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**Demographic Change in Iceland and its
Impact on the Social Security System and
Health Care Expenditures**

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Chapter 1

1. Introduction

The majority of industrialized countries are experiencing a rapid aging of their populations. This development, as well as its impact on government expenditures, has been under scrutiny for some time. It receives even more attention now than in the past, because in some countries – Japan, for instance, where fertility is the lowest in the world and longevity the highest – this aging process has already led to economic depressions. In the context of population aging, social security programs and health care have received the most attention.

Iceland, an isolated island in the middle of the Atlantic Ocean, is separated from the markets on the mainland. It is the most sparsely populated country in Europe, with a population totalling only around 278 thousand. Despite these facts, its standard of living is one of the highest in the world.

At the beginning of the 20th century, Icelanders' life expectancy was only around 50 years, and people spent the greatest part of their lives working. At the end of the century, life expectancy is around 78 years, and most adults now expect to enjoy relatively good health care and to spend a considerable part of their lives in retirement. But longer life expectancy and better health do not seem to be accompanied by longer working lives. The result could be that fewer people will

produce the goods and services needed to support a population that includes a greater number of retired people. If not looked into in time, this development could lead to some economic difficulties.

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Three indicators of welfare will be analyzed in this paper: the future population, the future development of the public pension system, and the future development of the health care system. Furthermore, this paper will examine the question of whether these indicators will be of concern in the near future. The method of generational accounting will be used to evaluate the effect these systems will have on current and future generations.

Generational accounts provide an alternative perspective on public finance to that given by government statistics such as the budget surplus/deficit. The accounts do not focus on a single bottom-line figure but on individuals, their lifetime tax payments, and transfers from the government through the education, health care, public pension, social security and welfare systems. The accounts are often used to test the outcome of certain policy decisions and are used in this manner here. Chapter 2 describes the method of generational accounting and the assumptions that lie behind the method.

Chapter 3 concentrates on evaluating the future population structure, as population structure is the basis for the analyses of the future public pension and health care systems. The chapter outlines and describes the basic properties of the model used to forecast future population: *the cohort component method*. High, medium and low variant population forecasts are made. The forecasts were made in the program Matlab, but an Excel front was designed in order to make the forecast more user-friendly; therefore, it will be rather easy to make new population forecasts in the future. Thanks are due to Ásta Herdís Hall, who helped with the programming of the interface.

Chapter 4 focuses on the public pension system. It discusses the institutional features of the Icelandic pension system as a whole, examining the past development of the system and discussing its expected future development. In the chapter, the current public pension system is projected 50 years into the future. Examples of various retirement ages are given, and the effect they could have on the future economy is then evaluated with the generational accounting method.

Chapter 5 deals with the future development of the health care system. Health care expenditures are projected with a rather simple model called the “growth factor model.” The method assumes the growth in health expenditure to be decomposable into a set of independent growth rates, which can be estimated from available data. In the analyses, the factor is restricted to the effects of demographic change, a combination of aggregate population growth and age structure change, and a so-called underlying growth rate. The underlying growth rate takes into account numerous effects such as technological change, changes in the price of medical care, and others. Health care expenditures are also projected 50 years into the future and are evaluated with respect to whether the system will be a burden in the future.

Chapter 2

2. Generational Accounting

Generational accounts designate the distribution of the net tax burden that an average individual of a generation born in a specific year will pay for the remainder of his/her life. The distribution is indicated in present value terms, given that the fiscal policy of the base year is retained throughout the individual's lifetime. The accounts shed light on whether current policies favor present generations or future generations. Generational accounts are only forward-looking; therefore, only taxes that remain to be paid or transfers that remain to be received are taken into account. Because the accounts are forward-looking, a few assumptions must be made. The main assumptions concern the growth rate of the economy, the discount rate and future population. The fundamental methodology applied here is based on a method developed by Raffelhuschen in a European Commission study on generational accounting in Europe¹.

Although generational accounts depend on certain assumptions, their value cannot be questioned. Official statistics certainly indicate whether the economy is experiencing a boom or a recession, whether the budget is run with a deficit or a surplus, and how government revenue is spent. However, such statistics are not particularly informative about the impact of government policy on individuals of different ages or

gender, nor whether they work to equal the tax burden of current and future generations. This is where generational accounts are of value.

2.1 The Method

The fundamental equation of the generational accounting model is the government's intertemporal budget constraint, which requires the present value of future net tax payments of current and future generations to service the net government debt in the base year. In algebraic terms, the budget constraint reads as follows:

$$\sum_{s=0}^D N_{t,t-s} + \sum_{s=1}^{\infty} N_{t,t+s} = B_t \quad \text{Eq. 2.1}$$

where B_t is the government's net debt in year t , D is by definition the highest age that individuals can reach, and t is the base year of the accounts.

$N_{t,k}$ is the present value of the net tax payments (taxes paid net of transfers received) made by all members of the generation born in year k , over the remainder of their lives. The first term of Equation 2.1 is therefore the aggregate net taxes of all generations alive in the base year.

Equation 2.1 places a limit on the government's debt accumulation. Specifically, it requires government debt to grow at a slower rate than the rate of interest². Note that the budget constraint does not imply that the government's debt in the base year is ever paid off, only that the debt is serviced through payments of future and current generations.

¹ EU (1999) and Raffelhüschcn (2001)

² The assumption that government debt grows at a lower rate than the interest rate entails that the future level of debt does not have to be considered (for a detailed discussion, see Auerbach et.al. 1995). Thus, interest payments on net government debt do not enter into the generational accounts.

To calculate the total lifetime net tax payments of a generation born in year k , the net payment terms on the left hand side of Equation 2.1 can be decomposed into

$$N_{t,k} = \sum_{s=\max\{t,k\}}^{k+D} T_{t,k} P_{s,k} \left(\frac{1+g}{1+r} \right)^{s-t} \quad \text{Eq. 2.2}$$

where $P_{s,k}$ is the number of members of the generation born in year k still alive in the year s , and $T_{t,k}$ is the difference between tax payments and transfer receipts in the base year, for an average member of the generation born in year k . When generational accounts are constructed, it is assumed that the fiscal policy and economic conditions of the base year will prevail. Therefore, it is possible to project future net taxes of future individuals from the base-year age profiles, assuming taxes and transfers to grow at the rate of per capita productivity growth.

The generational accounts of current generations are found by dividing the aggregate remaining net tax payments of the generation born in year k by the total members of this generation who are still alive:

$$GA_{t,k} = \frac{N_{t,k}}{P_{t,k}} \quad \text{Eq. 2.3}$$

The generational account indicates the tax burden that an average individual of a generation born in year k will pay for the remainder of his life. This tax burden is represented in present value terms, given that the fiscal policy of the base year is retained throughout his lifetime. Note that generational accounts are forward-looking; that is, only taxes that remain to be paid or transfers that remain to be received are taken into account.

As has already been stated, the generational accounts assume that the fiscal policy of the base year will remain unchanged forever; therefore, the question remains whether this particular fiscal policy is sustainable, whether its continuation will lead to the fulfillment of the government's intertemporal budget constraint. To assess whether this is the case, intertemporal public liabilities (IPL) are calculated as follows:

$$IPL = B_t - \sum_{s=0}^{\infty} N_{t,s} \quad \text{Eq. 2.4}$$

where $N_{t,s}$ is calculated based on indefinitely maintained net taxes, T^* .

The value of IPL indicates how far the government is from fulfilling the intertemporal budget constraint given current fiscal policy. IPL also indicate the degree of policy adjustment necessary to restore fiscal sustainability. Positive IPL imply that the taxes of current and future generations fall short of covering the claims of the government and that taxes must be raised or transfers cut sometime in the future. Negative IPL mean that future generations will receive a bonus: that taxes can be cut or transfers increased. Thus non-zero IPL mean that current fiscal policy is unsustainable and must at some point be revised.

The IPL consist of two parts: first, the explicit debt, B_t , which is estimated from official statistics; and second, the implicit debt, which represents the accumulated debt (or surplus) generated from future tax payments and transfer receipts of current and future generations.

$$IPL = \text{Explicit debt} + \text{Implicit debt} \quad \text{Eq. 2.5}$$

If the intertemporal liabilities are not zero, the intertemporal budget constraint of the government is violated. Therefore policy adjustments are required to redeem intertemporal sustainability (to fulfill the budget constraint). The generational

accounting method assigns the entire adjustment to future generations. When computing the net tax burden of future generations, it is assumed that all tax payments made by members of future-born cohorts are adjusted proportionally with help of a uniform scaling factor, set to ensure the balance of the intertemporal public budget as defined in Equation 2.1.

Two measures for generational imbalance are used here. The first measure is the intertemporal public liabilities (IPL), which show the extent of the intergenerational imbalance, the burden that current generations roll over onto future generations by the current fiscal policy. The second measure of the imbalance is the comparison of the net tax burden of current newborns and future generations.

2.2 Assumptions and Data

The sources of the Icelandic data are thoroughly covered in earlier work on generational accounting in Iceland, where the estimation of initial government debt and government consumption is also detailed³. There are, however, some aspects of the Icelandic accounts that require further discussion here. The first concerns the quality of the Icelandic data. One of the advantages of a small economy like Iceland is that data are readily available. For example, the construction of the micro profiles was based on real payments in the social security system and in most of the direct tax groups. This is not an option in many countries and should enhance the reliability of the Icelandic generational accounts.

Three assumptions must be made in order to calculate the accounts: a growth rate, a discount rate, and a population forecast. The population forecast is the subject of the next chapter. The generational accounts in this paper assume that all government revenues and all expenditures – except the public pension and health care profiles,

which are evaluated separately in the paper – will increase at the rate of GDP growth. A standard assumption in the generational accounts of most countries is a growth rate of 1.5%; that figure is also used here. A 6% discount rate is used to calculate the present value of payments made in the future. This is a higher interest rate than is commonly used in most other countries. The reason is a high risk-premium due to the small size of the country and its dependence on a volatile natural resource.

³ IoES (1997a), IoES (1999) and IoES (2000)

Chapter 3

3. Population Projection

In modern society, it is becoming increasingly important to estimate the future size and composition of the population. Population forecasts are required for many purposes. Local education authorities must forecast the number of children for whom school space will be required in the immediate future. Forecasts of the future age structure are required for pension and health care purposes. Moreover, forecasts are needed to ensure that the future demand for power, transport and other services will be met, and so forth.

A population forecast for Iceland is the starting point here. This chapter discusses briefly the methodology and assumptions used to develop the population projections. The forecast is made from the base year 1999. It extends over a 50-year period and projects the population by single year of age and sex. The first part provides a brief overview of past demographic trends. The second presents the methodology used to project the future population. The third part presents the forecast of the individual components underlying the method, and the fourth and final part presents the future population forecast and its variances.

3.1 Population Transition in the 20th Century

At the beginning of the 20th century, the population of Iceland was estimated at around 78 thousand. By the beginning of the 21st century, the population had grown to about 279 thousand. The population growth was, on average, around 1.3% per annum the first 50 years and around 1.8% per annum over the period from 1950 to 1970. Since then, population growth has been steadily decreasing, hovering around 0.96% per annum during the last 10 years of the century.

In the beginning of the 20th century, the Icelandic population was young as a result of high levels of fertility and mortality. In 1920, the fertility rate (TFR)⁴ was around 4 births per woman, but at the same time, infant mortality rate was rather high. Due to this high mortality, life expectancy at birth was only 56 years for males and 61 years for females.

Population aging is occurring in most industrialized countries. Reduced infant mortality and increased opportunities for women have led to lower fertility. At the same time, improved medical care has extended the life span of older adults. This has been the case in Iceland as well as in other countries. Today the fertility rate has decreased to around 2 births per woman, and life expectancy is now 76 years for a newborn male and about 81 years for a newborn female.

