Population Ageing and Social Expenditure in New Zealand: Stochastic Projections

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Abstract

It is widely recognised that as the population ages there will be potentially significant implications for a wide range of economic variables, including in particular the fiscal costs of social expenditures. Long term fiscal planning requires estimates of the possible future path of public spending. This paper presents projections for 14 categories of social spending. These projections are based on detailed demographic estimates covering fertility, migration and mortality disaggregated by single year of age and gender. Distributional parameters are incorporated for all of the major variables, and are used to build up probabilistic projections for social expenditure as a share of GDP using simulation. Attention is focussed on health expenditures which are disaggregated into seven broad classes. In addition we explore the impacts of alternative hypothesis about future health costs. While it can be predicted with some confidence that overall social expenditures will rise, the results suggest that long term planning would be enriched by recognising the distributions about point estimates of projected social costs.

JEL CLASSIFICATION

E61: Fiscal policy

H50: Government Expenditures

J11: Demographic Trends and Forecasts

KEYWORDS

Population, projections, stochastic simulation, social expenditure, fiscal costs, New Zealand

Table of Contents

List of Tables

List of Figures

Population Ageing and Social Expenditure in New Zealand: Stochastic Projections

1 Introduction

The fiscal costs of meeting public social expenditures are widely expected to rise in most industrialised countries as their populations age.[1] Policies are already being implemented to deal with the increased share of the Gross Domestic Product (GDP) expected to be devoted to meeting social expenditures. Some countries have reduced eligibility for publicly provided services and transfers, while others have reduced the level of benefits. In the case of the universal superannuation scheme in New Zealand, the government, based on expected increases in the fiscal cost, has introduced a prefunding mechanism. In this way, today's taxpayers contribute to a common fund which can subsequently be drawn upon to reduce the tax burden on future generations. Expectations about future fiscal costs are reflected in policy initiatives taken today. This paper presents projections for social expenditures in New Zealand over the next 50 years, as a contribution to the stock of information on which such policies can be based. It is precisely on the basis of projections of future social expenditures that policy decisions are being taken by governments today.[2]

Projecting social expenditures requires a range of assumptions about future paths of fertility, mortality, migration, labour force participation, unemployment and productivity growth, together with assumptions about the social policies governing future expenditures. There is substantial uncertainty surrounding projections of these underlying variables. Demographic projections typically recognise this uncertainty by conducting a sensitivity analysis using, for example, high medium and low values for some of the key variables.[3] In contrast, this paper examines the statistical properties of social expenditure projections. By specifying distributions of the relevant variables, simulation methods are used to translate the inherent variability of the component variables into variability of the projected social expenditures. Scenario based approaches, while providing a general sense of the possible range of outcomes, do not offer these distributional insights. A principal contribution of this paper is to provide such distributions through stochastic simulation.

[1] For an overview of the economic issues associated with population ageing see (Stephenson and Scobie 2002) and (Creedy 2000).

[2] The question of whether, in the face of uncertainty, it is optimal to act now or wait to see what eventually happens was examined by (Auerbach and Hassett 2000) . The roles of risk aversion, constraints on the ability of governments to change policy and the strength of a precautionary motive were examined in an overlapping generations model.

[3] The population projections from (Statistics New Zealand 2000) for 100 years are based on 8 scenarios reflecting different levels of fertility, mortality and net migration. No probabilities can be attached to each of these projections. In addition, they implicitly assume perfect correlation between the various rates.

A US Congressional Budget Office study of the financial balances of the Social Security trust Fund described stochastic simulation as follows:[4]

> The ideal approach would be to assign a probability to every possible combination of paths for input assumptions, solve for the system's finances under each set of paths, and then use the probabilities associated with each set of inputs to assign probabilities to every set of outcomes. Although it is impossible technically to assign probabilities to every set of outcomes, it is feasible to create an arbitrarily large sample of input combinations, solving each time for system finances, and then evaluate how finances vary within that sample and draw conclusions about the probability distribution of the outcomes…that technique (is) called stochastic simulation.
>
> (Congressional Budget Office 2001):53).

Other studies for New Zealand which project the fiscal costs of population ageing include Bagrie who used a simplified model with labour productivity growing at 1.9%, and per capita social expenditure for all ages growing at an equivalent rate (Bagrie 1997). His study focused on the implications for revenue and expenditure and the sustainability of the fiscal settings. Polackova used a similar approach to examine the public sector balance (Polackova 1997), while Cook and Savage included an exploration of the net debt position (Cook and Savage 1995).[5] While the overall results for social spending are in line with the findings of the present study, uncertainty was handled through the conventional approach of alternative scenarios.[6]

Section 2 provides an overview of the key relationships together with a formal statement of the model. In Section 3, details of the data are set out, while Section 4 presents the benchmark results. The effect of varying some key assumptions is explored in Section 5. Conclusions are in Section 6.

[4] See also (Daponte, Kadane and Wolfson 1997, Lee and Tuljapurkar 2000), (de Beer 1992), (Alho 1997), (Lee and Edwards 2001), (Creedy and Alvarado 1998) and (Alvarado and Creedy 1998).

[5] Davis and Fabling focused on the welfare gains from tax smoothing to meet the fiscal costs of population ageing using a simulation approach to provide confidence bands on the balanced budget and tax smoothing rates of taxation (Davis and Fabling 2002).

[6] In this paper we do not pursue the implications of higher social expenditures due to ageing on the management of the public sector balance or the Crown's balance. Nor do we address the issue of the social costs of any higher taxation, either on present or future generations, to meet these expenditures. For an examination of the latter question for Australia see (Guest and McDonald 2000)

2 The projection model

2.1 An overview

The sequence of calculations is set out in Figure 1. The first stage in projecting social expenditures is the production of demographic projections for the size of the population, together with its distribution by age and gender. To achieve this requires forecasts of the underlying trends in fertility, mortality and net migration.[7] Estimates of the rates of labour force participation are then combined with age and gender specific unemployment rates to generate the size of the workforce. When this is multiplied by the average productivity per worker an estimate is obtained of GDP.

