age structure of populations. Fertility, mortality and migration patterns in the country are effective in shaping the age structure. Steep narrowing in bars of higher age groups is accepted as an indication of higher level of mortality whereas as fertility decreases the bottom part of the pyramid becomes narrower (Koç et al., 2009).

The narrow bars in older age categories (60+) in 1970s have become wider till 2010 which designates rising number of people in the concerned ages. Although there are more people in

those age groups when comparison is based on years, the shape of the population pyramid is still a "pyramid" from 15-19 to last age category in 2000.
A relatively more rectangular shape is starting from the bottom since 2000 and this process can be observed from visual inspection of population pyramid for 2010.

4.2 Pension eligibility rules and their implications

The legal framework of pensions regime in Turkey has been changed several times since 1950 (Table 4.2). Rules have been rearranged 10 times with an average period of every five years. This results in different types of pensioners who were subject to various regulations and pension payments.

Table 4.2 Eligibility requirements for pensions in Turkey between 1950 and 2000

Eligibility requirements for pensions in Turkey							
	Enforcement	Years of Service		Age		Days of Contribution	
Law Nr.	Date	Women	Men	Women	Men	Women	Men
5417	01.04.1950	25	25	60	60	Minimum 200 average annual days	
6391	01.04.1954	25	25	60	60	5000	
6900	01.06.1957	25	25	60	60	5000	
506	01.03.1965	25	25	55	60	5000	
		-	-	50	55	5000	
1186	01.03.1969	25	25	-	-	5000	
		15	15	50	55	Minimum 120 average annual days	
		-	-	50	55	5000	
1992	26.05.1976	20	25	-	-	5000	
		15	15	50	55	Minimum 120 average annual days	
		-	-	50	55	5000	
2422	01.04.1981	15	15	50	55	3600	
		20	25	-	-	5000	
3246	10.01.1986	-	-	55	60	5000	
		15	15	55	60	3600	
		-	-	50	55	5000	
3774	20.02.1992	15	15	50	55	3600	
		20	25	-	-	5000	
4447	08.09.1999	-	-	58	60	7000	
		25	25	58	60	4500	

Notes: Table is figured out from legislative notes received from Social Security Institution of Turkey and with personal communication with Z.B. Kiran-SSI Expert, June 4, 2010. Source: SSI.

For a person working under service contract, there are three topical requirements that should be fulfilled simultaneously to be eligible to get pensions. These are years of service (YoS), age and days of contribution (DoC). For instance, if a person satisfies the condition DoC and YoS, he/she should either wait until staisfying age condition or keep on working until that age

and thus increase the accrual rate (also known as replacement rate) for every additional working year. In that latter case the level of pensions will be higher.
YoS in Table 4.2 denotes the period between retirement date and the date that work history of the insured starts. It is probable that there are times of cessation since first registration date but this does not affect YoS. In other words, it does not mean that someone should have worked 25 years fully if YoS requirement is 25. The requirement for DoC designates the time for total liability of the insured. If it is 5000 days (approximately 13 years and 11 months) for instance, the insured should have paid 5000 DoC for old age insurance to the system. Between 1969 and 1976 Law 1186, between 1976 and 1981 Law 1992 and also Law 2422 and Law 3774 until 1999 have options that age criterion is not considered for full pensions.
There are various options for an insured to get a full pension considering his/her own conditions. An example can be given for the Law 3774 that was in force between 1992 and 1999. There are two options for full pensions. A woman can have old age pensions at age 50 if she has paid 10 years old age insurance contribution in a period of 15 years since first registration. As an extreme illustration, a woman starting to work when she is 35 can have pensions at 50 if she works as insured and has 3600 DoC. Hereby it is worth to emphasize that a 50 year old women in 1992 approximately had 28 years left to life (Table 4.3) and receive pension benefits. The extreme example of 35 year old women then would have on average 28 years benefits after retirement at 50 with only paying 10 years old age insurance contribution. If pension age decreases 10 years from 60 to 50, average pension payment period increases eight to nine years for women. Five years decrease in pension age from 60 means four years increase in average pension payment period for men and women.

Table 4.3 Remaining life expectancies in Turkey between 1970 and 2000

	Sex composition					
	Female				Male	
	Ages					
Years	60	58	55	50	60	55
1970-1975	18	19	22	26	21	25
1975-1980	18	19	22	26	21	25
1980-1985	19	20	23	27	20	24
1985-1990	19	21	23	28	20	24
1990-1995	20	21	24	28	19	23
1995-2000	21	23	25	30	19	23

Source: Gjonca, 2006 and author's calculations

The other possibility according to Law 3774 is having 5000 DoC and 20 YoS without any requirement of age. According to that rule there can be a woman starting to work at 18 and have 20 YoS at ate 38 with 7200 DoC if she works continuously. Then she will start receiving pensions at 38 with an average of 39 years remainig life (in 1992) which is longer than her chronological age. Table 4.3 shows male and female remaining life expectancies at some other ages. The ages in Table 4.3 reflect different pension age requirements for men and women between 1950 and 2000.
This introductory part gives an overview of pension regime in the second part of 20th century in Turkey and enlightens the character of the system in terms of conditions for full pensions. Pension calculation rules as well as pension age have affects on sustainability via accrual rate, valorisation of past earnings at pension calculation date and indexation of current pensions. But these are outside the scope of this study which only focuses on pension age.
With the Law 4447 in 1999, age is increased to 58 for women and 60 for men which is still more gentle than the age rule in 1950. There is a positive discrimination for women which

allows them to get retired earlier than men. Although retirement age is increased in the start of the millennium, it is not implemented at once. There is a gradual implementation and those who start working after 1999 will be subject to new age rules indicating a postponement of at least 7000 days or 25 years. The affect of gradual implementation is more visible when average age of new pensioners is analysed (Table 4.4).

Table 4.4 illustrates flow rather than stock data. Only the last five years of the period 1975 and 2000 is available but it still gives an idea on how young pensioners Turkey has. Since 2001, data includes public and private sector distinction. In every year for both sexes, average retirement age in the public sector is one or two years younger than the private sector.

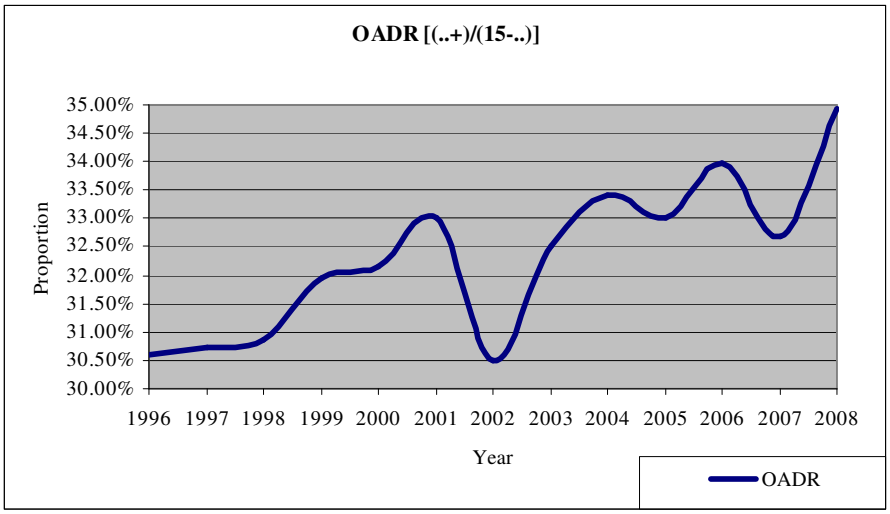
Table 4.4 Average age of new pensioners in Turkey

Time	Women		Men	
1996	47		50	
1997	47		50	
1998	47		50	
1999	47		49	
2000	47		49	
	Public	**Private**	**Public**	**Private**
2001	46	47	48	49
2002	47	49	49	50
2003	46	48	49	50
2004	46	48	49	50
2005	47	49	49	50
2006	47	49	49	50
2007	48	50	49	51
2008	48	49	50	51

Source: SSI, 2009

When average age of those getting old age pensions in a year is taken into account, the population ageing study for Turkey indicates ages younger than 50 as entrance to 'old age' from point of view of SSI. Although results for conventional measures of ageing is presented in the third subsection of this chapter, new versions of dependency ratio and proportion of people above the average ages in Table 4.4 is given hereby in Figure 4.3 and Figure 4.4. The dependency ratio in Figure 4.3 depicts the ratio of those above the ages in Table 4.4 to the the population aged between 15 and these ages.

Figure 4.3 Dependency ratio with respect to average age of pensioners between 1996 and 2008



Source: TurkStat, 1993, 2003, 2010d and author's calculations

Dependency ratio fluctuates between 30.49% and 34.95% which approximately means one third of the population. Although, not every member of population above these ages is a pensioner or people between 15 and these ages are workers, the ratio still gives an idea about the implications of pension eligibilty rules. On the other hand, as stressed by Bongaarts (2004), old age dependency ratio with respect to 15 and 65 has the same aforementioned drawbacks.
The proportion of people above the average ages change in a range of 15.95% to 19.21% between 1996 and 2008. There is 1% decrease in 2002 relative to 2000 and the proportion is 19.21% in 2008.

Figure 4.4 Proportion of people above average age of pensioners between 1996 and 2008

Source: TurkStat, 1993, 2003, 2010d and author's calculations

4.3 Trends for conventional measures of population ageing

MA, dependency ratios and proportion of older population are the most common measures of ageing at population level. Although the focus is on pension age and on measures that are directly linked to old age, an introduction is given with MA which also provides information on the first research question.