The major improvement in mortality in Iceland has been among the young; therefore, the population today is still rather young. About one fourth of the total population was below the age of 15 in 1999, and only one person out of ten was elderly (67 or older). These ratios are expected to change, however, in the near future.

⁴ Total fertility rate (TFR) is the sum of the age-specific fertility rates between ages 15 and 49. This is therefore the total number of children a woman will have in her life.

3.2 Method

One of the fundamental facts about population change is that it only takes place due to a limited, countable number of events: fertility, mortality, and migration.

The basic demographic equation is derived from the above events:

$$P_{t+1} = P_t + B_t - D_t + M_t \quad \text{Eq. 3.1}$$

where at time t the population is P_t and one year later the population is P_{t+1} . B_t and D_t are the number of births and deaths occurring in the population between times t and $t+1$, and M_t is the difference between the number of immigrants and emigrants to and from the country during the same period.

In practice, a variety of models are used for population projections, but the method that is used here is called the *cohort component method*⁵. The name is derived from the fact that population only changes because of the above-mentioned events (fertility, mortality, migration), which are called *the components of population change*.

3.2.1 The Cohort Component Method

The cohort component population projection method follows each cohort of people of the same age and sex throughout its lifetime, according to its exposure to the components of population change. Starting with a base population by sex and age, the population at each specific age is exposed to the chances of dying, determined by projected mortality levels. Once deaths are estimated, they are subtracted from the population, and those surviving become older. Fertility rates are projected and applied to the female population of childbearing age in order to estimate the number of births every year. Each cohort of children born is also followed through time by

exposing it to mortality. Finally, the component method takes into account immigrants who enter the country, thus increasing the population, and emigrants who leave the population. Migrants are added to or subtracted from the population at each specific age. The entire procedure is repeated for each year of the projection period, resulting in the projected population by age and sex.

The applications of the component method can be somewhat complicated. Its fundamental principles are, however, quite simple and are derived from Equation 3.1 (the base equation). The base equation is replaced by two equations, depending on whether the age group is born at the base year t or will be born in the period from year t to year $t+l$.

The projection of people who are already born in the base year t :

$$P_{x+1,t+1} = P_{x,t} - D_{x,t} + M_{x+1,t+1} \quad \text{Eq. 3.2}$$

where x is the age as of the last birthday. The projection of newborns over the period from year t to year $t+l$ is:

$$P_{0,t+1} = B_t - D_{0,t} + M_{0,t+1} \quad \text{Eq. 3.3}$$

Equations 3.2 and 3.3 can also be written in the following way:

$$P_{x+1,t+1}^m = P_{x,t}^m (1 - q_{x,t}^m) + M_{x+1,t+1}^m \quad \text{Eq. 3.4}$$

$$P_{0,t+1}^m = B_t^m (1 - q_{0,t}^m) + M_{0,t+1}^m \quad \text{Eq. 3.5}$$

⁵ Hinde, A. (1998)

where q is the probability that a person aged x as of the last birthday in the base year will die before the year $t+1$.

The population projections are “launched” from a so-called base-year population. In the projections of this study, the base-year population is based on the mid-year population (July 1st). Other time intervals are, for example, calendar quarters or a calendar year.

Components of the population change are estimated and projected separately. They are then applied to Equations 3.4 and 3.5 to produce a series of population projections. Thus the value of the forecast of population structure depends completely on the value of the forecast made of fertility, mortality and migration. Therefore, if the assumptions about the components are illogical, the result of the population forecast will be meaningless.

Four sets of data are required before applying the cohort component method. First, a base-year population divided by age and sex is necessary (P_t). Second, sex-specific life tables are needed in order to find the probability of an individual’s living through one period (q_t). Third, age-specific fertility rates (ASFR) are necessary, and fourth, age- and sex-specific net migration rates (M_t) for the projection period are required.

3.3 Population Projection for Iceland

The information required to “start” the projection is a base-year population (July 1st 1999) subdivided by age and sex, a sex-specific life table, age-specific fertility rates,

and age- and sex-specific net migration rates. All information is obtained from Statistics Iceland⁶.

The following section describes the assumptions that determine future levels of fertility, mortality and migration and that underlie the population projections.

3.3.1 Fertility

The slowing of population growth in Iceland is the result of steadily declining birth rates. The total fertility rate (TFR) per year for women aged 15 to 50 in Iceland has been on the wane during the last century, as can be seen in Figure 1. The TFR was around 4 births per woman from the beginning of the century until around 1920; however, by 1940 the TFR had fallen to about 2.7 births per woman. Fertility increased considerably from then on until around 1960, when TFR was at its highest, around 4.25 births per woman. After 1960, however, TFR began to decline gradually and, by 1999, it was 1.99 births per woman, which is below replacement levels. In evaluating the immediate future trend, it can be useful to evaluate the fertility trends of the recent past. However, such evaluation provides little information concerning the trend over the next 100 years. To formulate fertility assumptions, past and current national and international fertility trends were analyzed.

⁶ www.hagstofa.is

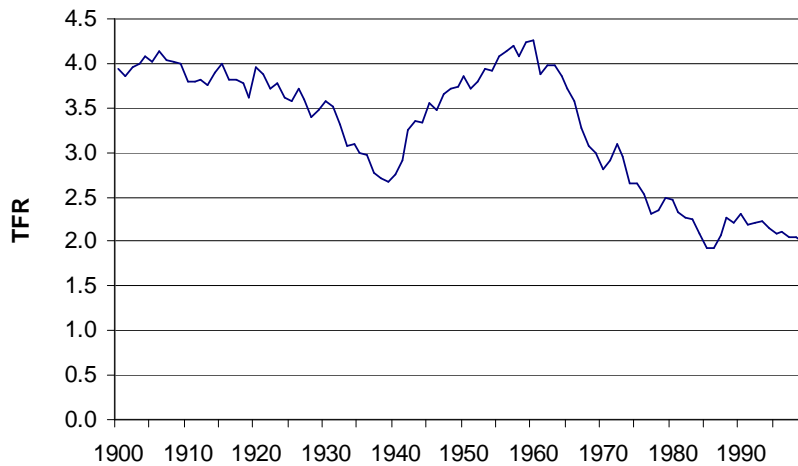


Figure 1: *Total fertility rate from 1900 to 1999*

According to UN data on fertility,⁷ Iceland had the third highest fertility rate in Europe in 1995; only Albania and Macedonia had higher rates. Even though the total fertility rate is higher in Iceland, it is assumed that the trend will be in the same direction as in other European countries, where total fertility rate has been declining.

Women in Iceland today are not only having fewer babies over their lifetimes, but they also have children later in their lives. This is obvious from Figure 2, where age-specific fertility rates (ASFR) for age groups 15-19, 20-24, 25-29, 30-34 and 35-39 are demonstrated over the period 1965 to 1999. Fertility for women in all age groups decreased from 1965 until about 1985. The fertility rate of the age group 15-24 continued to decrease until 1999, but the fertility of older women (30-39) increased after 1985 and has been more or less constant ever since. The first part of the period in Figure 2, the age group 20-24, had the highest age-specific fertility; but since 1985 the highest age-specific fertility is found in the 25-29 age group, and the second highest is the 30-34 age group (since 1990).

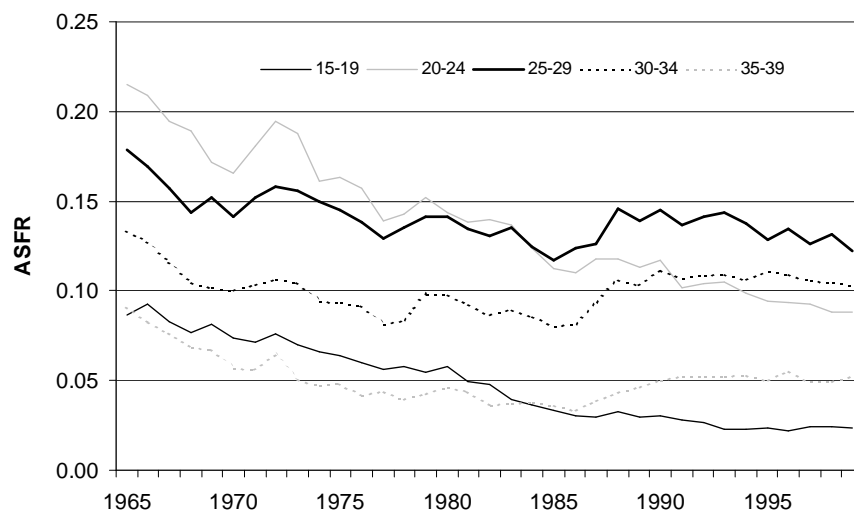


Figure 2: *Age-specific fertility rate*

The projection assumes that the total fertility rate over each woman's life will decline during coming years, reaching a target of 1.9 in 2015 and remaining at that general level until the middle of the century. This means that the total fertility rate is assumed to decrease by about 0.3% per year.

Low and high fertility assumptions are evaluated as well. High fertility assumptions expect the decrease in the total fertility rate to be 0.5% per year, whereas low fertility assumption projects a decrease of 2% per year. The total fertility rates for the middle, low, and high series for the projection period 1999 to 2050 are detailed in appendix A.

3.3.2 Mortality

Two important measures of mortality improvement are reductions in infant mortality rates and increases in life expectancy at older ages.

⁷ United Nations (1997)

Between 1966 and 1970, the infant mortality rate in Iceland was 16.6 per thousand live births. By 1998 that number had fallen to 3.2 per thousand.

Life expectancy at birth has increased significantly throughout the century and is expected to continue to increase in the immediate future. Figure 3 shows the development of life expectancy at birth for both males and females from 1921 to 1998. At this moment in time, as before, significant mortality differences exist between males and females.

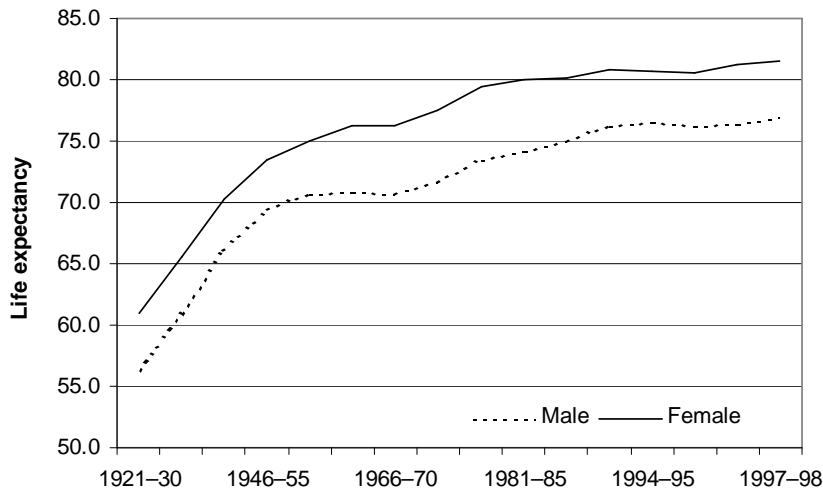


Figure 3: *Life expectancy for males and females during the period 1921 to 1998*

Life expectancy for the elderly has also been increasing, resulting in a rapid growth of the elderly population. The projection assumes that it will increase even more.

The assumption of the mortality for each cohort is made of a slow decline in mortality. The approach used here is to analyze the trends in the age-specific death rates (ASDR) by age and sex. During the past few decades, the rate of decline of

ASDR has varied greatly with age. The development of ASDR for males is demonstrated in Figure 4. The same pattern can be seen in the ASDR for women.