Combining the social expenditures per capita with the projected population by age and gender leads to the estimate of total social expenditure built up from the expenditure on each category for each of the age and gender groups. The resulting social expenditures are finally expressed as a share of projected GDP. In moving through the sequence of calculations, a random draw from the distribution of each variable is made, and the resulting set of input values is used to compute the ratio of social expenditure to GDP for a given forecast year. This process is repeated 5000 times for each year, to produce a distribution of the social expenditure ratio for each year from 2001 to 2051. The process therefore also generates distributions of the population by age and gender, as well as for each of 14 categories of social expenditure.

The uncertainty about each variable is reflected in the standard deviation of its distribution. The values used below are based on an analysis of past trends and the variability in fertility, mortality, migration, male/female birth ratios, labour force participation rates, unemployment rates and major categories of social expenditure. The resulting estimated standard deviations are used, and it is assumed that these remain the same in the future.[8]

The projections are entirely mechanical in that they do not rely on economic models of fertility, mortality, migration, labour force participation and so on. Instead, various exogenous age and gender specific rates are used and no allowance is made for possible feedback effects, which may for example be generated by general equilibrium changes in wage rates.[9]

2.2 Population projections

Population projections are obtained using the standard social accounting, or cohort component, framework.[10] There are $N = 100$ (single year) age groups, and no one is assumed to survive beyond the age of N. The square matrix of flows, f_{ij}, from columns to rows, has $N-1$ non-zero elements which are placed on the diagonal immediately below the leading diagonal. The coefficients, a_{ij}, denote the proportion of people in the jth age who survive in the country to the age i, where p_j is the number of people aged j and

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7 However, we ignore marriage and divorce, and make no distinctions for ethnicity.

8 It would be possible to use the same general model with a priori assumptions about the distributions, based on a combination of past information and a range of considerations concerning views of the future; see Creedy and Alvarado (1998).

9 It is hoped to model some of these interdependencies in future work.

10 For further exploration of this model, see Creedy (1995).

$$a_{ij} = \frac{f_{ij}}{p_j} \tag{1}$$

where only the $a_{i+1,i,}$ for $i = 1,...,N-1$ are non-zero. This framework applies to males and females separately, distinguished by subscripts m and f. Hence the matrices of coefficients for males and females are A_m and A_f respectively. Let $p_{m,t}$ and $p_{f,t}$ represent the vectors of male and female populations at time t, where the i-th element is the corresponding number of the aged i. The N-element vectors of births and immigrants are represented by b and m respectively, with appropriate subscripts; only the first element of b is non-zero, of course. The number of people existing in one year consists of those surviving from the previous year, plus births, plus immigrants. Hence the forward equations corresponding to this framework are:

$$p_{m,t+1} = A_m p_{m,t} + b_{m.t} + m_{m,t} \tag{2}$$

$$p_{f,t+1} = \mathrm{A}_f p_{f,t} + b_{f,t} + m_{f,t} \tag{3}$$

Given population age distributions in a base year, and information about the relevant flows, equations (2) and (3) can be used to make projections. In general the matrices A_m and A_f, along with the births and inward migration flows, vary over time. Changes in the A matrices can arise from changes in either mortality or outward migration.

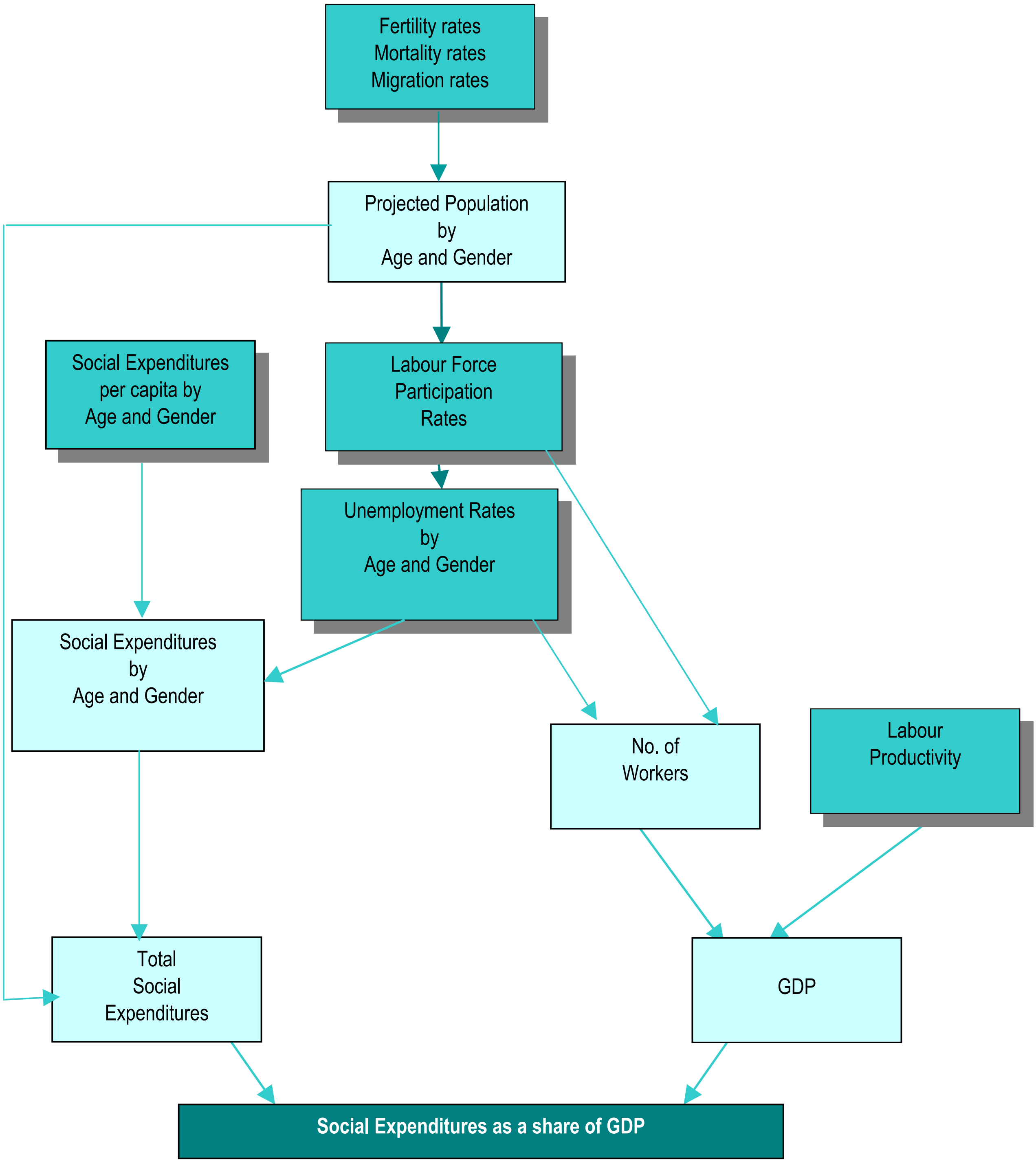
Suppose that c_i represents the proportion of females of age i who give birth per year. Many elements, for young and old ages, of the vector, c, are of course zero, and in general the $c_i s$ vary over time. Suppose that a proportion, δ, of all births are male, and define the N-element vector τ as the column vector having unity as the first element and zeros elsewhere. Then births in any year can be represented by:

$$b_m = \delta \tau c' p_f \tag{4}$$

$$b_f = (1-\delta) \tau c' p_f \tag{5}$$

where *c'* is the transpose of the vector *c*, that is, the column vector written as a row. The b vectors contain only one non-zero element. Equations (2) to (5) can thus be used to make population projections, for assumed migration levels.

Figure 1 - An overview of the key relationships in the model



Note: The shadowed boxes represent input data.

2.3 Social expenditure and GDP

The per capita social expenditures are placed in a matrix with N rows and k columns, where there are k items of social expenditure. If this expenditure matrix is denoted S, then the i, jth element s_{ij} measures the per capita cost of the jth type of social expenditure in the ith age group. Suppose that the jth type of social expenditure per capita is expected to grow in real terms at the annual rate ψ_j in each age group. Then define g_t as the k-element column vector whose jth element is equal to $(1+\psi_j)^{t-1}$. Aggregate social expenditure at time t, C_t, is thus equal to:

$$C_t = g_t' S' p_t \qquad (6)$$

where, as above, the prime indicates transposition. In the projections reported below, expenditure per person in each category and age differs for males and females, so that (6) is suitably expanded.[11]

Projections of Gross Domestic Product depend on assumptions about five factors, including: initial productivity (defined as GDP per employed person); productivity growth; employment rates; participation rates; and the population of working age.

Total employment is the product of the population, participation rates and the employment rate. Employment is calculated by multiplying the labour utilisation rate by the labour force. If U_t is the total unemployment rate in period t, the utilisation rate is $1-U_t$. The aggregate unemployment rate is calculated by dividing the total number of unemployed persons in period t, V_t, by the total labour force in that period, L_t. The value of V_t is in turn calculated by multiplying the age distribution of unemployment rates by the age distribution of the labour force, where these differ according to both age and sex.

Let the vectors U_m and U_f be the N-element age distributions of male and female unemployment rates. If the symbol ^ represents diagonalisation, whereby the vector is written as the leading diagonal of a square matrix with other elements equal to zero, the total number of people unemployed in period t is:

$$V_t = U'_{m,t} \hat{L}_{m,t} p_{m,t} + U'_{f,t} \hat{L}_{f,t} p_{f,t} \qquad (7)$$

The labour force in period t, L_t, is given by:

$$L_t = L'_{m,t} p_{m,t} + L'_{f,t} p_{f,t} \qquad (8)$$

[11] Care needs to be taken with the treatment of unemployment costs per capita, because unemployment levels are endogenous (depending on unemployment rates, participation rates and the age structure). The unemployment costs per unemployed person in each age and gender group therefore need to be converted into per capita terms in each year.

Suppose productivity grows at the constant rate, θ. Then GDP in period t is calculated as the product of the utilisation rate, $1-U_t = 1-V_t / L_t$, the labour force, L_t, and productivity, so that:

$$GDP_t = \left\{ \frac{GDP_1}{(1-U)L_1} \right\} (1+\theta)^{t-1} (1-U_t) L_t \tag{10}$$

If the population age distribution, along with the gender and age specific participation and unemployment rates, are constant, the social expenditure to GDP ratio remains constant if all items of expenditure grow at the same rate as productivity; that is if θ= ψ_j for $j = 1,...,k$. From (10), the rate of growth of real GDP (g_y) is given by:

$$(1+g_y) = (1+\theta)(1+g_w) \tag{11}$$

where g_w is the rate of growth in the number of workers.

Many assumptions are required to make projections, and many potential interdependencies may exist, though they are not easy to model. For example, productivity may itself depend on social expenditures and the age distribution of workers. Furthermore, participation rates and population growth are likely to be interdependent. The changing age distribution is only one component of the ratio of aggregate social expenditure to GDP, and its influence may, for example, be substantially affected by other components. However, as mentioned above, such interdependencies are not modelled here.