4.3.1 Median age

According to Turkstat (1977), half of the total population was younger (and older) than 19 years in 1970. There is ten years increase in MA between 1970 and 2010 (Table 4.5).

Table 4.5 Median age between 1970 and 2010

	Sex composition		
Years	Female	Male	Total
1970	19	19	19
1975	20	19	19
1980	20	20	20
1985	21	21	21
1990	23	22	22
1995	23	23	23
2000	25	24	25
2008	29	28	28
2009	29	28	29
2010	29	28	29

Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, 2010a and author's calculations

Female MA is higher than males in some years. Therefore the population is ageing since 1970 but as at 2010, Turkey can still be characterised as a young country.

4.3.2 Old age dependency ratios

In this section the analysis focuses on OADRs that are based on different threshold ages. As a reminder, the first two measures *OADR (65+,15-64)* and *OADR (65+,20-64)* deal with age 65 as threshold age for entrance to old age. Measures in Figure 4.5b accepts 60 and over as old age. Another difference in four measures lies in the definition of working age population. OADRs with *(15-64)* or *(15-59)* assume 15 for entry to workforce whereas measures with *(20-64)* and *(20-59)* assume 20. Sanderson and Scherbov (2008) also reflect this minor definition differences for OADR in demography. They stress variations with regard to age, both in numerator or denominator and style of representing the proportion i.e. either multiplying by 100 or not.

The curves in Figure 4.5a have a parabolic shape. The arms of the parabol for *OADR (65+,15-64)* start from 8.17% in 1970 and reaches a value of 10.46% as at 2010. *OADR (65+,20-64)* is 10.13% in 1970 and it reaches 11.99% in 2010.

Figure 4.5a Old age dependency ratios based on 65+ between 1970 and 2010

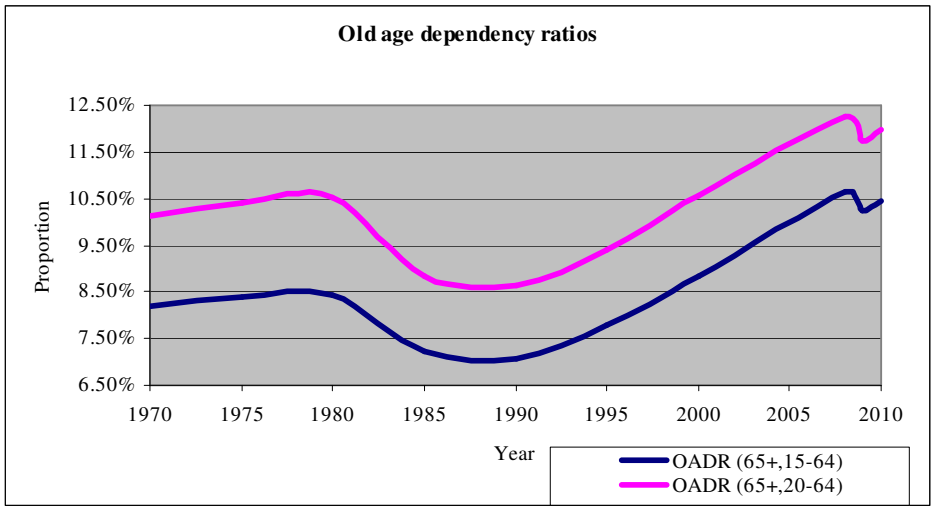
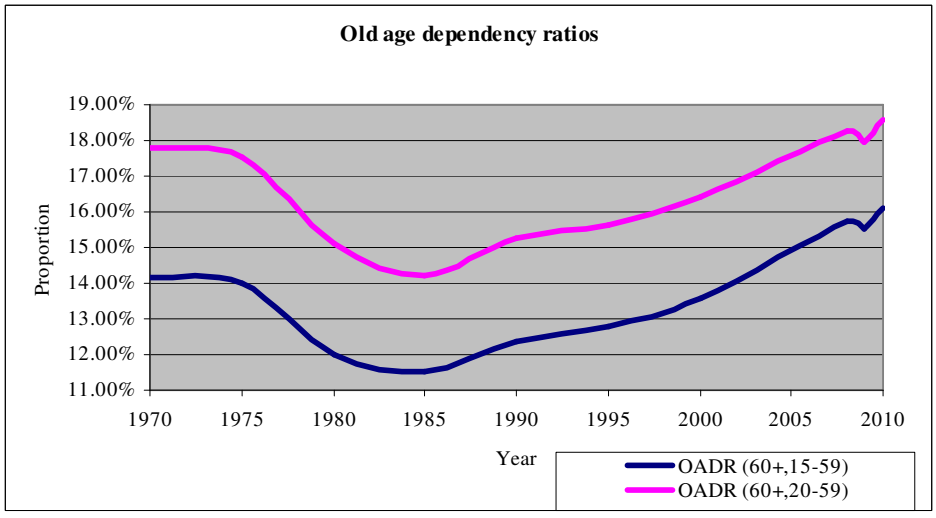


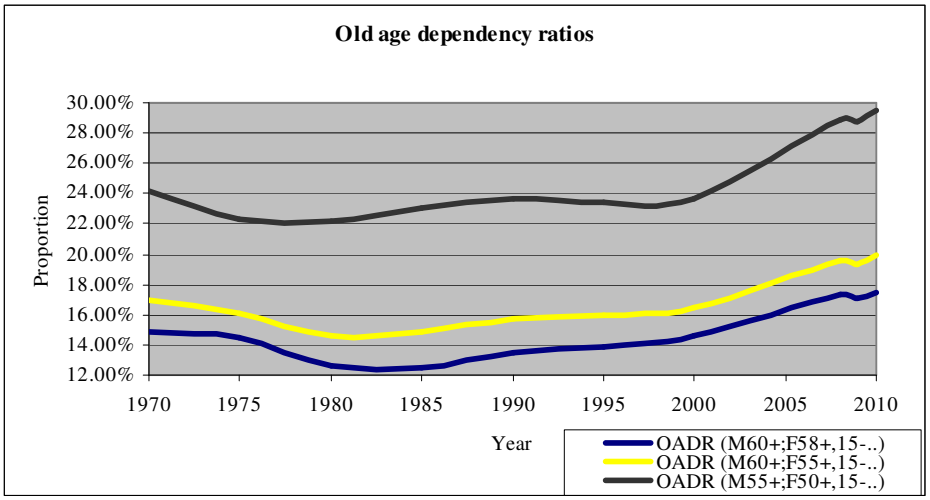
Figure 4.5b Old age dependency ratios based on 60+ between 1970 and 2010



Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, 2010d and author's calculations

There is a rising trend from 1990 to 2008 for both measures. The curves drop slightly in 2009 but rise again in 2010 slightly below the 2008 levels.
Similar to the first two measures, *OADR (60+,15-59)* and *OADR (60+,20-59)* fall initially and then rise since 1985. The minimum level is 11.50% for *OADR (60+,15-59)* and 14.22% for *OADR (60+,20-59)* in 1985 (Figure 4.5b). As measures with 20-59 include fewer people in the denominator compared to 15-59, curve for *OADR (60+,20-59)* is above *OADR (60+,15-59)* and curve for *OADR (65+,20-64)* is above *OADR (65+,15-65)*. Finally the measures show a pattern that *OADR (60+,20-59)* > *OADR (60+,15-59)* > *OADR (65+,20-64)* > *OADR (65+,15-64)* for all years.
The inverse of OADR is known as support ratio (Bongaarts, 2004). It shows the number of people in the working age group supporting persons above the 'old age' threshold. For *OADR (65+,15-65)* results indicate that there are around 9.5 people of working age to every person 65 and over in 2010. In the last decade it is around 10 people. On the other hand, the dependency ratios in Figure 4.3, which are derived from average age of those getting retired within the year shows that the mean support ratio between 2000 and 2008 is 3 people in the last decade.
An additional inference can be possible when official pension ages are taken into account. As presented in Table 4.2 pension eligibilty rules in Turkey have been changed various times in the past. If old age definition is assumed to be in line with official pension age at that time, dependency ratios would be as given in Figure 4.6. However, gradual implementation of enforced rules result in new pensioners with average ages younger than official ages.
Except years in which age rule was abolished, 55 for men and 50 for women was the rule that had been in force in the majority of the period. The threshold ages imply OADRs not lower than 22.17% between 1970 and 2010. As at 2010, dependency ratio is the highest with 29.51% which means a support ratio of 3.4 people in the working age versus the ones above 55 and 50.
Figure 4.6 also presents trends for; *OADR (M60+;F58+,15-..)* which means OADR that is defined for 60 for males and 58 for females. Respectively *OADR (M60+;F55+,15-..)* 60 for males and 55 for females is shown as well. The curves are below *OADR (M55+;F50+,15-..)* and oscillate in a band 14.87% to 17.44% and 17.01 to 19.94% between 1970 and 2010.