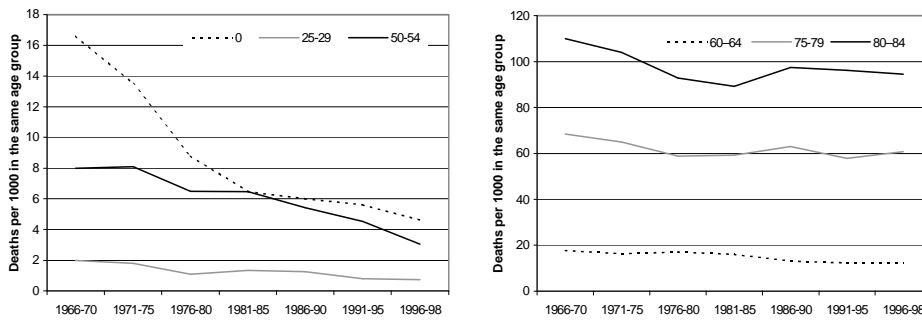


Figure 4: ASDR for males

This decline has been greatest for infants and smallest for the very old. Assumptions about future developments are therefore made on an age-specific basis and derived from the past trends in ASDR, which is probably the simplest method (see Hinde (1998)). The mortality forecast expects the mortality rate to decrease over the next 20 years, commensurable with the average decrease per annum during the last 30 years, and to remain constant from then on. This results in an increase in life expectancy from 76.3 to 79.2 years for males, and from 80.8 to 83.8 years for females, over the period.

Low and high life-expectancy assumptions are evaluated for mortality rates as well as for fertility rates. They are constructed using the same base life table and methodology as the middle series, except that different decreasing proportions are used. For the low life-expectancy series, the life expectancy for a newborn male and female is expected to increase from the base year to 78.5 and 83.1 years respectively. For the high life-expectancy series, it is assumed to grow to 79.8 and 84.4 respectively for males and females.

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Appendix A shows the differences in life expectancy given the three assumptions.

3.3.3 Migration

Over the last 35 years, migration in Iceland has always been significantly under 1% of the total population. Because of this, migration is not a large influence in the population change and is therefore assumed to be zero in the Icelandic population projection.

3.4 The Projection

Figure 5 shows how the population in Iceland is expected to develop over the next fifty years, according to assumptions made in the previous chapter⁸.

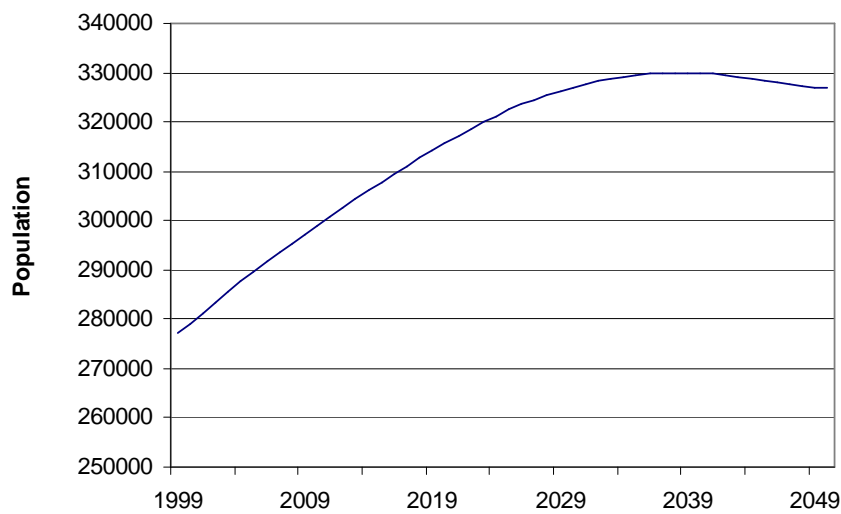


Figure 5: *Population projection from 1999 to 2050*

⁸ The forecast assumes the proportion of newborn males to be 51% of total newborns from the base year and throughout the period.

According to the forecast, the total population in Iceland will reach a maximum of 330 thousand in 2038 and then decline to 327 thousand in 2050. The decline occurs considerably later in Iceland than in other European countries, as the fertility rate in Iceland has been one of the highest in Europe. The series show that the national population is projected to grow, on average, by about 0.5% per annum from 1999 to 2038, and to decrease about 0.08% per annum over the last 12 years of the projection period.

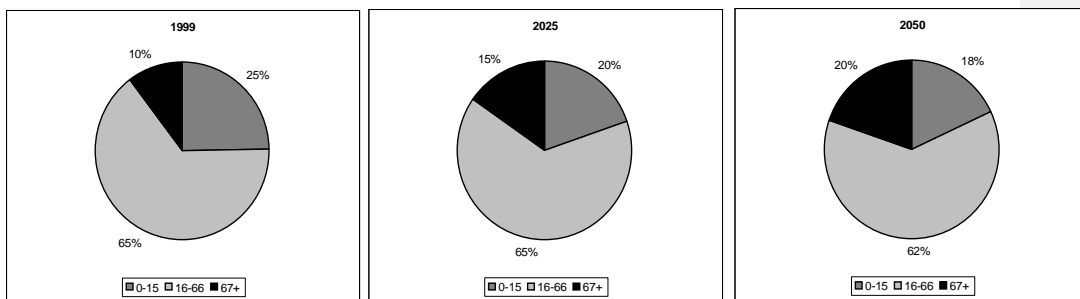


Figure 6: *The development of age groups over the period 1999 to 2050*

As in most other European countries, an aging process is underway in Iceland. However, as the fertility rate is still quite high, the aging process begins rather late. Figure 6 illustrates the partition of the total population into young (0-15), working age (16-66), and elderly (67 and over). The share of the elderly increases over the projection period, growing from 10% in 1999 to 20% in 2050. The proportion of the oldest population (aged 80 and over) is expected to grow from 2.6% in 1999 to around 6.7%, an almost threefold increase in size.

The old-age-dependency ratio⁹ in 1999 was about 16%; according to the projections, it will be around 18% in 2015. The old-age-dependency ratio increases more rapidly during the coming decades, to 29% in 2035 and to around 32% in 2050, with one out of every three people classified as elderly. Therefore, the time required for the

proportion of the elderly population to double from current values is projected at around 50 years.

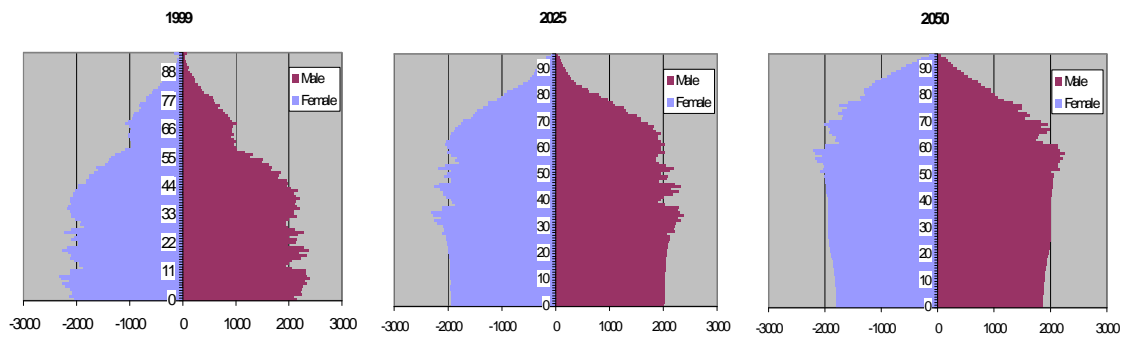


Figure 7: *The population pyramid in the years 1999, 2025, and 2050*

Figure 7 shows the age structure of males and females in the years 1999, 2025, and 2050, in terms of the population pyramid. The shape of the base-year figure resembles some sort of a Christmas tree rather than a pyramid. This form then evolves to become more like an “African hut” as the youngest age group decreases and the older age groups increase, resulting in an increasing elderly dependency ratio, as is mentioned above. The male and female structures remain similar throughout the period, as it was assumed that the ratio of newborn males to females will be 51% during the entire period.

The results of the high and low population forecasts are shown in Figure 8 with respect to the medium population projection. The high variant population projection assumes the population to grow constantly during the whole period, thus reaching a maximum population of 384 thousand in the year 2050. The low variant population projection assumes that the population will grow until the year 2025, reaching about 299 thousand, and then decrease to a minimum of 269 thousand in 2050.

⁹ The old-age-dependency ratio is calculated as the ratio of people aged 67+ to those aged 16-66.

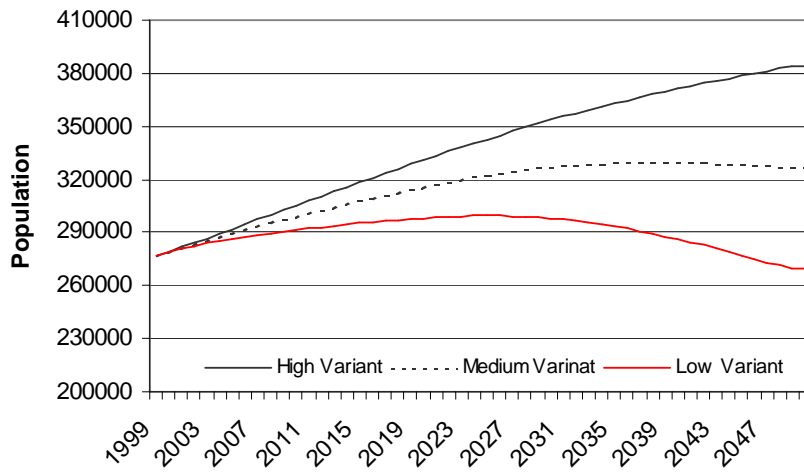


Figure 8: *High, medium, and low variant population projections*

Chapter 4

4. The Effect of an Aging Population on the Public Pension System

Demographic patterns for the majority of OECD countries indicate that they will experience a rapid aging of the population in the near future. An increasing proportion of the population will be older than the current retirement age, potentially placing stress on pension systems. In some countries, pension schemes will impose major burdens on their societies in the next century if present pension payments are left untouched, either through requiring higher taxation or through spending cuts. The impact made by this problem will, of course, vary from country to country. For nations like Japan, Germany, France and Italy, pension expenditure is expected to peak at between 15 and 20% of GDP, while in the United States and the United Kingdom the peak is expected to be between 5 and 8% of GDP¹⁰.

Chapter 3 evaluates the future population structure for Iceland. The result shows a trend similar to that in most other Western countries: a decline in overall population growth and a considerable increase in the elderly population.

¹⁰ OECD, (1995)

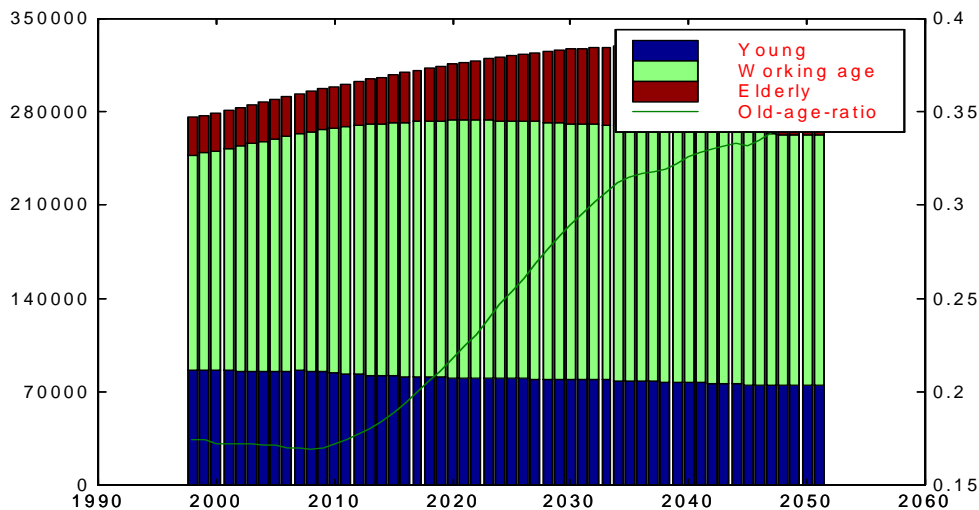


Figure 9: *Population projections and elderly dependency ratios*

Figure 9 demonstrates the expected development of the young, working-age, and elderly populations in Iceland over the next 50 years. Each column represents the total population in a given year, divided between the three age groups (left axis). The figure also presents the expected development of the old-age-dependency ratio¹¹ (right axis). As the old-age-dependency ratio and the declining number of working-age individuals imply, a significant pressure on the public pension system could occur in Iceland as well as in the other OECD countries.