2.4 A Stochastic specification

The above description of the projection model is deterministic in the sense that each component is assumed to be known with certainty. The future mortality, fertility and migration rates, along with the various unemployment and participation rates and growth rates of productivity and social expenditure costs, cannot be known with certainty. One way to allow for this uncertainty is to specify, for each appropriate variable, a distribution. Each observation is regarded as being drawn from the corresponding distribution. A large number of projections can be made, where each projection uses random drawings from each of the distributions. This exercise produces a 'sampling distribution' of the ratio of social expenditure to GDP.[12]

It is therefore necessary to specify the form of the various distributions. Consider a relevant variable, denoted by x. This could be, for example, an unemployment rate, a fertility rate for women of a given age, or an item of social expenditure. In some cases, indicated below, it is assumed to be normally distributed with mean and variance μ and σ² respectively; that is, x ~ N(μ,σ²). If r represents a random drawing from the standard normal distribution N(0,1), a simulated value of x, x_r, can be obtained using:

$$x_r = \mu + r\sigma \tag{12}$$

[12] This type of numerical simulation needs to be carried out in view of the complexity of the relevant transformation required to obtain the social expenditure ratio, which rules out the derivation of the precise functional form of its distribution.

since $(x-\mu)/\sigma$ is $N(0,1)$. In cases where the variable is assumed to be lognormally distributed as $\Lambda(\mu,\sigma^2)$, where now μ and σ^2 refer to means and variances of logarithms, a corresponding draw can be obtained using:

$$x_r = \exp(\mu + r\sigma) \tag{13}$$

The use of lognormal distributions ensures that the random draws are always positive.[13]

[13] The assumption of lognormality was also made, for example, by (Alho 1997) and Creedy and Alvarado (1998).

3 Input data and projections

This section describes the key input variables, sources and the derivation of their projected values. In the case of fertility, mortality and labour force participation rates, their growth rates and standard deviations were estimated from the following regression:[14]

$$\log y_t = \alpha + \beta t + u_t \qquad (14)$$

This implies that the constant growth rate is given by $\hat{\beta}$ where $\beta = \partial \log y_t / \partial t = (\partial y / \partial t).(1/y)$. As $Var(\log y_t) = \sigma^2{}_u$, the standard deviations are derived from the estimated standard error of the regression, $\hat{\sigma}_u$. The log-linear specification was found to provide a good fit to the historical data. The growth rates for male and female mortality rates and fertility rates are given in Appendix Table 1, and the respective standard deviations are documented in Appendix Table 2.[15]

3.1 Fertility rates

Fertility rates by single age year of mother from 1980 to 2001 were used to estimate the trend annual rates of change using a regression of the logarithmic rates against time, as described above.[16] The decision to truncate the data for the regressions and start at 1980 was based on the finding that there is a marked turning point in the fertility rates around 1980, especially for older mothers.[17] The trends prior to 1980 were quite distinct and reflected the substantial decline in fertility following the 1960s.[18] These rates were used to form the projections for the next ten years, after which fertility rates were assumed to remain constant.[19] A selection of the actual and projected values is presented in Appendix Figure 1.

3.2 Mortality rates

Mortality rates are available by single year age groups (from 0 to 99) for three-year averages centered on the years 1971, 1976, 1981, 1986, 1991, and 1996.[20] For 1999, values were only available for 5-yearly age brackets for 1999-2001. Single year values for that year were interpolated by using the same proportions as in 1996. The values for ages 96 to 100 in 1999 were taken to be equal to those for 1996 to 2001. The resulting data set of seven observations for each single year of age were used to estimate the trend annual rates of change using the regression of the logarithm of mortality rates against time, as discussed above. These rates were used to form the projections of the mean rates for each age. The standard deviations were taken from the standard errors of each

[14] This form, is a simplified form of the more general Box-Jenkins type of time series specification used by(Lee and Tuljapurkar 2000).
[15] The data for the base year (2001) for population, immigration and emigration for males and females are shown in Appendix Table 1.
[16] Data for fertility rates by single age year of mother for the years 1962 to 2001 were supplied by Statistics New Zealand.
[17] To estimate the ratio of male:female births we used data from 1970 to 2000 and computed the average based on VTBA.SB1TRZ and VTBA.SB2TRZ from Statistics New Zealand. The estimated mean and standard deviation are 0.51298 and 0.0025 respectively.
[18] Regressions were run with start dates of 1978, 1979, 1980 and 1981. There was little or no difference in the estimated equations based on the different sample periods, and 1980 was chosen as the start date for the sample on which the results were based.
[19] In view of the use of constant rates of change, the total fertility rate would begin to increase if changes were projected over a much longer period. Statistics New Zealand also hold rates constant after ten years.
[20] These rates, taken from the life tables were supplied by Statistics New Zealand. The life table for 1999-2001 is available at : http://www.stats.govt.nz/domino/external/web/Prod_Serv.nsf/htmldocs/Births+and+Deaths

regression. Hence, as with fertility, each rate is assumed to be lognormally distributed. The precise values are given in Appendix Table 2.

Changes in mortality rates were projected for the next twenty years, after which these rates were assumed to remain constant.[21] Given the relatively small numbers involved, it was assumed for simplicity that 100 years is the upper limit of the age distribution. The actual and projected values of mortality rates for selected ages are presented in Appendix Figure 2.

3.3 Migration

For the last 100 years net migration (permanent and long-term) has averaged 5,000 per year, although major swings have frequently occurred. This long-term average was adopted as the benchmark rate for net migration with a corresponding gross level of immigration of 50,000. We assume that future inward and outward migration flows have the same age and gender distribution as the average for the years 1997 –2001.[22] Data for this period were used to estimate the standard deviations of the arrival and departure rates for males and females by single year of age. The average for the age group 99+ were assigned to age 99, and migration flows for those aged 100 were arbitrarily assumed to be zero.

3.4 Labour productivity growth

Bagrie (1997) reported a long-term average for labour productivity growth of 1.5% per year based on the period 1955-56 to 1995-96. This is close to the value reported by Diewert and Lawrence ((Diewert and Lawrence 1999), Table 4.2, p.66) of 1.66% for the period 1978 to 1998. The Long Term Fiscal Model at the Treasury assumes 1.5 percent.[23] Downing *et al* find similar rates for more recent time periods: 1.28% for 1993 to 1997 and 1.54% for 1999 to 2002.[24] The present study adopted a rate of 1.5% for the benchmark average annual growth in labour productivity, assumed to remain constant over the projection period. The standard deviation of 0.01707 was obtained using data from 1979-2002. The initial value of labour productivity in the base year 2001 was given by GDP ($114,374m) per worker (1.804m) ie $63,400.