Figure 4.6 Old age dependency ratios based on various pension age criterion between 1970 and 2010



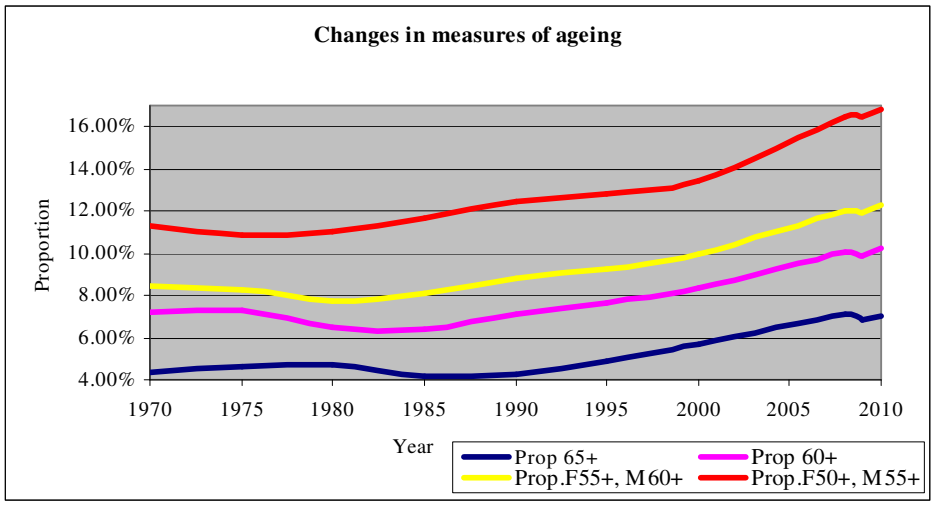
Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, 2010d and author's calculations

4.3.3 Proportion of older people in the population

Age which is accepted as old is a relative phenomenon. Old age varies for different societies and sometimes for different sexes. Social and economic context, behavioural patterns and public health improvements are some examples of intricate factors interacting with each other. A simple rule of 65+ for both sexes disregards this framework (Sanderson and Scherbov, 2008).

In addition to the OADRs based on 65+, trends for population ageing in Turkey is depicted with measures that have a milder criterion for 'old age' (Figure 4.7). During the study period, eligibilty ages for pensions has never been 65. If old age is assumed to start with retirement, 65 is far from real life circumstances. As a result this section discusses trends for *Prop.65+, Prop.60+*, *Prop.F55+,M60+* and *Prop.F50+,M55+* as four types of conventional measures.

Figure 4.7 Change in proportion of older people between 1970 and 2010



Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, 2010d Gjonca, 2006 and author's calculations

The population in Turkey is the youngest with respect to *Prop.65+* during the study period (Figure 4.7). Other measures follow, where the oldest is with respect to *Prop.F50+,M55+*. *Prop.65+* was 4.40% in 1970, after an increase until 1980 it decreases again to 4.20% in 1985 and then with a continuous rise until 2008 finally reaches 7.08%. The curve drops slightly in 2009 having a value of 6.84%, but rises again to 7.01% in 2010 slightly below the 2008 level. In addition *Prop.60+* varies in a band between 6.44% in 1985 and 10.26% in 2000. There is again a rising curve for *Prop.60+* since 1985. *Prop.F55+,M60+* which is a measure directly reperesenting the pension eligibility ages in 1960 and thus would be the measure for ageing when old age is assumed to start with pension age, depicts a curve that lies above other two measures. It is close to 12.30% in 2010. The *Prop.F50+,M55+* curve lies obviously far above other curves. *Prop.F50+,M55+* is 11.31% in 1970. With a continuous increase from 10.85% in 1975 to 16.49% in 2008, finally it is 16.87% in 2010. On the other hand, *Prop.F50+,M55+*, represents ageing stronger than other three conventional measures as official pension age from 1970s until the end of 1990s was 50 for women and 55 for men.

According Eurostat (2010), *Prop.65+* was 13.6% in the Netherlands, 15.6% for EU27 and 15.7% for EU25 in 2000 which are close to the value of 13.44% for *Prop.F50+,M55+* in the same year for Turkey. As a result, although population ageing in Turkey in that year was not as dramatic as EU for other measures, use of *Prop.F50+,M55+* (which is competent to represent ageing with respect to definition of old age in terms of pension age) acts as population ageing figures for *Prop.65+* in EU. This comparison is of course a symbolic one in the sense that pension age for EU27 or EU25 in every country in that time period is not

analysed one by one and checked if it is different from 65 or not but it still fits for the Netherlands.

4.4 Trends for prospective measures of population ageing

PMA, POADRs and proportion of those with specific remaining years left to live constitute measures analysed in this section. The common property of aforementioned measures is the conception that age can also be defined with remaining years of life. The total period for which life tables are available is 1970 to 2000. In addition they cover five year periods in that interval. Therefore trends presented in this section combine life tables which is for five years and mid period population. For instance, 1970-1975 life table is used to calculate *POADR* for 1972, where age and sex specific population in 1972 is calculated from 1970 and 1975 census data under constant age and sex specific growth rate assumption. This results in visualisation of trends from 1972 to 1997 which is not the same period for conventional measures. But it is irrevocable considering life table data availability.

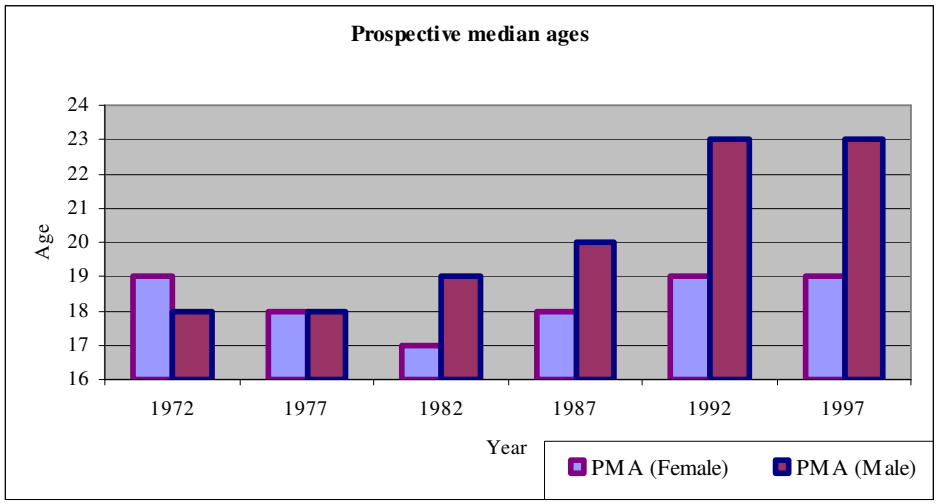
4.4.1 Prospective median age

MA calculation requires chronological age. As it is mentioned in the section for operationalisation in chapter three, a similar measure is PMA in which real ages are used. The lifetables in this study are for males and females. Age specific life expectancies for total population is not available. In that sense, PMA is not calculated for total population.

As it is clear from the definition of PMA, calculation is not done here by standardising all ages or constructing a life expectancy standardised population and then having the MA of this synthetic population. A shortcut proven to be equivalent by Sanderson and Scherbov (2007) is applied. Authors have shown that PMA and MA of the population member's prospective ages are identical. However there is an assumption under this proposition. All members of the population can have a prospective age. But it may be complex when life expectancy in a year for young ages are so high that equivalent ages in the reference year does not exist. In that case these ages attain a prospective age considering the highest life expectancy in the life table.

In PMA, MA is adjusted for changes in remaining life expectancy. Figure 4.8 shows PMAs for women and men between 1972 and 1997.

Figure 4.8 Prospective median ages between 1972 and 1997



Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, Gjonca, 2006 and author's calculations.

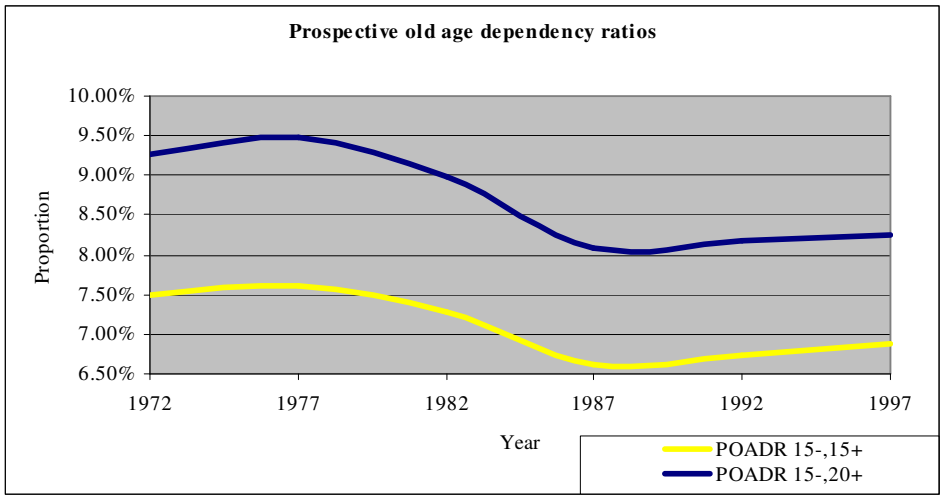
In calculation of PMAs, 1970-1975 life table is used as reference. Female PMA is 19 years in 1972 and it is one year younger in 1977 and 1987, two years younger in 1982. It rises back to 19 years in 1992 and 1997.
As mentioned in chapter three, prospective or real ages need a reference year and account for changes in life expectancy in comparison to the reference year. Decrease of female PMA from 19 in 1972 to 18 in 1977 with 1970-1975 life table as reference shows that, women population in 1977 is one year younger compared to 1972 according to PMA if changes in life expectancy is adjusted. Similarly PMAs for all years in Figure 4.8 represent the situation in which ages are "real" or adjusted according to reference life table. A lower PMA of 17 years in 1982 for women compared to 19 in 1997 shows that the average women in 1982 has more remaining years to live than the average women in 1997. [2]
Male PMA is 18 years in 1972 and 1977. It increases steadily to 23 in 1992. PMA pattern for males is different than females in that there is either an increase or it is stable in the years under study. A similar reasoning such as in Footnote 2 shows that a higher PMA in 1992 and 1997, denotes less remaining years to be lived by an average men in these years than the average men in the preceding periods.
However, as it is touched upon in the section for data quality, use of estimated life tables has affects on interpretations. For some age categories and for some years, there is a decrease in life expectancies of males. In addition, single age specific death rates which are derived from pure data are not used in life tables due to unavailability. Abridged life tables are transformed to an unabridged life table via graduation in this study. Consecutive single ages with close life expectancies may have higher or lower remaining life expectancies and PMA is sensitive to this difference.
Eventually, PMA designates that female population has simultaneously grown younger and older between 1972 and 1997 whereas male population has grown older. With 1970-1975 life table as reference, less ageing occured for females.