Comment [AB3]: Page: 1
Should this not be 9 ?

The purpose of this chapter is to evaluate the effect that this development in population structure will have on the Icelandic pension system, and to determine whether it will be a concern for future generations. Section 4.1 describes the nature of the Icelandic pension system. Section 4.2 summarizes the development of the system in recent years and presents its expected development in the future. Section

¹¹ The old-age-dependency ratio is calculated as the ratio of people aged 67+ to those aged 16-66; i.e., the elderly who are past working age.

4.3 presents the public pension forecast, and Section 4.4 presents the generational accounts and their interpretation.

4.1 The Nature of the Pension System in Iceland

The main purpose of a formal pension system is to provide income in old age. The Icelandic pension system is built on three main pillars¹².

- Social security system
- Mandatory, fully funded occupational pension system
- Private pension system with voluntary individual accounts, investment plans, life insurance, etc.

People over 67 years of age (60 years of age for sailors) receive a public pension. This system is financed on a pay-as-you-go (PAYG) basis, which means that today's workers are taxed to fund today's pensioners, the implicit contract being that tomorrow's workers will similarly make transfers to tomorrow's retirees.

The public pension is divided into a basic pension and a supplementary pension, which is paid to those with very low income. Both pensions are means-tested, but the supplementary pension has a much stricter means test. The system ensures a maximum pension that is roughly equal to the minimum wage as determined by the Icelandic Federation of Labour. The social benefits are not indexed: neither by wages nor by the cost of living. All increases are made in increments determined by the government.

¹² See Herbertsson et al. (2000) and Guðmundsson, M. (2001)

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This is the official spelling of the IFL, even though your paper is in US English.

The Icelandic public pension system is relatively small by European standards. In 1999, it amounted to about 2% of GDP. This low ratio in Iceland emanates, to some extent, from the law on pension schemes that was enacted in the 1970's. Membership in a pension fund has been mandatory for all Icelandic employees and self-employed persons since 1974 and 1980, respectively.

In 1998, new pension scheme legislation entered into force, and all pension funds in Iceland operate on the basis of these laws. The legislation states that each and every wage earner and self-employed person is obliged to belong to a pension fund. In order to acquire pension rights, a payment of at least 10% of wages is obligatory. The law states as well that, for a 40-year period of contribution, minimum pension payment rights must be at least 56% of wages over the contribution period.

In excess of this minimum payment of 10% to the funds, employees are allowed to add 2% of their gross income to a private pension fund and receive matching contributions of 0.2% from their employer; i.e., the employee immediately receives 10% interest on his extra contribution. In 2000, this ratio increased to 4% and 0.4%. The contribution to the funds is exempt from income taxation, but the pension payments themselves are not.

Members can begin to withdraw old age pensions at the age of 65, but with reduced benefits, or as late as 70 years of age, with additional benefits.

4.2 The Development of the Pension System

Several facts about the Icelandic nation must be considered before projecting the future development of the Icelandic pension system. First, the population is younger than most western European countries and will remain so for the next several decades. Figure 9 showed that the old-age-dependency ratio will grow to about 32%

at the end of the projection period, whereas in countries like Denmark and Germany the old-age-dependency ratio is expected grow to about 43% and 49% respectively, at the same time¹³. Second, labor participation of the elderly is higher in Iceland than in most other developed European countries, as is the effective retirement age. Labor participation of Icelanders aged 65 to 74 was, for example, higher than labor participation of the population aged 55 to 64 in many European countries¹⁴. Finally, the law on mandatory membership in fully funded pension funds will put less stress on future generations. Iceland should therefore be better prepared for the aging of the nation than are most of the developed European countries.

The development of the expenditure in the Icelandic pension system as a percentage of GDP is showed in Figure 10¹⁵. The ratio to GDP of the public pension (only the old age pension) has been steadily falling during the last six years, whereas the ratio of the pension funds has been steadily increasing.

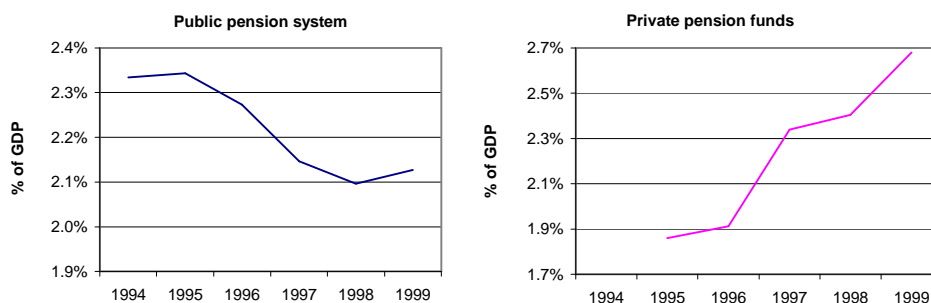


Figure 10: *The development of expenditures in the Icelandic pension system from 1994 to 1999*

What is interesting is that the expenditure as a ratio to GDP of the public pension system has become lower than the expenditure of the pension funds. In 1999, the

¹³ This old-age-ratio is calculated as the ratio of people aged 65+ to those aged 15-64.

¹⁴ See the Icelandic Ministry of Health and Social Security (2001)

pension funds paid about ISK 17 billion to members, or about 2.7% of GDP, but the public pension system paid about ISK 13 billion, or about 2.1% of GDP.

Guðmundur Guðmundsson (2000) and Benedikt Jóhannesson (2000) have analyzed the future development of the pension system and have drawn similar conclusions. Guðmundsson estimated that pension payments to the retiree would amount to about 50 to 60% of full-time earnings (a replacement ratio) for the typical general occupational pension fund at full maturity, and with the public pension to amount to between 60 and 70%. Jóhannesson estimated the total replacement ratio to be 63% in 2040,¹⁶ as compared to 41% in the year 2000.

As the proportion of pension funds to total pension income will increase, it is expected that the supplementary pension, for most people who have paid into occupational pension funds during their working life, will die out because of means testing.

4.3 The Public Pension System Forecast

4.3.1 Assumptions and Method

The forecast is divided into two parts, a *basic pension forecast* and a *supplementary pension forecast*. The forecast of the basic pension payments is simple, as it is expected to increase with GDP growth, like most of the profiles in the generational accounts. The forecast of the supplementary pension is more complex, however. It relies on the previously mentioned estimations of the replacement ratios made by Guðmundsson and Jóhannesson; i.e., that at full maturity the replacement ratio of the pension funds will be around 50-60%.

¹⁵ Information from the State Social Security Institute and the Financial Supervisory Authority

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The general rule is "ð" becomes "d", and
"þ" becomes "th".

The distribution rules of the public pension system for a single pensioner are demonstrated in Table 1¹⁷. The table displays the amount received – that is, a basic pension (column B) and a supplementary pension (column C) – by a single pensioner, subject to his/her pension fund payments (column A).

Jóhannesson estimated the total replacement ratio of the private funds and the public system in 2000 to be around 41%; from that assumption, the average lifetime wage is calculated (wage = total pension / replacement ratio) and presented in column E.

A	B	C	D	E
Pension fund payments	Basic pension	Supplementary pension	Total pension payments	Average lifetime income
0	17,715	52,149	69,864	170,400
7,124	17,715	45,025	69,864	170,400
15,000	17,715	45,025	77,740	189,610
32,513	17,715	45,025	95,253	232,324
50,000	17,715	33,392	101,107	246,602
70,000	17,715	20,089	107,804	262,937
80,000	17,715	13,438	111,153	271,105
100,204	17,715	0	117,919	287,607

Table 1: *Distributioning rules of the public pension system in the year 2001*

If the replacement ratios of the pension funds were 50 or 60% (at full maturity) of average wages, and the same distribution rules would apply, a re-evaluation of the distribution rules (the amount of the supplementary pension is found with a simple interpolation of Table 1) would be as follows:

¹⁶ In about 2040, all pensioners are expected to have paid contributions to pension funds their whole working lives, full maturity (equilibrium). Jóhannesson also expects the funds to be around 3/4 of the total replacement ratio. This results in a roughly 50% replacement ratio for the funds.

¹⁷ Information from the home page of the State Social Security Institute: www.tr.is

A	50% replacement ratio			60% replacement ratio		
	B	C	D	E	F	G
Average lifetime income	Pension fund payments	Basic pension	Supplementary pension	Pension fund payments	Basic pension	Supplementary pension
170,400	85,200	17,715	9,979	102,240	17,715	0
170,400	85,200	17,715	9,979	102,240	17,715	0
189,610	94,805	17,715	3,591	113,766	17,715	0
232,324	116,162	17,715	0	139,395	17,715	0
246,602	123,301	17,715	0	147,961	17,715	0
262,937	131,468	17,715	0	157,762	17,715	0
271,105	135,552	17,715	0	162,663	17,715	0
287,607	143,804	17,715	0	172,564	17,715	0

Table 2: *Table 1 updated to reflect 50 and 60% replacement ratios of funds*¹⁸

The pension fund payments from the funds (columns B and E) are found subject to the average lifetime wages (column A in Table 2 and column E in Table 1). Columns B to D demonstrate the distribution rules for the 50% replacement ratio, and columns E to G demonstrate the distribution rules for the 60% replacement ratio. It is interesting to see that, for the 60% replacement ratio, the supplementary pension payments are zero for the single pensioner (not for other groups, e.g., married citizens).

Even though this method is simple, it gives an indication of future development. The same procedure is used for other groups of the society (other rules apply for married pensioners).

The total decrease of the supplementary pension for the two replacement ratios is between 80 and 90% over the 40-year period. This amounts to a decrease of about 4.3% per year subject to the 50% replacement ratio, and a decrease of 5.6% per year if the replacement ratio is 60%.

4.3.2 The Forecast

The latest age distribution profile of payments through the public pension system, dating from 1999, is used as a base for the forecast. The data were obtained from the State Social Security Institute in Iceland and demonstrate average pension payments per person for each cohort.

Comment [AB6]: Page: 1
Assuming you are referring to Tryggingastofnun, this is the official Eng translation from Hagstofa Íslands.

Each cohort's average supplementary pension is expected to decrease during the next 40 years according to the above, then stabilize and increase with GDP growth thereafter. The basic pension profile is expected to increase with GDP during the entire period, as is mentioned earlier.

Figure 11 shows the development of the public pension system until the year 2050. The expenditure as a share of GDP will not increase after the year 2050, as the population forecast expects the population to remain constant thereafter, as is reported in Chapter 3. The solid lines show the projection of pension expenditures at 50% replacement ratio at full maturity, whereas the dashed lines demonstrate a 60% replacement ratio.

¹⁸ The supplementary pension in columns D and G are found according to Table 1 because of the assumption that the same distribution rules apply, with an extrapolation.

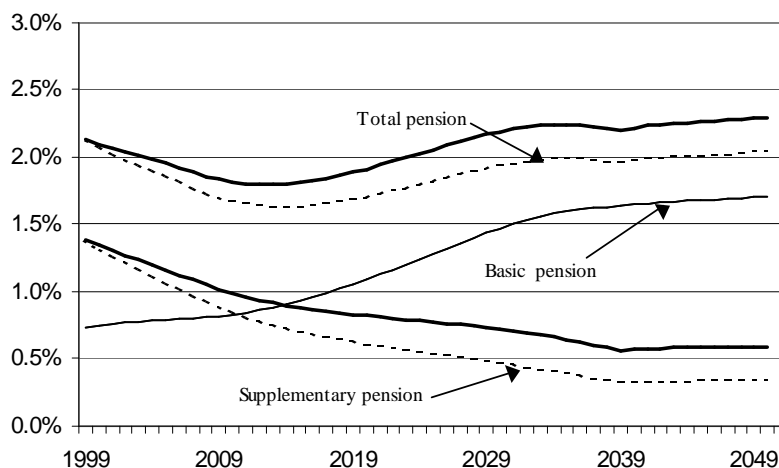


Figure 11: *The projection of the public pension system from 1999 to 2050*

The difference between the two extreme assumptions is small. It is possible to see, however, that the public pension system will not put much stress on future generations, as maximum expenditures are not expected to exceed 3% of GDP. This is a rather low percentage compared to the expectations of many other countries (see page 26).