3.5 Labour force participation rates

Labour force and social expenditure data are available only for certain age groups, rather than single years. Hence, having obtained the single year age distributions using the demographic component of the projection model, these needed to be grouped for each of the social expenditure projection years, for the purposes of calculating GDP and social expenditure.

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[21] Statistic New Zealand also allow mortality rates to change over 20 years.

[22] Migration data are from Statistics New Zealand for 1997 to 2001 for male and female permanent and long term arrivals (using EMIA.S1VE00 to 99) and departures (EMIA.S2VEE00 to 99).

[23] See http://www.treasury.govt.nz/ltfm/.

[24] These estimates are based on hours rather than full-time equivalent labour units, and apply over the full business cycle; see (Downing, McLellan, Szeto and Janssen 2002).

Significant changes have occurred in participation rates over recent years. The rates have typically fallen amongst the younger age groups, associated with increased tertiary education rates. Male participation rates up to age 50 have fallen, while most female rates have been rising. Data on age-specific rates for the years 1987 to 2002 were used to estimate the trend rates of growth.[25] These in turn were used to generate projected rates for the next 10 years, after which no further change was assumed. There are some exceptions to this – specifically in the case of older males, where a rise in participation following 1990 can be attributed to an increase in the age of eligibility for universal superannuation; for this reason the trend was not extrapolated. Appendix Figure 3 shows the actual and projected rates for a selection of age groups, while the means and standard deviations for both the participation and unemployment rates are given in Appendix Table 3.

3.6 Social expenditures

Social expenditures are divided into 14 categories. These are: Age Related; Medical/Surgical; Mental Health; Pregnancy/Childbirth; Primary Diagnostics; Primary General; Public Health; Education; NZ Superannuation; Domestic Purposes Benefit; Sickness Benefit; Invalids' Benefit; Other Benefits; Unemployment Benefits. Hence, categories 1 through 7 refer to health and categories 10 through 13 are denominated social security and welfare. Data from Treasury's Long Term Fiscal model for Categories 1 to 7 of health expenditures were used to compute the shares of each category by age and gender. These shares were applied to estimates of total health expenditures by age group (Johnston and Teasdale 1999).

Data from the Household Economic Survey were used to find the distribution by age and gender of other categories. Where there was no division by gender (in the cases of education, invalids' and other benefits) the rates for males and females were set equal. Payments under Category 10 were assumed to be received by females, and no payments under category 4 were assigned to males.[26] Data from the HES were for 1997-98 and indexed to 2001 prices using the Consumer Price Index. A complete set of the social expenditure data by category, age and gender is given in Appendix Tables 4 (for males) and 4 (for females).

The growth rate of total social expenditure in each category was applied to all age and gender groups. This is because in most cases relevant information was available only at an aggregate level. Growth rates and standard deviations were derived from per capita expenditure series for health, education and superannuation from 1960 to 2000, and 1980 to 2000 in the case of unemployment benefits which are calculated on a per recipient rather than per capita basis. These are reported in Table 1. In the case of NZ Superannuation, it was assumed that there was a 100% take-up by all those over the age of 65, and all received the rate applying to single persons. A series for Social Expenditure for 1960 to 2000 was used to derive the growth rate and standard deviation applied to the sub-category Social Security and Welfare.[27] The historical trends and annual changes of the major categories of social expenditure are shown in Appendix Figure 4.

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[25] Labour force participation rate data are from Statistics New Zealand using HLFA.SAF1AA to AK and HLFA.SAF2AA to AK.

[26] Approximately 10% of Domestic Purposes Benefit recipients are in fact sole fathers.

[27] For the underlying data on social expenditure see (Dalziel and Lattimore 2001), p.140.

Table 1 - Historical growth rates of social expenditure

Category	Estimation Period	Mean	Std Deviation
Health	1960-2000	3.08	4.05
Education	1960-2000	3.41	7.23
NZ Superannuation	1960-2000	2.26	7.70
Unemployment	1980-2000	1.06	4.19
Soc. Sec. & Welfare	1960-2000	2.68	6.54

Sources: All data are from unpublished Treasury sources from the Long Term Data Series, except for social security and welfare from (Dalziel and Lattimore 2001)

4 Benchmark results

This section presents the benchmark projections. The essential features are that all social expenditures are assumed to grow at 1.5% per year, the same rate as labour productivity. The results therefore refer to a 'pure ageing' assumption. Migration is set at the long-term average of 5,000 net migrants each year, and changes in fertility, mortality and labour force participation are assumed to apply for 10, 20 and 10 years respectively, after which no further change in these rates is projected. The demographic and social expenditure projections are discussed in turn.

4.1 Demographic projections

Starting from the initial age and gender structure of the population in 2001, randomly drawn values from the distributions of fertility, mortality and migration rates were used to project the population by single year of age and gender for each year until 2051. The age and gender structure is depicted in Appendix Figure 5. A summary is given in Table 2. The growth rates of the total population and for those 65 and over are given in Table 3. It can be seen that most of the anticipated change in the structure occurs by 2031. The 95% confidence limits on these estimates are relatively narrow. One explanation of the narrowness of the range, in addition to the relatively low standard deviations for many of the demographic variables, is that the projections assume independence between age groups and time periods. If, for example, changes in mortality rates were positively correlated across age groups, the confidence limits would be expected to be larger. As shown in Appendix Figure 6 there are significant shifts in the population shares. People aged 85 and over for example are projected to rise from 1.3% to 4.8% of the total population by 2051.

Two types of dependency measure are defined. The demographic dependency ratio is the total number of individuals aged from 0-14 and over 65, expressed as a ratio of those aged 15-64. The economic dependency ratio is equal to the number of non-workers divided by the number of workers. The number of workers is the product of the labour force and the employment rate, while the labour force is the product of the total working age population and the labour force participation rate.