4.4.2 Prospective old age dependency ratios

Prospective versions of OADRs include measures based on thresholds ages with remaining life expectancy 15 years or less and 20 years or less. People of working age is either based on 20 and 15.
POADR (15-,15+) changes in a band of 6.61% (1987) and 7.62% (1977). Initially it rises slightly and afterwards with a slight decrease it reaches 6.61% in 1987. Since 1987 there is a minor increase and *POADR (15-,15+)* is 6.88% in 1997. The support ratio is 13.1 to 15.1 people at working age to every person with remaining life expectancy 15 years or less (Figure 4.9).
The curve shifts upwards to a band of 8.09% (1987) and 9.47% (1977) for *POADR (15-,20+)*. The pattern is similar to *POADR (15-,15+)* as the only difference between the two is number of persons in the denominator. Since 1987 there is a minor increase also for *POADR (15-,20+)* and it is 8.26% in 1997. The support ratio is 10.6 to 12.4 people at working age to every person with remaining life expectancy 20 years or less.

[2] MA for females in 1997 is 24 and it corresponds to 54.30 years of remaining life in the life table 1995-2000. Then this 54.30 years of remaining life expectancy is matched in the life table 1970-1975 as it is the reference and age 19 years is observed which we call PMA in 1997. In addition, MA for females in 1982 is 20 and it corresponds to 55.48 years of remaining life in the life table 1980-1985. This 55.48 years of remaining life expectancy is matched in the life table 1970-1975 and 17 is found which is the PMA for 1982. As 55.48 > 54.30, there are more years to be lived by an average women in 1982 compared to 1997.

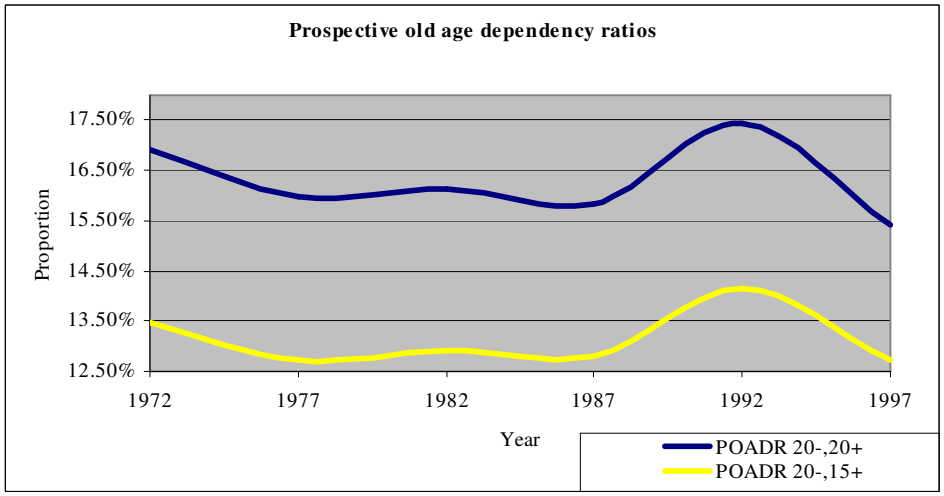
Figure 4.9 Old age dependency ratios based on RLE 15- between 1972 and 1997



Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, Gjonca, 2006 and author's calculations

POADR (20-,20+) and *POADR (20-,15+)* are illustrated together in Figure 4.10. *POADR (20-,20+)* with 20 as age for entrance to workforce is upwards shifted version of *POADR (20-,15+).* Both curves are above the curves in Figure 4.9.
POADR (20-,20+) and *POADR (20-,15+)* are the highest in 1992 and reach lowest level in 1997. All four measures show a pattern that *POADR (20-,20+) > POADR (20-,15+) > POADR (15-,20+) > POADR (15-,15+)* for all years.
Figure 4.10 designates that according to *POADR (20-,20+)* and *POADR (20-,15+),* the population has grown younger and older between 1972 and 1997 in Turkey. Threshold ages for RLE 15- and RLE 20- is studied again in subsection five of this chapter to comment on the second research question which is about the influences of population ageing on pension age.

Figure 4.10 Old age dependency ratios based on RLE 20- between 1972 and 1997



Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, Gjonca, 2006 and author's calculations

4.4.3 Proportion of people under specific life expectancy thresholds

Prop.RLE 15- shows that proportion of older people in 1972 is 4.09%, falls to 3.95% in 1987 and rises to 4.43% in 1997. The range of oscillation is narrow which means a *Prop.RLE 15-* of 4.18% on average. Similar to POADRs, *Prop.RLE 15-* and *Prop.RLE 20-* indicate that population in Turkey has grown younger and older between 1972 and 1997 (Figure 4.11a and 4.11b). *Prop.RLE 20-* is the highest in 1992 with 8.22% and lowest in 1972 with 6.98%. The range of oscillation is also narrow for this measure. It denotes a *Prop.RLE 20-* of 7.33% on average.

Figure 4.11a Proportion of those with remaining life expectancy 15 years or less

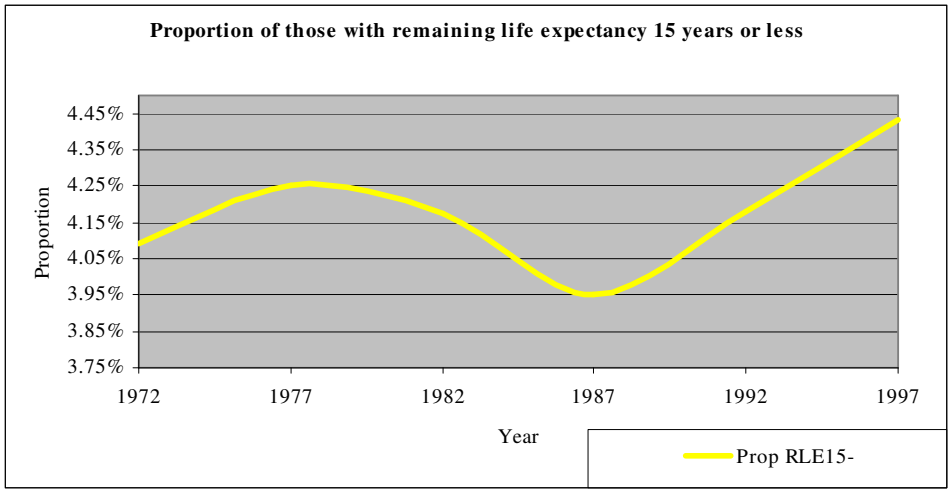
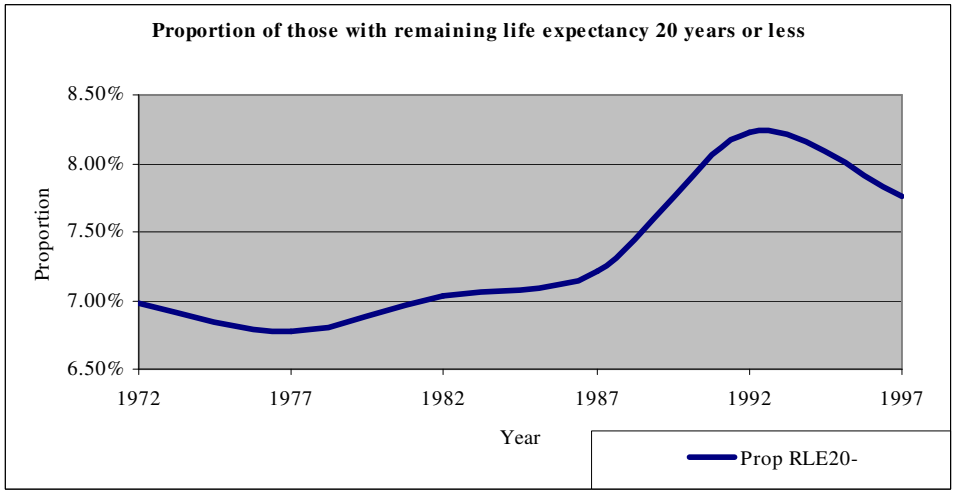


Figure 4.11b Proportion of those with remaining life expectancy 20 years or less



Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003 and author's calculations.

Prospective type of proportion of older people are close to their conventional versions between 1972 and 1997. The difference between *Prop.RLE 15-* and *Prop.65+* is not more than 0.82% in this period. Similarly, the absolute difference between *Prop.RLE 20-* and *Prop.60+* is 0.84% (Table 4.6).