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You may need to update the page number here.

The entrance of the so-called baby-boom generation (see Chapter 2) is quite obvious in the projections. The baby boomers will enter the system in about 2010-2015 and will peak in about 2030-2035.

4.3.3 Experiments¹⁹

Workers in almost all the OECD countries have tended to withdraw permanently from the labor force at earlier and earlier ages. The “standard” age at which male workers qualify for a full state pension is 65 years in more than half of the OECD countries. This age tends to be lower for females. It is therefore natural to ask what

¹⁹ The following experiments are performed subject to the 50% replacement ratio.

effect a lower retirement age has on the public pension system. Figure 12 shows the result if the retirement age in Iceland were lowered to 65 years of age instead of the obligatory age of 67.

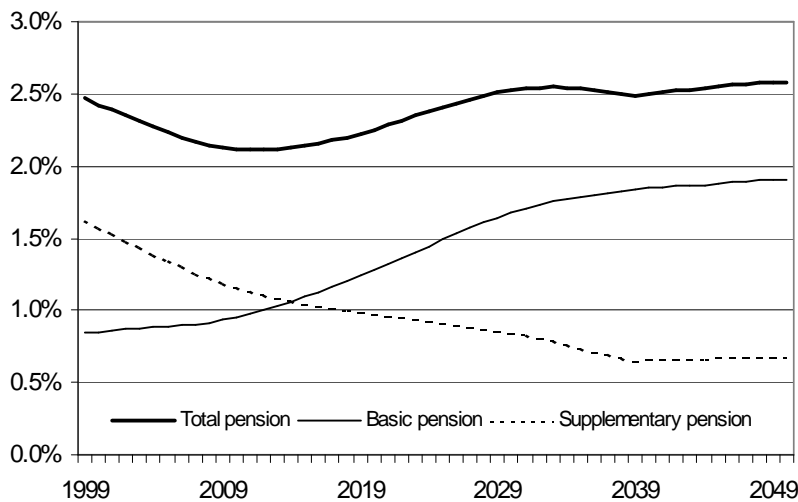


Figure 12: *Projection of the pension system assuming a retirement age of 65*

Compared to Figure 11, the increase is not dramatic, but it represents a shift upwards nonetheless. The total pension increases to about 2.6% in the year 2050 with the retirement age at 65, compared to about 2.3% with 67 years as the qualified retirement age.

When most pension schemes were instituted, they were generally designed to cover a relatively small number of years between work and death. As life expectancy has risen and is expected to rise further, many OECD countries have initiated reforms on their public pension systems. One option is to raise the effective retirement age. If the retirement age were raised to 70 years, the pension system would increase to only about 2% of GDP at the end of the projection period. Another way to react to the

aging is mentioned in a report written for the Icelandic Ministry of Health and Social Security. This report suggests that people be offered the opportunity to postpone retirement until age 72 in return for a 0.5% increase in their monthly pension. Figure 13 shows an example of this, as well as the other alternatives mentioned above. The light gray line displays a system where 40% of the elderly (67 years of age) postpone retirement until age 72²⁰. This demonstrates that giving the pensioners this opportunity to postpone pension payments until later in their lives will lower the government's expenditures to the public pension system.

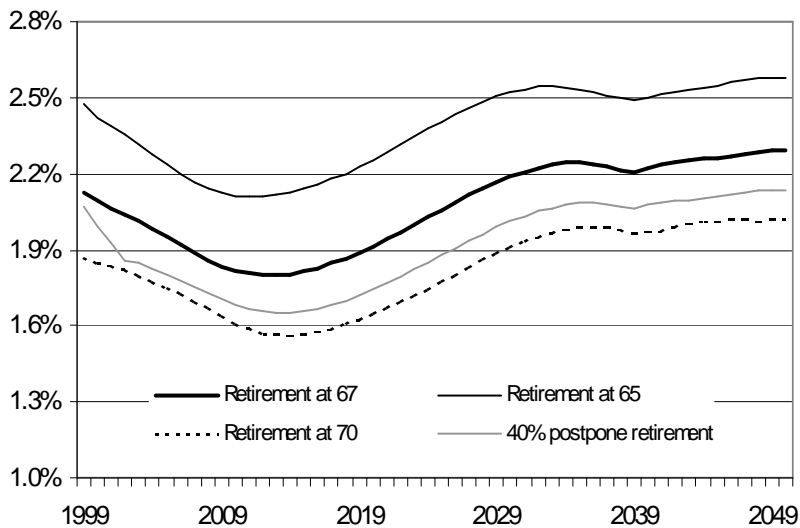


Figure 13: *Difference among four retirement ages*

The difference among the expenditures for these retirement ages is sizeable, but none of the four options is likely to put a burden on future generations.

²⁰ In 1999 the ratio of pensioners under 70 years of age who were still working was around 60%; see The Icelandic Ministry of Health (2001)

4.4 Generational Accounts

Generational accounting is a tool for the analysis of fiscal policy, as is mentioned in the introduction to this treatise. The method is used here in order to analyze how the pension system affects the burden of current and future generations. In addition, it is used as a tool for comparing the various options under consideration in the previous subchapter.

Calculating the intertemporal public liabilities (IPL) associated with the stance of fiscal policy for the base year 1998 reveals that none of the four pension alternatives pass liabilities on to future generations. The results show rather that current generations are being shortchanged, no matter which way is taken. Table 3 reports the findings. The IPL is quite negative, indicating an intertemporal public wealth, thus bringing more prosperity to future generations than to current ones. As a consequence, all taxes for future cohorts can be reduced in order to fulfill the budget constraint. This gives the result that future newborns will have to pay less to the government than the 1998 generation.

<i>Assumptions</i>	Retirement at 65	Retirement at 67	40% retire at 72	Retirement at 70
Explicit debt (% of GDP)	39	39	39	39
Implicit debt (% of GDP)	-71	-78	-82	-84
IPL (% of GDP)	-31	-39	-43	-45
Current generational account*	-5586	-5563	-5550	-5543
Future generational account*	-7540	-8004	-8219	-8361
Difference*	-1954	-2442	-2668	-2818

* 1,000 ISK

Table 3: Generational accounts for the pension system

As expected, retirement at 70 gives the highest intertemporal assets IPL and retirement at 65 gives the lowest.

Comment [AB8]: Page: 1
In the table below, it is better to say "Some retire at 72" or even "40% retire at 72" (as this is the figure you mention in the text) rather than "a part retires at 72"

The above accounts are not intergenerationally balanced. In order to ensure equality between current and future generations, an immediate tax reduction or increase in transfers would be necessary. An immediate tax reduction to current and future generations of 3.3% to 4.77% would be sufficient to ensure equality between current and future generations for the above example.

The private pension system does not enter directly into the generational accounts. But as the pension payments are liable for taxation, the increasing weight of the private funds should raise the government's income through income taxes; thus the funds should "enter" the generational accounts through that channel.

But as this increase in income taxes is not included in the above generational accounts calculations, as the government's tax income was only increased with GDP growth, an adjustment to the income tax profile must be made in order to make the GA accounts as accurate as possible. The method used is to increase the income tax profile for the age group 67 and older until they have reached about 60 to 70%²¹ of the average income taxes of the age group between 20 and 66 years of age in the year 2040. This is in accordance with Guðmundsson and Jóhannesson's findings, where they expect the total replacement ratio to be in this range. This is, of course, a very simplified way of evaluating the income tax increase. The argument for this simplified method is that the income tax profile increases with GDP growth (and therefore wages), so that a pensioner who is 70 years of age today received, at age 40 (30 years ago), the same income in present value as the worker who is now 40 years old. It can therefore be said that the pensioner's average wages over his/her working life are the average wages of the age groups 20 to 66 years of age.

This adjustment to the income tax profile makes the difference in the net tax burden between the generations even greater. This is demonstrated in Table 4.

²¹ See page 31

Comment [AB9]: Page: 1
In this table as well, I would say "Some retire at 72" or "40% retire at 72"

<i>Assumptions</i>	Retirement at 65	Retirement at 67	40% retire at 72	Retirement at 70
Explicit debt (% of GDP)	39	39	39	39
Implicit debt (% of GDP)	-84	-92	-95	-98
IPL (% of GDP)	-45	-53	-56	-59
Current generational account*	-5506	-5483	-5470	-5463
Future generational account*	-8317	-8782	-8996	-9138
Difference*	-2812	-3299	-3526	-3675

* 1,000 ISK

Table 4: *Generational accounts with an addition of tax increase*

The effects of the four various pension alternatives on the rest-of-life net tax payments of current generations can be seen in Figure 14. The basic pattern of the curves is as expected; i.e., the basic pattern of benefiting from schooling expenditure, paying taxes during middle age and receiving old-age pensions towards the end of one's life. Another factor is that the break-even points do not change with the different ways. There is not much difference among the options for the youngest age groups, but a difference becomes apparent for working people, especially for those approaching retirement age.

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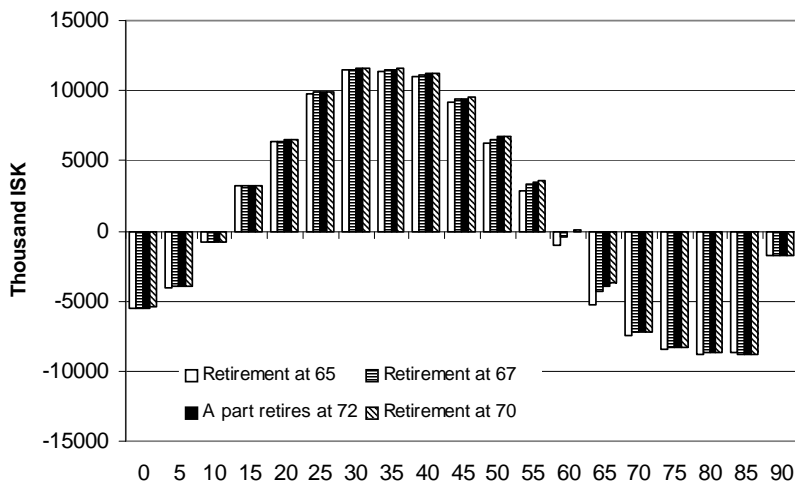


Figure 14: *Current generations' rest-of-life net tax payments*

In order to calculate generational accounts, the methodology must be adapted to the circumstances and data of the respective country. In Iceland, data are relatively readily available and reliable; this includes data on tax- and transfer payments, as well as information on the assets and liabilities of the general government. However, the methodology of the accounts requires that certain parameters be decided, specifically to include a discount rate to compute the present value of future payments and the rate of future productivity growth. As the accounts are sensitive to the value of these parameters, it is important to perform a thorough analysis to assess the sensitivity of the accounts.

Table 5 reports the sensitivity of the findings given the retirement age of 67, with respect to realistic variations of the key economic variables and demographic assumptions. A lower growth rate and higher discount rate both serve to reduce this generational imbalance. The volatility is quite high, as is witnessed by the fact that for combinations of three real interest rates (5, 6 and 7%) with three alternative GDP growth rates (1, 1.5 and 2%), the IPL ranges between -27 and -102% of GDP.