Table 2 - Age structure and dependency ratios : 2002-2051

	2002		2011		2031		2051	
Age	'000	%	'000	%	'000	%	'000	%
0-14	876	22.6	838	20.1	880	18.6	877	18.3
15-64	2,543	65.4	2,753	65.9	2,804	59.3	2,919	60.2
65-84	414	10.7	498	11.9	892	18.9	874	16.8
85+	52	1.3	86	2.1	156	3.3	272	4.8
Total	3,885	100.0	4,175	100.0	4,732	100.0	4,941	100.0
Dependency Ratios								
Demographic[a]	0.53		0.52		0.69		0.69	
Economic[b]	1.14		1.10		1.33		1.34	

Note: [a] The Demographic Dependency Ratio is defined as the population aged 0-14 and 65 over expressed as a ratio of the population aged 15-64
[b]The Economic Dependency Ratio is the number of non-workers divided by the number of workers

The number of workers in each age group between 15 and 64 is given by the product of the population of a given age and gender, and their corresponding rates of labour force participation and employment. Non-workers are the balance of the population. Both measures, together with their 95% confidence bands, are depicted in Figure 2. After an initial decline, the economic dependency ratio is projected to rise markedly from 2011 until 2031. In 2011 one worker is projected to support 1.1 non-workers; this ratio rises by over 20% to 1.33 by 2031. Already workers over age 40 comprise almost half of the workforce and this is projected to rise by five percentage points by 2051. For those aged 50 and over, their share of the workforce rises by over seven percentage points, as shown in Table 4.

Table 3 - Annual average population growth rates: 1951-2051

Year	Total population	Average annual growth rate (percent)	Population aged 65 and over	Average annual growth rate (percent)
		Historical		
1951	1,937,852		177,459	
1961	2,414,984	2.2	208,649	1.6
1971	2,862,631	1.7	244,167	1.6
1981	3,143,307	0.9	309,795	2.4
1991	3,373,929	0.7	379,767	2.1
2001	3,850,060	1.3	457,560	1.9
		Projections		
2011	4,175,060	0.8	583,960	2.5
2021	4,477,390	0.7	805,970	3.3
2031	4,731,950	0.6	1,048,540	2.7
2041	4,873,750	0.3	1,148,590	0.9
2051	4,941,120	0.1	1,145,610	0.0

Figure 2- Projected economic and demographic dependency ratios : 2001-2051

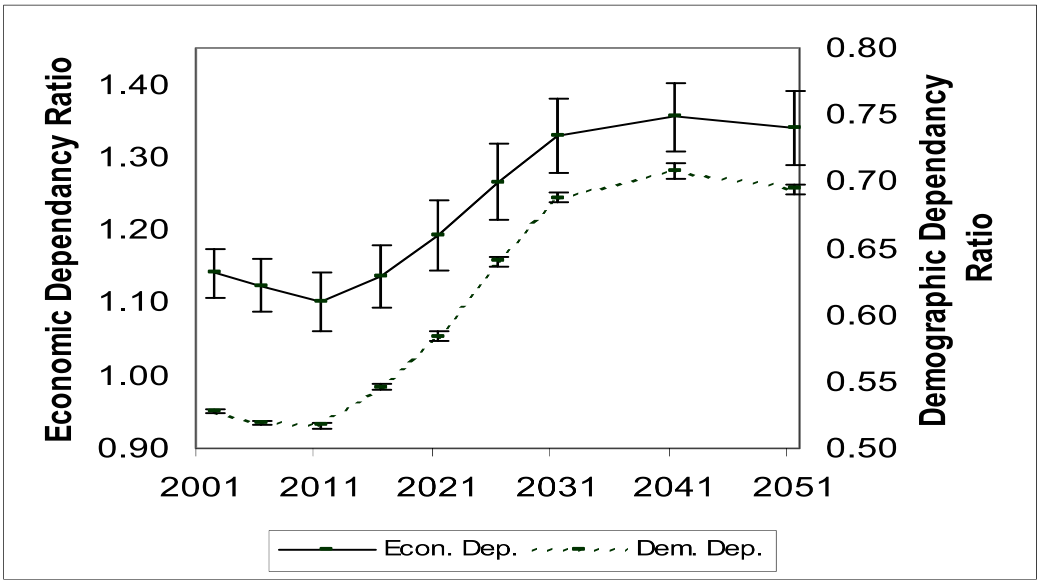


Table 4 - Projected size and composition of the workforce : 2001-2051

	2001	2011	2021	2031	2051
Male	983	1,024	1,055	1,056	1,104
Female	815	967	993	981	1,013
Total	1,798	1,991	2,048	2,037	2,117
Percentage Male	54.7	51.4	51.5	51.9	52.2
Percentage Female	45.3	48.6	48.5	48.1	47.8
Average Working age	36.7	38.5	38.8	38.6	38.9
Median Working Age	34.5	36.9	36.6	36.3	36.8
% Age 40+	48.3	54.5	53.2	53.0	53.8
% Age 50+	34.9	42.4	42.7	41.1	42.5

An alternative measure is the elderly dependency ratio, defined as those 65 and older as a percentage of the population between 15 and 64. The present projections suggest that this ratio rises from 18% in 2002 to 34% by 2031, which is similar to the OECD average.[28]

4.2 Social expenditure

Future rises in social expenditures depend on three critical sets of factors. These are the population ageing effect, labour market changes and policy settings. The benchmark model can be viewed as providing estimates of the "pure" population ageing effect as it assumes that existing policies remain in place unaltered, and that all categories of social expenditure grow at an annual rate of 1.5%, equal to the underlying rate assumed for productivity growth.