Table 4.6 Proportion of older people between 1972 and 1997

	Proportion of older people with respect to different measures			
Years	*Prop.RLE 15-*	*Prop.65+*	*Prop.RLE 20-*	*Prop.60+*
1972	4.09%	4.49%	6.98%	7.25%
1977	4.25%	4.62%	6.78%	6.81%
1982	4.18%	4.44%	7.04%	6.43%
1987	3.95%	4.21%	7.22%	6.74%
1992	4.18%	4.56%	8.22%	7.38%
1997	4.43%	5.26%	7.77%	8.00%

Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, Gjonca, 2006 and author's calculations

4.5 Influence of different measures on pension age

When pension age increases are in reform agendas of countries, the debates focus on how to determine the appropriate ages. The motivation to do reforms can be due to increases in life expectancy at birth or at advanced ages such as 65 or 60. As analysed in several recent papers (Shoven and Goda, 2008; Sanderson and Scherbov, 2007; 2008) pension ages can be determined with use of prospective age which uses constant remaining life expectancies. This option translates gains in life expectancy to increased ages of pension eligibility.

Sustaining intergenerational fairness can be another decision criterion for the appropriate pension age. Sanderson and Scherbov (2008) stress that use of conventional fixed pension age is unfair for young generations as they contribute a fixed period, but receive longer years of benefit which is based (calculated) on that period. On the other hand, a fixed prospective age criterion of pension age is accepted as unfair to older generations as they will pay contributions longer but receive a pensions for fixed years. Thus, Sanderson and Scherbov (2008) propose to take the average of the threshold for retrospective and prospective age to sustain intergenerational fairness.

Determining pension ages that keep the conventional OADRs constant through time is also possible. It requires determination of threshold OADRs or consequently support ratios. According to UN (2001), a decline of support ratio from 4 or 5 to 2, or 3 makes pension and health reforms indispensible. Increasing the pension age and having a sustainable support ratio is presented as a possible option. Thus reforms are recommended if OADRs rise above 25% or 20% to 50% to 33% (UN 2001, p.98). Most recent Eurostat data indicates that OADR in Europe is around 25% which is mentioned as a limit level. In 2008, it is 25.2% for EU27 and 25.4% for EU25 (Eurostat, 2010). Results with respect to pension age determination criterions mentioned above are presented in the following subsections. Eventually, starting with various baseline pension ages for men and women in 1970, historical adjustment of ages is also discussed.

4.5.1 Pension age as threshold ages for prospective old age dependency ratios

Prop.RLE 15- and *Prop.RLE 20-* define old age according to the thresholds when life expectancy falls below 15 or 20 years.

Female and male threshold ages for the measures vary between 57 and 67 in different years. According to the estimated period life tables, remaining life expectancy 15 years or less and 20 years or less for men are higher than women in the study period. On the other hand, the change in life expectancy is four years for women and two years for men indicating a gain for the former and a loss for the latter. If the pension age was determined according to RLE 20- it would be 57 for women in 1970-1975 and increase to 61 in 1995-2000 (Table 4.7).

Table 4.7 Threshold ages for RLE 15- and RLE 20- in Turkey between 1970 and 2000

	Remaining Life Expectancies			
	15 years or less		20 years or less	
	Sex composition			
Years	Female	Male	Female	Male
1970-1975	63	68	57	61
1975-1980	63	68	57	61
1980-1985	65	66	58	59
1985-1990	65	66	59	59
1990-1995	66	65	59	58
1995-2000	67	66	61	59

Source: Gjonca, 2006 and author's calculations

Pension age according to RLE 20- would decrease from 61 in 1970-1975 to 59 in 1995-2000 for men. The study could give more information on unisex pension ages if life tables for total population were available. But averaging the ages for men and women is another option. In case of age equality for both sexes (no positive discrimination for women as at 1970-1975), pension ages would be the average of RLE 20- for men and women. It would be 59 from 1975 to 1995 and 60 in 1995-2000 (1985 and 1995 are 58.5 years i.e. rounded up).
Albeit its applicability as pension age is a divisive issue because of the high threshold, a similar interpretration is feasible for RLE 15-. If the pension age was determined according to RLE 15- it would be 63 for women in 1970-1975 and increase to 67 in 1995-2000. It would decrease from 68 in 1970-1975 to 66 in 1995-2000 for men.

4.5.2 Pension age as the average of threshold ages for different measures

Pension age as the average of retrospective and prospective age is depicted in Table 4.8. Only two set of policy options are presented. These are the average of RLE 15- and 65, and the average of RLE 20- and 60. Proposed ages are equal or smaller than 65 until 1985-1990 and increases to 66 in 1995-2000 for women. For men it changes between 67 and 65. Average of RLE 20- and 60 is one year above or below the retrospective age of 60 for both sexes.

Table 4.8 Average of threshold ages in Turkey between 1970 and 2000

	Average of conventional and prospective ages			
	65 and remaining life expectancy 15 or less		60 and remaining life expectancy 20 or less	
	Sex composition			
Years	Female	Male	Female	Male
1970-1975	64	67	59	61
1975-1980	64	67	59	61
1980-1985	65	66	59	60
1985-1990	65	66	60	60
1990-1995	66	65	60	59
1995-2000	66	66	61	60

Source: Gjonca, 2006 and author's calculations

Average male and female threshold ages for RLE 20- and 60 indicate that 60 as a unisex pension age is appropriate for the entire study period. This finding designates that new pensioners in these years (Table 4.4) get retired in a range of 10 to 13 years younger than the age suggested hereby as 60.

4.5.3 Pension age for constant old age dependency ratios

In this section, with use of population census results since 1970 and ABPRS data, threshold ages for which OADRs become greater than 25%, 20%, 15% and 10% is calculated. It means support ratios 4, 5, 6.7 and 10. Threshold ages in Table 4.9 are between 50 and 67 for women and between 50 and 63 for men. For all measures and all years, threshold ages for women are equal or higher than ages for men. Until 2000, for an OADR of 25% or more, male ages are 50 or less whereas female ages increase to 52 from 50 in 1970.

For an OADR of 25%, or in other words to sustain a support ratio of four people in the working age to every person receiving full pensions, the threshold ages for pensions would be 55 for women and 53 for men in 2008, 2009 and 2010 (Table 4.9).

However, in 2008 with an average age of 49 for women and 51 for men, pensioner ages fall below this threshold. In Figure 4.3, it is shown that OADR reflecting age of new pensioners change between 30.49% and 34.95% which is approximately a support ratio of three. In 2008 it is even below three which is 2.86.

Table 4.9 Threshold ages for constant old age dependency ratios between 1970 and 2010

	Threshold levels for old age dependency ratios							
	OADR [(..+)/(15-..)] >= % 25		OADR [(..+)/(15-..)] >= % 20		OADR [(..+)/(15-..)] >= % 15		OADR [(..+)/(15-..)] >= % 10	
	Sex composition							
Years	Female	Male	Female	Male	Female	Male	Female	Male
1970	50	50	55	54	60	57	62	60
1975	50	50	54	52	60	56	63	61
1980	50	50	54	52	57	55	63	60
1985	51	50	54	53	57	56	61	60
1990	51	50	55	53	58	57	62	60
1995	52	50	55	53	58	57	63	61
2000	52	50	55	54	59	57	64	62
2008	55	53	58	55	61	59	67	63
2009	55	53	58	55	61	59	66	63
2010	55	53	58	55	61	59	67	63

Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, 2010d and author's calculations

For an OADR of 20% or more, male and female ages go up and down in the last 40 years. Age for females start with 55 in 1970, is one year below this level in the following years and then from 1990 to 2010, it increases to 58. Age for males start with 54 in 1970, is one or two years below this level and then from 2000 to 2010, it increases to 55. To sustain a support ratio of five people in the working age to every person receiving full pensions, the threshold ages for pensions would be 58 for women and 55 for men in 2008, 2009 and 2010.

For an OADR of 15%, age for females start with 60 in 1970, is one to three years below this level in the following years and since 2008 it increases to 61. Age for males start with 57 in 1970, is one or two years below this level and then from 1990 to 2010, it increases to 59. To sustain a support ratio of 6.7 people in the working age to every person receiving full pensions, the threshold ages for pensions would be 61 for women and 59 for men in 2008, 2009 and 2010.

To sustain a support ratio of 10 people in the working age to every person receiving full pensions, threshold ages for pensions would be 67 for women and 63 for men in 2010. In 1970 it is 62 for women and 60 for men. It oscillates in a band of 62 to 67 for women and 60 to 63 for men.

The information in this section is organised according to the measures of population ageing and their corresponding threshold ages. In that way, a link between population ageing and

pension age is discussed. Similarly the following section ellaborates on adjusting pension age since 1970. Different baseline ages at 1970 are tracked.

4.6 Historical adjustment of pension age

This section deals with historical adjustment of pension age between 1970 and 2010 for different mortality equivalence scenarios and conventional measures of ageing. Mortality equivalence results only cover 1970 to 2000 as they need use of life table data. They reflect the logic of prospective measures of population ageing, as change in mortality is used to redefine ages 60, 55 and 50 at different time periods.

Law 5417 in 1950 figured out pension age as 60 for both sexes. As it is presented in Table 4.2, the rules changed four times until 1970. Firstly, five years of decrease in age for women with the Law 506 was implemented in 1965. In 1970, Law 1186 which was in force proposed 55 for women and 50 for men. However in this section 60 is also included in tables to have additional information for a 'what if' scenario that reflects initial pension age criterion in 1950.

4.6.1 Adjustments according to mortality equivalence

Table 4.10a and 4.10b illustrates the results with four different scenarios of adjustment criterion that are also used by Shoven and Goda (2008). Detailed information about the scenarios and calculation techniques are presented in the third chapter.