Growth rate		1%	
Discount rate	5%	6%	7%
IPL	-71	-44	-27
Growth rate		1.5%	
Discount rate	5%	6%	7%
IPL	-85	-53	-33
Growth rate		2%	
Discount rate	5%	6%	7%
IPL	-102	-63	-40
	Constant population	Low mortality	High mortality
IPL	-6	-27	-78

Table 5²²: Sensitivity analysis

²² The following is conducted subject to the 50% replacement ratio.

The table also reports the sensitivity of the findings with respect to the underlying demographic assumptions (growth is assumed to be 1.5% and discount rate is 6%). High population (where life expectancy is 79.8 for men and 84.4 for women) gives intertemporal assets of 27% of GDP, whereas low population (where life expectancy is 78.5 for men and 83.1 for women) gives 78%. If the base-year population structure were to remain constant, which would eliminate population aging, the current fiscal policy would approach sustainability.

4.5 Concluding Remarks

The above analyses deal with the future development of the public pension system and conclude that it will not be a burden on future generations. The private pension funds were not a part of the analyses, as they do not affect the generational accounts. Their position is nonetheless very important for the total pension system. Private pension funds have grown considerably in recent years in relation to GDP and are expected to do so in the near future. The assets of the funds²³ in 1999 amounted to about 80% of GDP and are expected to increase to about 1.5 times GDP around the middle of the 21st century. It can therefore be concluded that the total pension system will be able to handle the aging of the nation.

According to the Icelandic Ministry of Health, the social security system will change in July 2001. The Ministry expects the government's expenditure to the system to increase by about ISK 1.350 million per year. The public pension system has received about 60 to 65% of the total contribution per year in recent years. This would suggest an increase of between ISK 800 and 900 million to the pension system, which is about a 6 to 7% increase. This will bring implicit public liabilities closer to sustainability.

²³ Már Guðmundsson (2001)

Comment [AB11]: Page: 1
Do you mean 1.350 million or 1,350 million ?

Chapter 5

5. Health and Geriatric Care Expenditure in an Aging World

The changing size and age distribution of the population make an impact on the demand for health care services. The Icelandic population is expected to grow by more than 54 thousand inhabitants until the year 2038 (when the population is forecasted to reach its maximum), an increase of about 20%. The focus of this chapter is on health care and the effect the changing demographic size and pattern will have on expenditures to the health care system. The economic weight of the health care system is significantly greater than the weight of the public pension system: the expenditure amounted to about 7% of GDP in 1998, as opposed to about 2% of GDP for the public pension system. The health care system, of course, serves all inhabitants, whereas the pension system only provides benefits to the elderly.

Analyses show that health care expenditures have been growing faster than GDP in the industrialized nations. The rising proportion of the population belonging to the elderly age groups, along with the life expectancy trends described in Chapter 3, might put yet further pressure on health care systems.

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I suggest "systems" here because we don't put pressure on the costs themselves but rather on those who must pay!

To evaluate the future trend in health care expenditures, the projection methodology described in Mayhew (2000) is used. This is based on a simple growth factor method, in which the increase in health expenditures is assumed to be decomposable into a set of independent growth rates, which can be estimated from available data.

This chapter is divided into four parts. The first part considers the way in which health care expenditures are divided among age groups. Section 2 explains the growth factor method. Section 3 demonstrates the health care expenditure forecast based on the growth factor findings. Finally, Section 4 shows the results of the generational accounts, where the health care expenditure forecast is taken into account.

5.1 Measuring Health Expenditure

The available data on the Icelandic health care system are not as detailed as the data on the pension system, where information on each cohort was available. There is no single or conclusive source of data covering all aspects of the health care system. The data used in the analysis of the health care system are composed of 5 parts²⁴:

- *Health affairs and services.* The distribution for this system is hospitalization days per 1000 persons, divided by sex and age. The total amount for this system is then divided according to the distribution.
- *Nursing and convalescent home service.* The distribution is the number of rooms per 100 residents, divided by sex and age. The total amount for this system is then divided according to the distribution.

²⁴ Information from the Ministry of Health and Social Security

- *Medication and medical equipment.* Reliable distribution on Icelandic medical spending is not available. A Swedish distribution is therefore used, at the suggestion of the Ministry of Health.
- *Medical and dental clinics and practitioners.* The data include the total transfers to this system and the distribution of its users by sex and age.
- *Emergency room.* The data are on the number of patients coming to the ER, divided by sex and age. The total amount is then divided according to the distribution

The information is average data for five-year age groups. All data, except those on emergency room which is a yearly data, are average figures from the period from 1992 to 1994. More recent information is not currently available. This shortcoming makes the analysis on the health care system less accurate than expected.

The pattern of health care costs at different stages in the average life cycle can be seen in Figure 15. Costs are relatively high in the first year of life, around ISK 100 thousand per person, but they fall to low levels throughout childhood and adolescence. There is then a rise in expenditures for women during their childbearing years. Health care costs begin to rise very steeply as people reach their sixties, and by the time inhabitants reach the age group 85 to 90, the cost averages around 1.3 million per person. This life cycle pattern implies that as the number of elderly persons increases, total health care costs are also likely to rise. The rise might not be as dramatic as was once feared because, at the same time that the nation is getting older, people are living healthier lives (Mayhew 2000).

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 you keep this format in the previous table)
 "Thousand ISK"

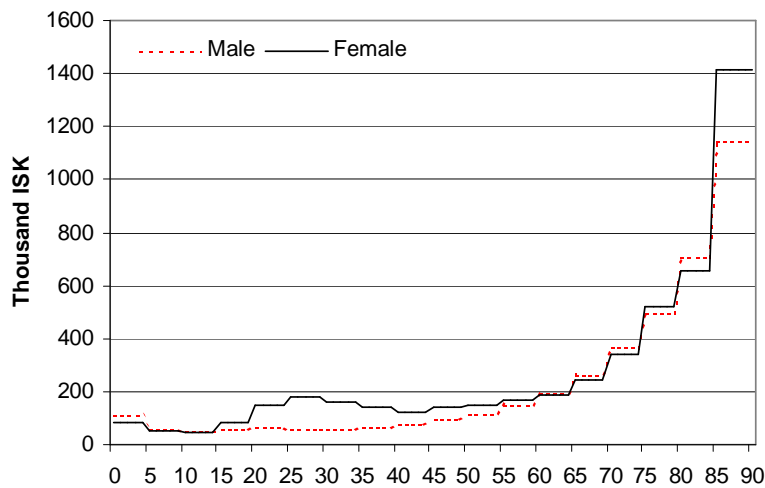


Figure 15: *Health expenditure per person for males and females*

The figure illustrates that, on the average, women receive higher health care payments over their lifetime than men do. The transfers to men and women are alike for the youngest age group but become considerably higher for women during their childbearing years, as mentioned above. Health care transfers to men and women are similar from the age of 60 until the age of 85 when women “pass” the men once again. This is mainly due to women’s greater use of nursing and convalescent home services.

The elderly receive considerably higher transfers per person than the rest of the population. The ratio of transfers to the age group 67 and older to total transfers was about 37% in 1998. This is a high percentage for a group that comprises only 10% of the total population. The development of this ratio in the immediate future, as the population becomes older, will be studied in the next chapter.

To understand better how health care expenditures are distributed among age groups, an age-specific expenditure index for males and females was calculated from the

available data and is presented in Table 6. The index is calculated as the ratio of per capita health expenditures in different age groups to average per capita health expenditures calculated over all age groups. Table 6 presents indices for seven age groups. The lowest age group (0-4) is chosen as the base (age 0-4 = 1.00). The index shows that an 85-year-old male is about 11 times more expensive than a male in the age group 0-4, whereas an 85-year-old female is around 16 times more expensive than a female in the age group 0-4. There is a substantial difference between expenditures to males and females, as is mentioned earlier. This difference is clearly demonstrated in the table.

	Males	Females
0-4	1.00	1.00
5.-14	0.50	0.56
15-44	0.59	1.61
45-64	1.27	1.87
65-74	2.91	3.40
75-84	5.55	6.78
85+	10.56	16.29

Table 6: *Relative per capita health care expenditure indices for males and females*

In the following calculations on the future development of health care expenditures, it is expected that the age-specific expenditure indices in Table 6 will not change over time.

5.2 Method of Analysis

In order to evaluate the effect that demographic changes have on the Icelandic health care system, a projection methodology called a “growth factor” model, described in Mayhew (2000), was used.

The general form of the growth factor model is expressed as follows:

$$H(t) = H(0) e^{\sum_i^t r_i} \quad \text{Eq. 5.1}$$

Here, $H(0)$ stands for health expenditures in a base period, $H(t)$ is expenditure in time t , and r_i is the growth rate of a particular “growth factor” such as treatment costs. In the following analyses, the factor is restricted to the effects of demographic change, a combination of aggregate population growth and age structure change, and a so-called “underlying” growth rate, which is estimated as a residual. The underlying growth rate captures numerous effects, such as technological change, changes in the price of medical care, and so forth. The specific form of the model in this case is as follows:

$$H(t) = H(0) e^{t(r_p + r_u)} \quad \text{Eq. 5.2}$$

where r_p reflects demographic change (changes in total population and changes in age structure), and r_u reflects the underlying growth rate for new technology and the growth in factor costs.

Let $I(t)$ be an index of population size and structure and r_p the rate of change in this index. Then

$$r_p(t) = \frac{1}{t} (\ln I(t) - \ln I(0)) \quad \text{Eq. 5.3}$$

It is then easy to confirm from Equations 5.2 and 5.3 that

$$r_u(t) = \frac{1}{t} \ln \frac{H(t)}{H(0)I(t)} \quad \text{Eq. 5.4}$$

If the demographic index at time zero is defined so that $I(0) = 1$, then Equation 5.4 can be written as:

Comment [AB14]: Page: 1
Is this number correct? Most of the equations have a number such as x.y.

$$r_u(t) = \frac{1}{t} \ln \frac{\frac{H(t)}{I(t)}}{\frac{H(0)}{I(0)}} \quad \text{Eq. 5.5}$$

$r_u(t)$ can thus be interpreted as the rate of growth of total health care expenditure normalized by an index of population size and structure.

The underlying rate, r_u , reflects technological change, changes in per capita utilization, and other factors, whereas the demographic rate, r_p , combines population trends and aging and is designed to capture the health needs of a growing population and the costs of treating an older population. These assumptions mean, for example, that even if the underlying rate of change were zero, health care expenditure would continue to rise (or fall) depending on changes in population size and age structure.

The index of population-related growth in health expenditure, $I(t)$, is defined as follows:

$$I(t) = \frac{\sum_i P_i(t)c_i(t)}{\sum_i P_i(0)c_i(0)} \quad \text{Eq. 5.6}$$

where $P_i(t)$ is population in age group i and $c_i(t)$ is the age-specific relative expenditure index. From Equation 5.6 $I(0) = 1$.

It is possible to decompose $I(t)$ into components related to population change and aging by rewriting Equation 5.6 as follows:

$$I(t) = I_P(t)I_A(t) \quad \text{Eq. 5.7}$$

where

$$I_P(t) = \frac{\sum_i P_i(t)}{\sum_i P_i(0)} \quad \text{Eq. 5.8}$$

and

$$I_A(t) = \frac{\sum_i p_i(t)c_i(t)}{\sum_i p_i(0)c_i(0)} \quad \text{Eq. 5.9}$$

where $p_i(t)$ is the proportion of population in age group i .

Based on the discussion in the previous section, it is assumed that $c_i(t)$ is constant over time at the values given in Table 6, *i.e.* $c_i(t) = c_i(0)$.

Once r_p has been calculated, the underlying growth rate r_u is calculated as a residual from the (known) overall growth rate, which can be calculated from historical data, as is mentioned earlier.