Figure 3 summarises the changing distribution of the ratio over time, and shows that the steepest increase in the average is projected to occur between 2011 and 2031, flattening thereafter. The critical issue concerns the uncertainty surrounding this point estimates. Even after only ten years, these bands are 20.0% to 26.8%. While the central estimate for 2051 is 31% of GDP, the 95% confidence bands range from 21.1% to 44.7%. The upward drift in the mean and the widening spread of the estimates are depicted in Appendix Figure 7, which plots the histograms resulting from the simulations. These show that the distributions become not only more spread, but also more skewed, in the later periods. This explains why the 95% confidence intervals are not symmetric about the average value.

The benchmark model projects that mean social expenditures rise from 22.7% in 2001 to 31.0% of GDP by 2051. Comparable results from other New Zealand studies are from 22.9% to 35.6% (Polackova 1997) and from 23% to 33% (Bagrie 1997) while a similar study for Australia reports that in the base case, social expenditure is projected to rise from 20.7% to 28.0% of GDP by 2051(Guest and McDonald 2000).[29]

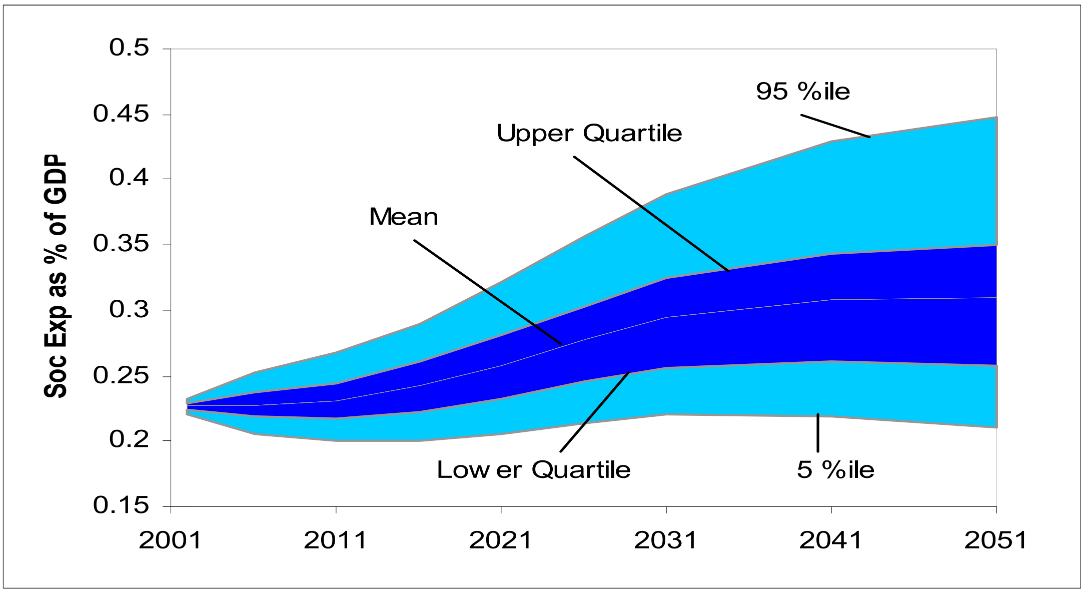
[28] See (Organisation for Economic Co-operation and Development 2000). The same source projects the New Zealand ratio to rise from 18% in 2000 to 27% in 2030 based on the United Nations medium variant estimates.

[29] Other studies giving similar orders of magnitude for Australia include Alvarado and Creedy (1998, p. 141) and Creedy (2000). A study by the Congressional Budget Office in the United States(Congressional Budget Office 2001) reports similarly wide confidence

Table 5 presents a summary of the projected growth in major groups of social expenditure as a share of GDP, due solely to population ageing. These are graphed in Figure 4. The costs of superannuation rise most markedly from 5% today to 10% by 2051.

Education costs fall slightly and there is a small increase in social security and welfare costs. Under the benchmark growth rates of the per capita real costs of social expenditure, the share of health costs in GDP rises by 50%, or by 3 percentage points. When health expenditure is divided into the seven sub-categories, the first two (age related and medical/surgical) account for almost all of this increase, as shown in Figure 5. For further details, see Appendix Table 6.

Figure 3 - Projected social expenditure as a share of GDP : 2001-2051



bands for the balance of the Social Security Trust Fund. Using a stochastic approach they find that by 2030 the expected funding gap is –4.78%, with 90% confidence bands of –9.49 to –1.00%.

Table 5 - Summary of projected social expenditures by major groupings for benchmark growth rates: 2002-2051

		Projected Shares					
	Categories	Share of Total Social Expenditure			Share of GDP		
		2002	2021	2051	2002	2021	2051
Health	1-7	0.26	0.28	0.30	0.06	0.07	0.09
Education	8	0.20	0.15	0.13	0.04	0.04	0.04
NZ Superannuation	9	0.21	0.28	0.32	0.05	0.07	0.10
Social Security and Welfare	10-13	0.25	0.21	0.18	0.06	0.05	0.06
Unemployment	14	0.09	0.08	0.06	0.02	0.02	0.02
Total		1.00	1.00	1.00	0.23	0.26	0.31

Figure 4 - Projected mean total social expenditure and expenditure by major categories