Table 4.10a Historical pension age adjustment with constant RLE and mortality risk

	Rule for historical adjustment									
	Remaining Life Expectancy					Mortality Risk				
	Sex composition									
	Female			Male		Female			Male	
	Ages									
Years	60	55	50	60	55	60	55	50	60	55
1970-1975	60	55	50	60	55	60	55	50	60	55
1975-1980	60	55	50	59	55	60	55	50	60	55
1980-1985	61	56	51	58	53	61	57	52	59	55
1985-1990	61	56	51	58	53	62	57	52	59	55
1990-1995	62	57	52	57	52	63	57	52	59	54
1995-2000	64	59	54	58	53	63	59	54	59	55

Table 4.10b Historical pension age adjustment with constant percent of expected life

	Rule for historical adjustment									
	Percent of expected life at age 0					Percent of expected life at age 20				
	Sex composition									
	Female			Male		Female			Male	
	Ages									
Years	60	55	50	60	55	60	55	50	60	55
1970-1975	60	55	50	60	55	60	55	50	60	55
1975-1980	61	56	51	62	57	60	55	50	60	55
1980-1985	64	58	53	63	58	62	56	51	60	55
1985-1990	65	60	55	64	59	62	57	52	60	55
1990-1995	67	61	56	65	59	62	57	52	59	54
1995-2000	69	64	58	66	61	64	58	53	59	55

Source: Gjonca, 2006 and author's calculations

Constant percent of expected life at age zero results in the highest age recommendation for the period. Results designate a pension age increment from 60 for 1970-1975 to 66 for men and 69 for women in 1995-2000. Other option, 55 for 1970-1975 is subject to an increase of nine years for women and six years for men. 50 in the initial period for women would be 58 for 1995-2000.
Constant percent of expected life at age 20 follows with the second highest pension age proposals except for 1995-2000 for women ages 55 and 50 in the initial period. In this scenario, according to the estimated life tables' life expectancies for men, pension age is below 60 for 1990-1995 and 1995-2000. For women, three years increase for 55 as well as 50 and four years increase for 60 is suggested.
Constant mortality risk suggests pension ages that are below the first two scenarios and finally constant remaining life expectancy has the lowest pension age recommendation for every five years. Constant mortality risk is the only measure in the table which does not take mortality in the successive years into account. Others are also related to the risk of mortality in remaining years.
Constant remaining life expectancy scenario proposes one or two years decrease in pension age for men for 1995-2000. Under constant mortality risk scenario, pension age of 60 in the initial period decreases one year for men whereas pension age of 55 in the initial period is kept constant except 1990-1995.
Table 4.10a and 4.10b summarise different policy proposals to start pension payments. It is obvious from the table that even there are changes in mortality equivalence compared to conventional age, there is still room for the policy makers to decide on the method. Although there are variations within methods, above results indicate that it is noteworthy to have a pension age rather than totally abolishing the age rule. It is also a fact that the mortality improvement of women has been higher than men between 1975 and 2000.
Similar to the study conducted by Shoven and Goda (2008) results in Table 4.10a and 4.10b assume that mortality improvements are perceived as working years. Gains or losses in life expectancy are treated as years of eligibilty. On the other hand one can still discuss this policy proposal if the gains in life expectancy should be directly accepted as working years or not. The authors recommend to share the improvements in remaining years of life between eligible and non-eligible years. In that case for instance, the highest pension age proposal for constant percent of expected life at age zero which is far away from applicability, has a more practical meaning. If a constant proportion of the gain, say 50% is used in this study, there will be an equal distribution between time for leisure and work. Consequently the pension age increment proposals in Table 4.10b for constant percent of expected life at age zero will be halfway traversed.

4.6.2 Adjustments according to constant conventional measures

Historical adjustment of pension age according to constant conventional measures include two types of measures. OADRs that assume either 15 or 20 for entry to workforce and use 60, 55 or 50 as entry to old age and proportion of older people 60+, 55+ or 50+. Firstly, the OADR or the proportion of older people for 1970 is calculated. For other years, proposed ages are the ages at which the value of measure is equal or greater than that of 1970.
Table 4.11a shows ages that equalise OADR based on 15 and Table 4.11b presents ages that equalise OADR based on 20.

Table 4.11a Historical adjustment with constant OADR based on 15 as start of working age

	Sex composition				
	Female			Male	
	Old age dependency ratio definitions with respect to different threshold ages				
Years	[(60+)/(15-60)]	[(55+)/(15-55)]	[(50+)/(15-50)]	[(60+)/(15-60)]	[(55+)/(15-55)]
1970	60	55	50	60	55
1975	59	52	49	59	52
1980	56	52	49	57	53
1985	57	53	50	57	53
1990	58	54	50	58	54
1995	58	54	50	58	53
2000	59	54	50	59	53
2008	61	56	53	60	56
2009	61	57	53	60	56
2010	61	57	53	61	56

Table 4.11b Historical adjustment with constant OADR based on 20 as start of working age

	Sex composition				
	Female			Male	
	Old age dependency ratio definitions with respect to different threshold ages				
Years	[(60+)/(20-60)]	[(55+)/(20-55)]	[(50+)/(20-50)]	[(60+)/(20-60)]	[(55+)/(20-55)]
1970	60	55	50	60	55
1975	59	52	49	59	52
1980	56	53	49	57	53
1985	57	53	50	57	53
1990	58	54	50	58	53
1995	58	54	49	58	53
2000	58	54	49	58	53
2008	60	56	52	60	54
2009	60	56	52	59	55
2010	60	56	52	60	55

Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, 2010d and author's calculations

Constant OADR for 1970 with respect to 15 as bottom threshold indicates that both for men and women, 60, 55 or 50 in 1970 increase one to three years at the end of the study period. Before 2008 there are fluctuations, which mean increasing or decreasing pension age at different periods. As touched upon with regard to population ageing and transition theories, this result is plausible as there are periods that age structure of population changes. 60, 55 or 50 in 1970 to 1975 for women respectively become 61, 57 and 53 as at 2010. On the other hand, 60 or 55 from 1970 to 1975 for men respectively become 61 and 56 as at 2010 (Table 4.11a).

Similarly, proposed ages for constant OADR for 1970 with respect to 20 as bottom threshold fluctuates in the last 40 years (Table 4.11b). 60, 55 or 50 in 1970 to 1975 for women respectively become 60, 56 and 52 as at 2010. After periods of oscillation, 60 or 55 from 1970 to 1975 for men is conserved as at 2010.

Historical adjustment for the conventional proportion of older people with respect to 60+, 55+, 50+ for women and 60+, 55+ for men is depicted in Table 4.12. Ages such as 60, 55 or 50 in 1970 to 1975 for women respectively become 65, 61 and 57 as at 2010. Similarly, 60 or 55 from 1970 to 1975 for men respectively become 64 and 59 as at 2010.

Table 4.12 Historical adjustment with constant proportion of older people

	Sex composition				
	Female			Male	
	Threshold Ages				
Years	(60+)	(55+)	(50+)	(60+)	(55+)
1970	60	55	50	60	55
1975	60	53	49	60	53
1980	57	53	50	58	53
1985	58	54	50	58	54
1990	59	55	51	59	55
1995	60	56	52	60	56
2000	61	57	53	61	56
2008	65	61	57	63	59
2009	64	60	57	63	59
2010	65	61	57	64	59

Source: TurkStat, 1977, 1982, 1984, 1989, 1993, 2003, 2010d and author's calculations

If historical adjustment is done according to constant proportion of older people, proposed pension ages follow a higher pattern than constant OADRs. The difference is up to five years.

Results presented in this chapter can briefly be summed up. As at January 1 st of 2010, Turkey has 72.5 million people, 7% of it is 65 and over which denotes a relatively young population.

Conventional MA in Turkey in 2010 is 29 which was 19 in 1970. The most common OADR, which is defined according to 65 as entrance to old age and 15 as entrance to labour force is 10.46% in 2010. There is 2.3% increase since 1970. If reference age is increased from 15 to 20, OADR increases around 2%.

All prospective measures show that the population has grown younger and older in Turkey between 1972 and 1997. PMA for both sexes is below conventional versions. Prospective version of proportion of older people are close to conventional ones between 1972 and 1997. The maximum difference between *Prop.RLE 15-* and *Prop.65+* is 0.82% in this period. Similarly, *Prop.RLE 20-* and *Prop.60+* are close to each other with an absolute difference of 0.84%.

Determining a pension age is a sensitive issue both from perspective of institutions and from the side of society. It is the key parameter that is affective in balancing the period for contribution payment of empolyees/employers and benefit payment of insurers.

Prospective measures stick to remaining life expectancy or mortality risk and conventional measures take constant levels of dependency ratios (and corresponding threshold ages) into account. Therefore, ages that can be proposed is sensitive to population ageing measure under interest. A pension age which provides a support ratio of more than four or five is proposed to be feasable for pensions and healthcare in recent literature. Prospective measures generally result in higher age proposals between 1970 and 2000.

Pension age as threshold ages for RLE 15- indicates the highest ages for males in five year long periods between 1970 and 2000. In the final period, it is 66 for men for 1995-2000 (as the life table data is for a limited period). Gains or losses in life expectany is converted to years of eligibility. Same measure shows the second highest age proposals for the same period for women. It is is 67 for 1995-2000. For women highest age proposal for entire period is the average of conventional 65 and RLE 15-. Averaging both type of threshold ages is argued to sustain intergenerational fairness in recent literature as it is more sensitive to benefits of old and young generations.