5.3 Baseline Findings

Health care expenditures in Iceland grew at a rate of 4.0% per year between 1980 and 1998 in real terms; at the same time GDP grew by 2.5% per year. This has resulted in an increasing share of health care expenditures as a percentage of GDP: from 5.5% in 1980 to about 7% in 1998. The increase per year to the health care system can only partly be explained by aging and population growth. Other factors include technical

change (new treatment and drugs), higher utilization per capita, institutional behavior, higher labor costs, and so on.

The development of the Icelandic health care system as a ratio of GDP is demonstrated in Figure 16. The share of health care increased progressively from 1970 to 1990, when the ratio amounted to about 7.4% of GDP. Thereafter, the ratio decreased somewhat and has been comparatively stable since, around 7% of GDP.

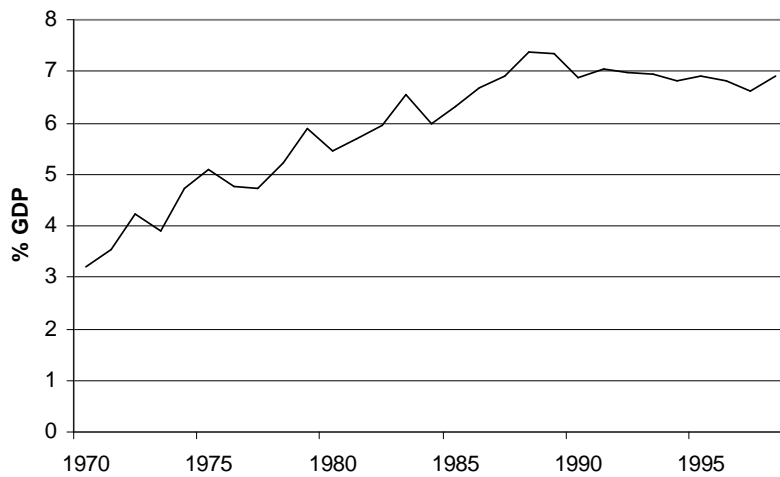


Figure 16: *Health care expenditure between 1970 and 1998 (% of GDP)*

Although the ratio has been stable in recent years, health care expenditures increased considerably over the period 1994-1998, or by about 6% per year in real terms. This increase is explained largely by the fact that the years 1994 to 1998 were particularly prosperous.

A 7% share of GDP for the health care system is a ratio that is rather high when one compares OECD countries. According to a Danish report (1999), only 5 countries out of 19, including Iceland, spent over 7% of GDP on health care in 1999. These

countries were Belgium, France, Germany, Iceland and Sweden. It can therefore be said that Icelanders enjoy a good health care system on a global scale.

Based on the growth factor model, of this total rate of growth of 6% during the period 1994 to 1998, 1.1% was caused by population changes and aging. The remainder, 4.9%, corresponds to the underlying rate, which has been explained elsewhere as an underlying rate for new technology and other effects. Column 1 of Table 7 shows the results. Of the 1.1% growth per year in population, 0.38% was due to aging and 0.75% was due to population change. About two-thirds of this growth can therefore be attributed to population change rather than change in population structure (aging).

Comment [AB15]: Page: 1
Surely you mean Table 7 and not Table 2?

	1994-1998	1998-2020	2020-2050
Health care expenditure growth per annum	6.00	2.2	2.2
of which			
.- underlying rate	4.87	1.08	1.03
.-age & volume	1.13	1.12	1.17
.-due to population change	0.75	0.59	0.16
.-due to aging	0.38	0.52	1.01
As percentage of GDP (end of period)	6.9	7.9	9

Table 7: *Development of health expenditure, 1994 to 2050, in percentage terms*

It is difficult to evaluate future health care expenditures. Three factors make up the basis of the development of future health care expenditures: population growth, the underlying rate of growth of health care, and the rate of economic growth. In the Icelandic government budget for the year 2001, future health care expenditures are expected to increase by an average of 2.2% per year (in real terms) for the next 4

years.²⁵ These assumptions are used in the growth factor model and presented in Table 7, Columns 2 and 3.

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I have translated the footnote for you but have not deleted the Icelandic, as I was not sure how you wish to present this.

Comment [AB17]: Page: 1
Table 7 again?

There is not much difference of the age and volume indices (I) for the three periods. It is the composition of the indices, i.e., the proportion due to aging and population change, that varies the most. According to the table, demographic change contributions in the period from 1998 to 2020 are expected to be 1.12% per year, of which 0.52% is due to aging and 0.59% is due to population increase. Between 2020 and 2050 the change is little more – 1.17% per year – of which 1.01% is due to aging and only 0.16% due to population increase. It can thus be concluded from the above that future demographic pressures on the health care system will not come from population increase, as has been the case before, but from population aging. The calculations also show that only about 1% of the 2.2% total health care growth is due to technological, institutional and other effects (the underlying rate). This is a considerably lower percentage than that for the period 1994 to 1998, when it was around 5%. As is mentioned earlier, this was a rather high percentage growth that is explained by the prosperity of those years and will almost surely not prevail in the long run.

The future population forecast is a major factor in the calculations in Table 7, regarding age and volume. Therefore it is essential to conduct a sensitivity analysis. This is presented in Table 8.

Comment [AB18]: Page: 1
Table 7 and not Table 2 ?

²⁵ According to a Danish report that I have seen, the increase in expenditures to health care systems has been approximately 2% per annum from 1988-1998. www.sum.dk/health/health1999

	1994-1998	1998-2020	2020-2050
Health care expenditure growth per annum	6.00	2.2	2.2
Medium population projection			
- underlying rate	4.87	1.08	1.03
-age & volume	1.13	1.12	1.17
.-due to population change	0.75	0.59	0.16
.-due to aging	0.38	0.52	1.01
Low population projection			
- underlying rate	4.87	1.23	1.35
-age & volume	1.13	0.97	0.85
.-due to population change	0.75	0.34	-0.49
.-due to aging	0.38	0.62	1.34
High population projection			
- underlying rate	4.87	0.95	0.74
-age & volume	1.13	1.25	1.46
.-due to population change	0.75	0.80	0.71
.-due to aging	0.38	0.44	0.75

Table 8: *Development of health expenditure with respect to high, medium and low population projection*

Table 8 shows that all three population projections draw the same conclusion regarding the age and volume rate; i.e., that future demographic pressure on the health care system comes from aging and not from population increase. Although the outcome is the same regarding aging pressure, the total age and volume rate does not follow the same trend for the three population projections. With the medium projection assumption, the rate stays rather stable over the period, as is mentioned earlier; with the low assumption it decreases over the period, and with the high assumption it increases. As the underlying rate is the difference between the total growth rate and the age and volume rate, the outcome (trend) is exactly the opposite from the age and volume rate.

Given the above assumptions and the assumption of long-run growth of 1.5% per year, health care expenditure will have increased to around 8% of GDP by the year 2020, and to about 9% by the end of 2050.

Comment [AB19]: Page: 1
This word is unfamiliar to me and is not in any of my 4 dictionaries! Should it be "demographic"?

Older people require more health care than younger people, as is previously mentioned. The share of the elderly (67 and over) in total health care costs will increase over the projection period from 37% in 1998 to about 58% in 2050. Figure 17 shows how health care expenditures are expected to be divided between the two age groups over the projection period. The rapid change of the ratios appears to be over the period from around 2012 to around 2035, when the baby-boom generation enters the old age group. The ratios do not change considerably thereafter.

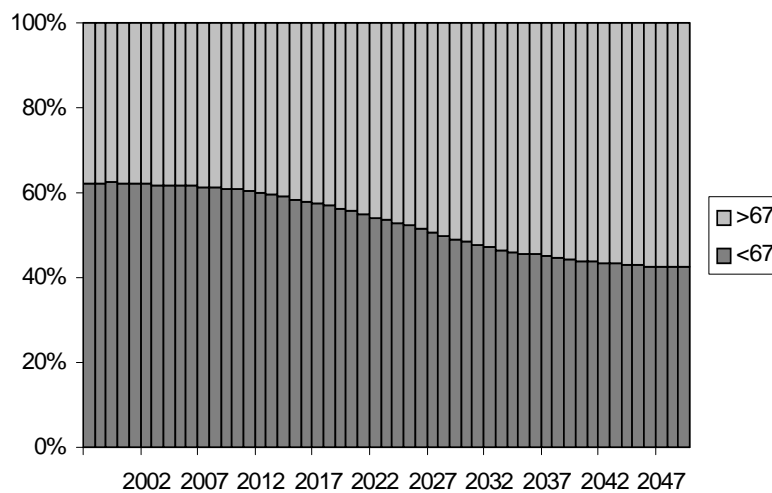


Figure 17: *Development of health expenditure to people aged 67+ and to people 67 and under*

This outcome is depended on the assumption that the health care indices in Table 6 will hold constant throughout the projection period.

An important unknown in the calculations is whether the assumed age-specific relative health expenditure indices in Table 6 will continue at the levels indicated. If it were assumed that the present relative expenditure for the age group 85 and older were replaced by those in the age group 80-84, which are lower, the GDP share of

health expenditure by the year 2050 would be reduced to 8%. The GDP share would be reduced to 7.5% if the expenditure to the age group of 80 and over were replaced by the age group of 75-79 (which would mean an even greater reduction in the expenditures of the elderly). If the expenditures to the age groups over 80 were, on the other hand, set to equal expenditures to the group aged 85 and over (thus increasing the transfers to the age group 80-84), the share of GDP would increase to 9.8%. It would increase to 11.3% if the increase reached the age group 75 and older. These examples suggest that cost reduction or increase policies aimed only at the elderly do not change the outcome significantly.

The future expectancy of a 2.2% increase in health care expenditures per annum is considerably lower than the previously mentioned average increase of 4% per annum over the period from 1980 to 1998. If the future health care expenditure growth per annum were one percent lower than the average increase in 1980-1998, or 3% (therefore resulting in a growth of the underlying rate of 1.9%), the share of GDP in 2050 would be around 13.5%, which is a considerably greater difference than simply increasing or decreasing health care expenditures to the elderly.

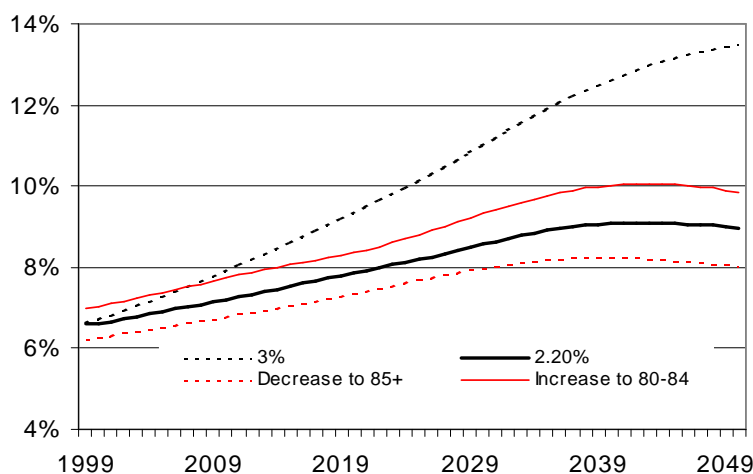


Figure 18: *The development of four health expenditure assumptions (% GDP)*

Four different projections are shown in Figure 18. The result is that health care expenditures do not decrease or increase considerably simply by cutting down or increasing the health care service to the oldest age groups (who are most costly): a change in the underlying rate makes a much greater difference.

5.4 Generational Accounts

As in the previous chapter on the public pension system, the discussion on the health care system is concluded with an analysis of the generational accounts. The method is used in order to analyze the effect that the health care system has on the burden of current and future generations.

Calculating the intertemporal public liabilities (IPL) associated with the stance of fiscal policy for the base year 1998 reveals different stories for the different assumptions enumerated in the previous chapter, ranging from an intertemporal debt to intertemporal assets. Table 9 reports the findings. Columns 1 and 2 show the results for the two total health care growth assumptions of 2.2% and 3%. Columns 3 and 4 show the result when health care costs for the elderly are cut (A = 85 and older index equal to 80-84 index, B = 80 and older index equal to 75-79 index), whereas columns 5 and 6 demonstrate the increase of transfers to the elderly (C = 80 and older index equal to 85-90 index, D = 75 and older index equal to 85-90 index).