To sustain a constant OADR of 25%, 52 for women and 50 for men is proposed for 1995-2000. OADR 25% proposes the lowest ages among conventional measures. In addition, constant OADR of 25% shows 55 for women and 53 for men for 2010 (as conventional measures can be calculated for a wider period).
On the other hand, to sustain a support ratio of 10 people (an OADR of 10%), proposed age is 67 for women and 63 for men as at 2010.
Among mortality equivalence definitions, historical adjustment of pension age with respect to constant percent of expected life at zero brings out highest pension ages. For instance 60 in 1970-1975 period is proposed to increase to 69 for women and 66 for men in 1995-2000 period.
Among constant conventional measure scenarios, historical adjustment of pension age with constant proportion of older people brings out higher pension ages. For instance 60 in 1970-1975 period is proposed to be also 60 for women and men in 1995-2000 period whereas constant OADRs indicates 58 for both sexes. 60 in 1970-1975 period is proposed to increase to 65 for women and 64 for men as at 2010 whereas constant OADR based on 15 as start of working age indicates 61 and OADR based on 20 as start of working age indicates 60 for both sexes. Eventually, different approaches provide different pension ages which provide alternatives for policy makers in Turkey.

5 Conclusion and recommendations

This is the final chapter of this study which provides conclusions on the results and recommendations.

5.1 Conclusion

The objective of this research is to describe the trends in population ageing and influences of population ageing on pension age in Turkey within evaluation of different measures since 1970.

The research question on trends for population ageing since 1970 is analysed with measures such as MA, OADR, proportion of older people and prospective versions of these measures. Prospective measures use remaining life expectancies in life tables and account for gains in life expectancy in time

Trends for commonly used measures of population ageing indicate that population in Turkey is young. Similar to the findings of Sanderson and Scherbov (2008), the magnitude can be different depending on the measure of population ageing.

However there is a general perception that entry to old age and pension age is connected. Measures such as OADR or proportion of older people are based on 65 or 60 and assume that old age starts with pensions. As age rule in pension regime was abolished several times between 1970 and 2000, entrance to 'old age' for social security system indicates ages such as 49 or 50 in 2008 when average of new pensioners in a year is considered.

Thus, in terms of young pensioners, implication of pension regime in Turkey makes population ageing in Turkey an issue if old age starts with pensions. When average age of new pensioners in recent years is used for definition of an OADR, the ratio is more than 30% in the last decade. It is higher than OADR for EU27 or EU25 in 2008 which uses 65 as threshold age for 'old age'. It denotes a support ratio around three people of working age to every person over the average age of pensioners.

If official pension age 55 for men and 50 for women (which are the age rules in force in majority) is used in defining a dependency ratio, OADRs are not lower than 22.17% between 1970 and 2010. Proportion of older people according to these threshold ages indicates a rising trend since 1975.

The measures that are discussed in chapter four, except MA and PMA, implicitly have a relation with pension age. Threshold ages 60, 65 for proportion of older people and old age dependency ratios as well as threshold ages for prospective measures *Prop RLE15-* and *Prop RLE 20-* include suggestions on the age to start pensions. The second research question on influence of population ageing on pension age is studied considering threshold ages for different measures and three aspects.

Firstly, adjustment of pension age according to changes in mortality results in higher ages of eligibility in case of improvements in life expectancy. Gains in mortality are assumed to be working years. To keep a remaining life of 15 years or less constant, pension ages for women would be 67 in 1995-2000 with 4 years increase since 1970-1975 whereas for men it would be 66 indicating two years decrease for the same intervals. For a remaning life of 20 years or less pension age could be 61 for women 61 and 59 for men between 1995 and 2000.

Secondly, to sustain intergenerational fairness, averaging conventional and prospective threshold ages is proposed. That means a unisex pension age not less than 60 for the period 1970 to 2000 which is average of conventional age 60 and threshold age for remaning life of 20 years or less.

Thirdly, to have an OADR less than 25%, (or a support ratio more than four) pension age is proposed not to be less than 50 for men up to 2000-2008 and not less than 53 in 2010.

OADR less than 25% indicates pension age for women not less than 50 up to 1980-1985 and not less than 55 for 2010. If OADR is decreased to 20%, minimum 58 for women and 55 for men is needed for a support ratio more than five in 2010.
Pension age for different years under the assumption of historical adjustments according to various measures give answers to the third research question. Historical adjustment of pension age since 1970 according to constant percent of expected life at age zero scenario produces highest ages for men and women. Initial rules 55 for men ans 50 for women would be 61 for men and 58 for women between 1995-2000.
Initial rule 55 for men and 50 for women are proposed to be adjusted up or down with constant OADR. It results in a pension age not less than 53 for women and 56 for men as at 2010. When constant proportion of older people is used for same ages for both sexes, pension age would not be less than 57 for women and 59 for men as at 2010.
In conclusion, results show that there is no ideal age for pensions, what ideal is dependent on the measure, way of approaching age and priorities against population ageing. However a decision rule is better than having no age criterion to receive pensions. Then it would not be possible to have new pensioners at 49 for women and 51 for men as at 2008, if pension ages had been adjusted in the past according to any of the conventional measures studied. Institutions such as SSI should provide information on various methods that policy makers in governmental units have enough source to decide on the criterion to be used. Thus a feasible pension age considering social and economical context of the country can be decided.

5.2 Recommendations

In this section, recommendations on improvement of data quality, probable policies and further research is presented.

5.2.1 Reflection on data and methods

There are a set of sophisticated expediences which require keeping the social protection during old age in a livable level (from point of view of society members) but also sustainable (from point of view of governments/institutions that are in charge of fiscal constraints). To have a sustainable pension system, age is one of the parameters of eligibility that can be adjusted in time. However, adjustment proposals especially for future should be based on reliable and accurate data.
As presented in this study, prospective measures of population ageing which are used to recommend on pension age, require life table data. Also to have recommendations for future using conventional measures, life tables are needed to project the population in future years. A set of life tables for men, women and total for the base year should be in hand in order to have projected life tables for future years. Future policies can then be accurately designed. As the basic life tables in this study are estimated and have underlying assumptions behind them, mortality projection should better be based on unadjusted real death rates that are figured out of deaths and mid year population. As stated by experts of TurkStat, death statistics derived from civil registration system will probably be available soon. Therefore, after death statistics are available, rechecking the results of this study and adding a projection component is recommended. A collaboration between TurkStat and SSI during the process will prevent double work and enhance share of expertise between public institutions.

5.2.2 Recommendations on probable policies and further research

Although the pension reform in Turkey in 2008 increased pension ages for future years, gradual implementation allows the reform to be affective later after 2036.
The affect of gradual implementation of legislative amendments in the past is visible today. The system allows for retirement at 49 for women and 51 for men (because of accrued rights)

as at 2008 (SSI, 2009). However the results of this study shows that for intergenerational fairness, a unisex pension age not less than 60 could be implemented for the period 1970 to 2000 which is average of conventional age 60 and threshold age for remaning life of 20 years or less. Also a sustainable support ratio of five indicates 58 for women and 55 for men in 2010. Historical adjustment of pension age is obviously not possible as a policy. But with analysis of the past, a reconsideration or a rehabilitation of current rules is always possible as the pension system is dynamic and open to debate. With the reform, a gradual increase of eligibility age from 61 for men and 59 for women in 2036 to 65 for both sexes in 2048 is legislated. Thus, based on analysis of past rules of pension age and their implications, the pace of gradual implementation in the reform law is recommended to be cautiously handled. As a further study, after TurkStat disseminates complete death statistics, the aforementioned projection component can be helpful to comment more on the reform.

As discussed in this study and also touched upon by Sanderson and Scherbov (2008), averaging conventional and prospective ages is an option for intergenerational fairness in pensions. Fairness can also be sustained by using conventional ages but rewarding those working longer than the pension age with a higher accrual rate in older ages. Consequently a higher pension age is not set as a rule but working longer has a bonus of increased pension. In other words, marginal utility of working an additional year would be then larger than that of retiring at the official pension age. That subject is not studied in this thesis as it is out of scope but still remains as an area for further research.

Additionally, if TurkStat disseminates death statistics that are derived from civil registration, a study that focuses on population ageing in Turkey at regional level will be possible. Although, pension age is set at national level, such a study can give ideas on how setting a fixed age affects redistribution in a pension system from those with short life expectancies to those with higher remaining life expectancies within regions of a country.

Remaining life expectancies can also be used in pension payment calculations rather than only pension age. Notional defined contribution (NDC) pension regimes which accumulate contributions of employers and employees in notional accounts and calculates the annuity payments considering the remaining life excpectancy of the retiree at retirement date, uses life table information. In NDC systems, the pension regime adjusts itself automatically according to mortality improvements by means of pension calculation formula. Remaining life expectancy at retirement date is used to calculate monthly pension level which makes it possible to actuarially equalise the present value of future benefits to accumulated value of contributions. Using life table data, a wider approach on pension reform (a systematic reform rather than a parametric one that only considers pension age) then can be studied also for the case of Turkey as a further research.

References

AIV (2009), 'Demographic Changes and Development Cooperation'. Advisory Council On International Affairs, No.66. The Hague.

Babbie, E. (2007), *The Practice of social research*. Belmont: Wadsworth Publishing Company.

Blake, S. (2009), 'Subnational patterns of population ageing'. *Population Trends* 136, pp 43-63.

Bennett, N. G. and S. Horiuchi (1981), 'Estimating the Completeness of Death Registration in a Closed Population'. *Population Index* 47(2), pp. 207-21.

Bogue, D.J., E.E. Arriage, G.W. Rumsey and V. Prachuabmoh (eds.) (1993), *Readings in Population Research Methodology*. Social Development Center: Chicago

Bongaarts, J. (2004), 'Population Aging and the Rising Cost of Public Pensions'. Population Council-Policy Research Division, Population Council Working Papers, 2004 No.185.

Bongaarts, J. (2006), 'How Long Will We Live'. Population Council-Policy Research Division, Population Council Working Papers, 2006 No.215.

Bruijn, B. de (2005), 'The structure and development of fertility theory'. In: Caselli, J. Vallin and G. Wunsch (eds.). *Demography: Analysis & Synthesis*. Chapter 39

Carey, J. R. (2003), *Longevity, the biology and demography of lifespan*. University Press, Princeton.

Coale, A. (1973), 'The demographic transition'. In: IUSSP (ed.), *International Population Conference, Liege 1973*, (1), pp. 53-73.

Carone, G., D. Costello, N. D. Guardia, G. Mourre, B. Przywara and A. Salomaki (2005), 'The economic impact of ageing populations in the EU25 Member States'. European Commission, Directorate-General For Economic And Financial Affairs, Economic Papers-Number 236.

CoE (2005), 'Recent demographic developments in Europe 2004'. Council of Europe Publishing, Strasbourg, Cedex.

Cutler, D. M., J. B. Liebman and S. Smyth (2006), 'How Fast Should the Social Security Eligibility Age Rise?'. *NBER Retirement Research Center Working Paper* 04 (05), pp. 1-32.

European Commission (2009), 'Ageing Report: Economic and budgetary projections for the EU-27 Member States, 2008-2060'. European Economy 2/2009 (provisional version). Internet: http://ec.europa.eu/economy_finance/publications/publication14992_en.pdf
Last visited on September 13, 2009.

Eurostat (2010), 'Population structure indicators on 1st January'. Internet: http://epp.eurostat.ec.europa.eu/portal/page/portal/population/data/database. Last visited on July 11, 2010.

Frątczak, E. (2002), '*Proces starzenia się ludności Polski*', Studia Demograficzne 2, 142, pp. 3–28.

Gavrilov, L.A. and P. Heuveline (2003), 'Aging of Population'. In: Paul Demeny and Geoffrey McNicoll (eds.), The Encyclopedia of population. New York, pp. 32-7.

Gjonca, A. (2006), 'Training on preparing a life table for Turkey'. Project Completion Report. Hifab International.

Golini, A. (2001), 'Demographic trends and population policies'. *Futures* 33, pp. 27-41.

Grant, J, S. Hoorens, S. Sivadasan, M. van het Loo, J. DaVanzo, L. Hale, S. Gibson and W. Butz (2004), '*Low Fertility and Population Ageing: Causes, Consequences and Policy Options*'. RAND Corporation, Santa Monica.

Heligman, L. and J. H. Pollard (1980), 'The age pattern of mortality'. *The Journal of the Institute of Actuaries* 107, pp. 49-80.

Hurd, M. D., J. P. Smith and J. M. Zissimopoulos (2004), 'The effects of subjective survival on retirement and social security claiming'. *Journal of Applied Econometrics* 19, pp. 761-775.

ISSA (2008), 'Social Security Programs Throughout the World: Europe, 2008'. International Social Security Association, Social Security Observatory, Geneva.

Koç, I., M. A. Eryurt, T. Adalı and P. Seckiner, (2009), 'Türkiye'nin Demografik Dönüşümü: Demographic Transition of Turkey'. Hacettepe University Institute of Population Studies, Ankara.

Kirk, D. (1996), 'Demographic Transition Theory'. *Population Studies* 50, pp. 361-87.

Kurek, S. (2007), 'Population ageing research from a geographical perspective-methodological approach'. *Bulletin of Geography* 8, pp. 29-49.

Lee, R. and S. Tuljapurkar, (1997), 'Death and taxes: Longer life, consumption, and social security'. *Demography* 34 (1), pp. 67-81.

Lin, S. and X. Tian, (2003), 'Population Growth and Social Security Financing'. *Journal of Population Economics* 16 (1), pp. 91-110.

Lutz, W., S. Scherbov and W. Sanderson (2008), 'The coming acceleration of global population ageing'. *Nature* 451 (7), pp. 716-9.

Marin, B. and A. Zaidi, (2007), 'Trends and Priorities of Ageing Policies in the UN-European Region'. *Public Policy and Social Welfare* 32, pp. 61-106.

Miller, T. (2001), 'Increasing longevity and medicare expenditures'. *Demography* 38 (2), pp. 215-26.

Omran, A.R. (1998), 'The epidemiologic transition theory revisited thirty years later'. *World Health Statistics Quarterly* 51, pp. 99-119.

Preston S.H., P. Heuveline and M. Guillot (2001), *Demography. Measuring and Modelling Population Processes.* Blackwell Publishers: Oxford.

Robine, J. M. and J. P. Michel (2004), 'Looking forward to a general theory on population ageing'. *The Journals of Gerontology* 59A (6), pp. 590-7.

Ryder, N.B. (1975), 'Notes on stationary populations'. *Population Index* 41(1), pp. 3-28.

Sanderson, W. C. and S. Scherbov (2005), 'Average remaining lifetimes can increase as human populations age'. *Nature* 435 (9), pp. 811-3.

Sanderson, W. C. and S. Scherbov (2007), 'A New Perspective On Population Ageing'. *Demographic Research* 16 (2), pp. 27-58.

Sanderson, W. C. and S. Scherbov (2008), 'Rethinking Age and Aging'. *Population Bulletin* 63 (4), pp. 1-16.

Shoven, J. B. and G. S. Goda (2008), 'Adjusting Government Policies for Age Inflation'. NBER Working Paper Series, 14231, pp. 1-29.

SSI (2009), 'Statistical Yearbook 2008'. Internet: http://www.sgk.gov.tr/wps/portal/!ut/p/c1/ Last visited on June 24, 2010.

TDHS (2009), 'Türkiye Nüfus ve Sağlık Araştırması 2008: Turkish Demographic and Health Survey 2008'. Hacettepe University Institute of Population Studies, Ankara.

TurkStat (1977), 1970 Census of Population: Social and Economic Characteristics of Population. Turkish Statistical Institute, Publication Number: 756. Ankara.

TurkStat (1982), 1975 Census of Population: Social and Economic Characteristics of Population. Turkish Statistical Institute, Publication Number: 988. Ankara.

TurkStat (1984), 1980 Census of Population: Social and Economic Characteristics of Population. Turkish Statistical Institute, Publication Number: 1072. Ankara.

TurkStat (1989), 1985 Census of Population: Social and Economic Characteristics of Population. Turkish Statistical Institute, Publication Number: 1369. Ankara.

TurkStat (1993), 1985 Census of Population: Social and Economic Characteristics of Population. Turkish Statistical Institute, Publication Number: 1616. Ankara.

TurkStat (2003), 2000 Census of Population: Social and Economic Characteristics of Population. Turkish Statistical Institute, Publication Number: 2759. Ankara.

TurkStat (2008), *Statistical Indicators 1923-2007*. Turkish Statistical Institute: Ankara.

TurkStat (2010a), 'Address Based Population Registration System Population Census Results'. Internet: http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=6178. Last visited on June 4, 2010.

TurkStat (2010b), 'Death Statistics'. Internet: http://www.tuik.gov.tr/demografiapp/olum.zul. Last visited on June 24, 2010.

TurkStat (2010d), 'Address Based Population Registration System Population Census Results'. Internet: http://tuikapp.tuik.gov.tr/adnksdagitapp/adnks.zul. Last visited on July 6, 2010.

TurkStat (2010c), 'Birth Statistics 2001-2008 Results'.
Internet:http://www.tuik.gov.tr/PreHaberBultenleri.do?id=6164. Last visited on July 11, 2010.

UN (2001), *Replacement Migration: Is It a Solution to Declining and Ageing Populations*. ISBN 92-1-151362-6. United Nations, New York.

UN (2002), *Report of the Second World Assembly on Ageing*. ISBN 92-1-130221-8. United Nations, New York.

UN (2003), United Nations Population Divison, 'Mortpak for Windows'. Department of Economic and Social Affairs, United Nations, New York.

UN (2006a), United Nations Population Divison, 'Population Ageing: 2006'. Internet: http://www.un.org/esa/population/publications/ageing/ageing2006.htm. Last visited on May 3, 2010.

UN (2006b), United Nations Population Divison, 'World Population Prospects Glossary'. Internet: http://data.un.org/Glossary.aspx?q=life+expectancy. Last visited on July 26, 2010.

UN (2008), United Nations Population Divison, 'World Population Prospects: The 2008 Revision. Population Database'. Internet: http://esa.un.org/unpp/index.asp?panel=7. Last visited on October 3, 2009.

Van de Kaa, D.J. (1994), 'The Second Demographic Transition revisited: Theories and expectations'. In: G.C.N. Beets et al. (eds.), *Population and family in the low countries*. Lisse, Zwets and Zeigninger, Amsterdam, pp. 81-126.

Yaman, H.. M. Akdeniz and Z. Kanevetçi (2008), 'Ülkemizde Beklenilen Demografik Değişime Hazırlık-Yaşlı Dostu Birincil Bakım Merkezleri: Preparing For the Prospective Demographic Change in the Country-Elderly Friendly Primary Care Centers'. *Aile Hekimliği Dergisi* 2 (1), pp. 15-22.

Yüçeşahin, M. M. (2009), 'Türkiye'nin Demografik Geçiş Sürecine Coğrafi Bir Yaklaşım: A geographical approach to Turkey's demographic transition process'. *Coğrafi Bilimler Dergisi* 7 (1), pp. 1-25.

WHO (1984), *The uses of epidemiology in the study of the elderly, Report of a WHO Scientific Group on the Epidemiology of Aging*. Technical Report Series, 706. Geneva.

Wolfson, M. C. (1996), 'Health-Adjusted Life Expectancy'. *Health Reports*, 8 (1), pp. 41-46.