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In the table below, the footnote at bottom left should read "ISK thousands" or "1,000 ISK" and the numerical separator should be a comma.

<i>Assumptions</i>	2.2% growth	3% growth	A	B	C	D
Explicit debt (% of GDP)	39	39	39	39	39	39
Implicit debt (% of GDP)	-72	-34	-85	-92	-57	-31
IPL (% of GDP)	-33	5	-46	-53	-18	8
Current generational account*	-5474	-5928	-5444	-5426	-5512	-5588
Future generational account*	-7529	-5580	-8321	-8771	-6629	-5013
Difference*	-2054	348	-2877	-3345	-1118	575

* 1.000ISK

Table 9: *Generational accounts for the health care system*

The main conclusion of the accounts is that by increasing the transfers, either to all age groups (column 2) or just to the elderly (columns 5 and 6), decreases the inequality between the current and future generations. The 3% growth per annum of the health care system comes closest of the 6 assumptions, bringing equality to both generations.

The difference in current generations' rest-of-life net tax payments given three different assumptions for health care growth – i.e., with a total growth of 2.2%, with a total growth of 3%, and with an increase in health transfers for persons 75 and older – can be seen in Figure 19. A 3% growth in health care costs increases the welfare of the youngest age groups the most, as it would result in the highest net transfers towards those groups. The increase for the group 75 and older would, on the other hand, be the most attractive choice for the oldest age group because the accounts are forward-looking and the elderly receive more from the government than they pay in their old age.

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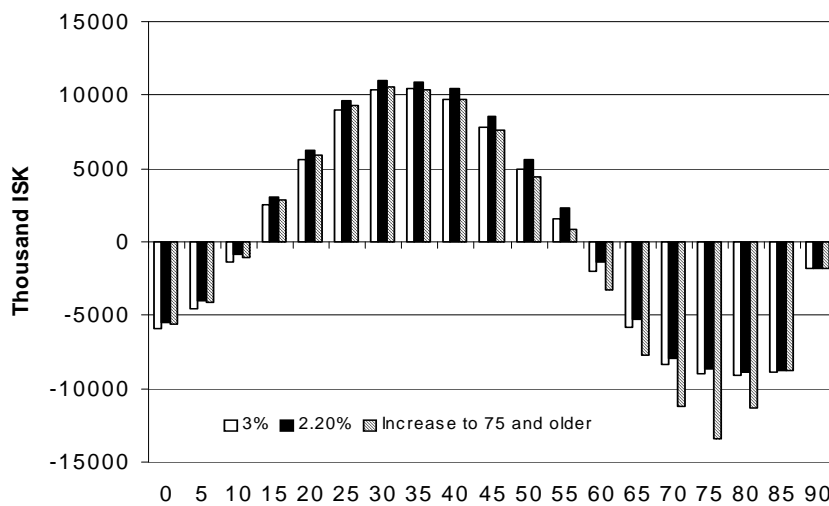


Figure 19: *Current generations' rest-of-life net tax payments*

As in the chapter on the public pension system, the chapter on the generational accounts concludes with a sensitivity analysis. A sensitivity analysis was conducted on the 2.2% assumption of total growth in the health care system. Table 10 reports the sensitivity of the findings. As before, a lower growth rate and higher discount rate both serve to reduce this generational imbalance. The volatility is high, as is witnessed by the fact that for combinations of three real interest rates (5, 6 and 7%) with three alternative GDP growth rates (1, 1.5 and 2%), the IPL ranges between -1 and -107% of GDP.

Growth rate		1%	
Discount rate	5%	6%	7%
IPL	-14	-7	-1
Growth rate		1.5%	
Discount rate	5%	6%	7%
IPL	-54	-33	-19
Growth rate		2%	
Discount rate	5%	6%	7%
IPL	-107	-66	-42
	Constant population	Low mortality	High mortality
IPL	1	-8	-59

Table 10: *Sensitivity analysis*

If the base-year population structure were constant, which would eliminate population aging, the current fiscal policy would approach sustainability, giving intertemporal assets of 1% of GDP.

5.5 Concluding Remarks

The above results show that the change in expenditure growth has a greater effect on the cost of health care than does simply cutting down or increasing services to the elderly. As has been shown, a change of 0.8% per year in health care expenditure changed the share of GDP by about 4.5% when in the year 2050, whereas an increase in expenditure to the age group 70 and over only changed the share of GDP by about 2%.

The Icelandic budget | for the year 2001 assumed the growth of the health care system to be 2.2% per year for the next 4 years. According to the generational accounts (where 2.2% growth is assumed indefinitely), there is some latitude for even higher growth in transfers to the health care system than this 2.2% figure..

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Chapter 6

6. Summary and Conclusions

This paper examines the effects that demographic changes have on the public pension system and the health care system. Like most Western countries, Iceland will experience an aging of its citizens in the future, and this development could put public pensions and health care systems under increasing pressure. This thesis examines the ways in which the expected demographic transition in the near future will affect the public pension system and the health care system. It makes use of generational accounts to examine the impact of aging on these systems. The method is also used to compare various assumptions.

A population forecast was the starting point of the thesis. The projections began in 1999 and reached through 2050. According to the forecast, the total population in Iceland will reach a maximum of 330 thousand in 2038 and then decline to 327 thousand in 2050. As in other European countries, an aging process is underway in Iceland. However, as the fertility rate is still quite high, the aging process will begin rather late in Iceland. The old-age dependency ratio²⁶ in 1999 was about 16%. According to the projections it will be approximately 24% in 2025 and around 32% in 2050, by which time almost one out of every three persons will be classified as

²⁶ The old-age-dependency ratio is calculated as the ratio of people aged 67+ to those aged 16-66.

elderly. Therefore, the time expected for the proportion of the old aged population to double is projected at around 50 years.

According to my analysis, the public pension system will not be a burden on future generations. This is primarily because of the three pillar pension systems that are administrated in Iceland: a public system, a fully funded system, and a tax-incentive private system, of which the two latter systems are expected to take over most of the pension payments to retirees in the future.

Four different retirement alternatives were evaluated for the public pension system: retirement at the age of 65, at age 67, at age 70, and finally, an example where a fraction of retirees would postpone receipt of pension benefits until age 72 in return for higher pension payments. As a share of GDP, retirement at 70 yielded the lowest figure and retirement at 65 gave the highest, as was expected. On the other hand, from the generational accounts point of view, retirement at the age of 65 was the most intertemporally balanced (though it, too, was quite far from balanced) of the four alternatives for the base year 1998. The intertemporal public liabilities (IPL) for the four options ranged from -45% of GDP to -59% of GDP, retirement at 70 yielding the least equality between the generations. The outcomes therefore reveal that none of the pension options under scrutiny pass liabilities on to future generations.

The results on the health care system indicated that the system will continue to consume an increasing share of national income. The total annual growth of the system is assumed to be 2.2%. The increase is due to two growth factors: a so-called underlying rate, which reflects technological changes, and a demographic rate, which is a combination of population increase and the aging of the population. The results revealed that the distribution of the total rate between the two factors is quite similar when a 2.2% total growth is expected.

The results showed that the population increase was the main cause of growth (of the demographic rate) between 1994 and 1998 and is expected to remain so until the year 2020. However, in the period from 2020 to 2050, aging is expected to take over as the main demographic cause of health expenditure increase. The growth of health care expenditures is more sensitive ~~to the changes in the underlying rate than to~~ changes in the per capita health expenditure weight for the very old. Thus, even if it is assumed that the Icelandic government will achieve some success in controlling health care costs for higher age groups, health expenditure will still rise unless the underlying growth rate is reduced as well.

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The results on the generational accounts for the base year 1998 gave intertemporal public liabilities (IPL) of -33% of GDP when anticipating a 2.2% growth of health care expenditures. This means that future generations will be better off than current ones. As mentioned above, the results were sensitive ~~to the assumption on the total~~ health care growth. The intertemporal public liabilities amounted to 5% of GDP when, for example, a 3% growth in health care was expected, which suggests a fiscal policy that is close to being sustainable.

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In earlier editions of the Icelandic generational accounts, all profiles were assumed to grow with GDP growth (1.5%). With that assumption, the intertemporal public liabilities for the base year 1998 amounted to -16% of GDP. When the various options mentioned in the two chapters on the public pension system and the health care system were put into the generational accounts together, and not separately, as the above results describe, the outcome showed that it did not matter which combinations of assumptions were used: the imbalance was always considerably in favor of future generations.

Therefore, the main findings of my thesis suggest that the overall tax burdens to be borne by future generations will be considerably lower than those for current

newborns. This implies that the systems under scrutiny will not be a burden on future generations. This result is, of course, dependent on several underlying assumptions, which include the population forecast, the growth rate, the discount rate, and the fact that the generational accounts assume that the base-year fiscal policy will hold forever.

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7. Appendix A

	1999	2010	2020
Medium	1.99	1.93	1.90
Low	1.99	1.50	1.46
High	1.99	2.31	2.33

Total Fertility Rate: medium, low, and high variant

	1999	2010	2020
Medium			
Male	76.3	78.2	79.2
Female	80.8	82.9	83.8
Low			
Male	76.3	77.8	78.5
Female	80.8	82.5	83.1
High			
Male	76.3	78.6	79.8
Female	80.8	83.3	84.4

Life expectation: medium, low, and high variant

8. Appendix B

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1999				2025				2050			
Age	Male	Female	Total	Age	Male	Female	Total	Age	Male	Female	Total
0-4	10,916	10,448	21,364	0-4	10,096	9,705	19,801	0-4	9,341	8,980	18,321
5-9	11,629	11,216	22,845	5-9	10,147	9,756	19,903	5-9	9,409	9,046	18,455
10-14	10,602	10,009	20,611	10-14	10,180	9,787	19,967	10-14	9,512	9,142	18,654
15-19	11,165	10,697	21,862	15-19	10,239	9,847	20,086	15-19	9,698	9,319	19,017
20-24	10,492	10,264	20,756	20-24	10,387	10,016	20,403	20-24	9,914	9,549	19,463
25-29	10,469	10,094	20,563	25-29	10,703	10,329	21,032	25-29	10,034	9,678	19,712
30-34	10,231	10,234	20,465	30-34	11,410	10,939	22,349	30-34	10,056	9,708	19,764
35-39	10,755	10,645	21,400	35-39	10,777	10,307	21,084	35-39	10,063	9,732	19,795
40-44	10,358	10,074	20,432	40-44	10,570	10,292	20,862	40-44	10,105	9,805	19,910
45-49	9,343	8,821	18,164	45-49	10,610	10,370	20,980	45-49	10,230	9,958	20,188
50-54	7,930	7,470	15,400	50-54	10,198	9,990	20,188	50-54	10,507	10,178	20,685
55-59	5,760	5,818	11,578	55-59	9,576	9,637	19,213	55-59	10,981	10,746	21,727
60-64	4,775	4,970	9,745	60-64	9,744	9,992	19,736	60-64	9,645	9,372	19,017
65-69	4,715	5,065	9,780	65-69	9,131	9,265	18,396	65-69	9,514	9,677	19,191
70-74	3,926	4,383	8,309	70-74	7,297	7,772	15,069	70-74	8,045	8,741	16,786
75-79	2,930	3,635	6,565	75-79	5,232	5,950	11,182	75-79	6,569	7,669	14,238
80-84	1,599	2,399	3,998	80-84	2,859	3,945	6,804	80-84	4,503	6,304	10,807
85+	1,188	2,159	3,347	85+	1,895	3,450	5,345	85+	3,992	7,046	11,038
Total	138,783	138,401	277,184	161,051	161,349	322,400	162,118	164,650	326,768		

Population by age and sex