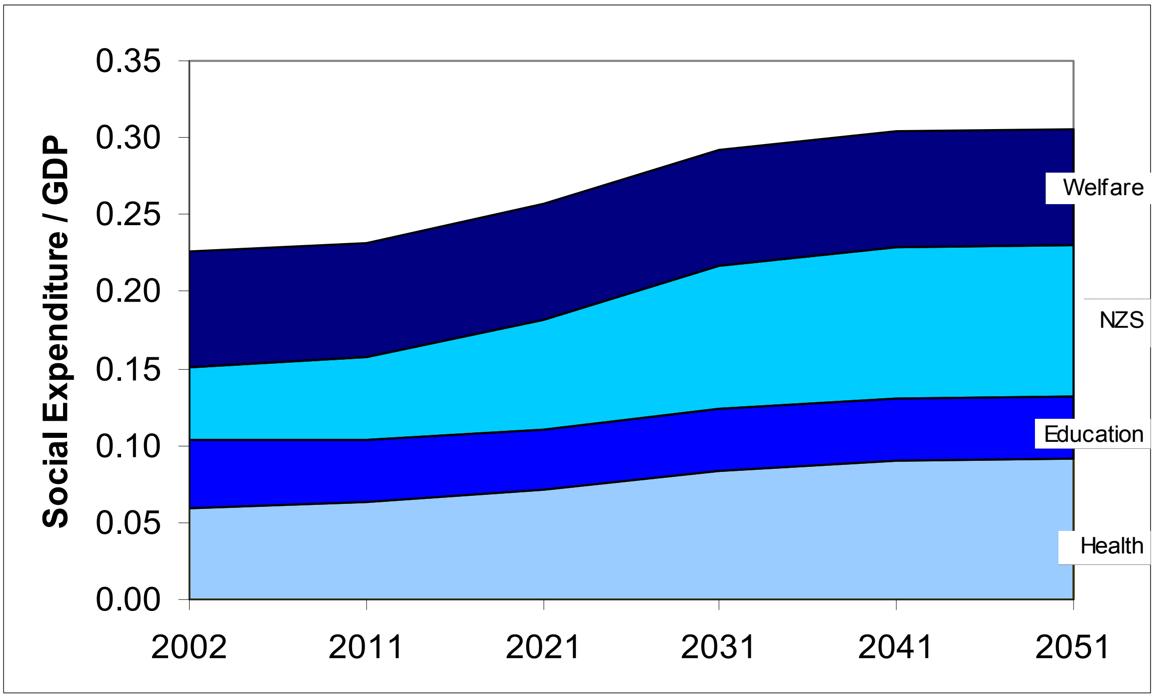
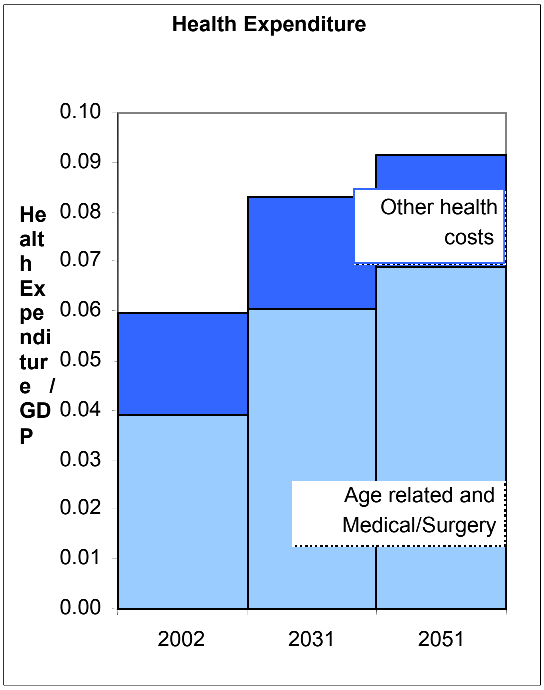


Figure 5 - Projected increases in health costs



5 Impact of Varying Assumptions

This section explores the impact on the projected levels of social expenditure of variations to the assumptions used in the benchmark case. In each case, the benchmark model is taken and one assumption or associated set of assumptions is varied. In this manner the following sections show the impact, relative to the benchmark case, of changes in each of these critical assumptions.

5.1 Higher Rate of Migration

The effect of higher net migration was examined by raising the annual net migration level from 5,000 to 20,000. This latter figure corresponds to the upper level used by Statistics New Zealand (2000). Higher rates of migration are variously seen as adding to the burden of social expenditure on the one hand, or providing more workers and enhancing the tax base on the other. The result depends on the age distribution of the migrants relative to the resident population. In this study we assume that the higher migration levels would simply reflect the mix by age and gender of migrants between 1997 and 2001. The effect (see Table 6) is to lower the projected rise in social expenditure by 2051 rather modestly from 31.0% to 29.5%. Migrants are only slightly younger on average than the New Zealand population. Given the estimates of the standard errors this change cannot be regarded as statistically significant.[30]

Table 6 - Effect on social expenditures as a share of GDP of varying demographic and labour market assumptions

		Benchmark	High Migration	Higher LFPR	Higher Labour Productivity
2011	Mean	23.1	22.9	21.7	23.2
	SD	2.1	2.0	1.9	2.4
	5 %ile	20.0	19.8	18.7	19.5
	95 %ile	26.8	26.5	25.1	27.5
2021	Mean	25.8	25.1	24.2	25.5
	SD	3.6	3.5	3.4	4.2
	5 %ile	20.6	20.1	19.3	19.3
	95 %ile	32.2	31.3	30.1	32.9
2031	Mean	29.5	28.1	27.5	28.4
	SD	5.3	4.9	4.9	5.8
	5 %ile	22.1	21.2	20.7	20.1
	95 %ile	39.0	36.8	36.4	38.8
2041	Mean	30.8	29.1	28.8	28.9
	SD	6.6	6.2	6.2	7.2
	5 %ile	21.8	20.7	20.4	19.2
	95 %ile	42.9	40.3	40.2	41.7
2051	Mean	31.0	29.5	29.1	28.7
	SD	7.5	7.0	7.0	8.0
	5 %ile	21.1	20.2	19.8	18.1
	95 %ile	44.7	42.2	41.9	42.8

[30] The migrants are assumed immediately to take on the demographic and other characteristics of the NZ population. For an extensive analysis of slower assimilation in the Australian context, using a decomposition of the population, see Alvarado and Creedy (1998).

5.2 Changes in Labour Market Parameters

Two adjustments were made to the labour market parameters. The first raised the average growth in labour productivity to 1.75% from 1.50% per year. This, as expected, reduces the projected mean ratio of social expenditure, from 31.0% to 28.7% by 2051. Details are given the final column of Table 6. In the second case higher rates of female labour force participation were used. All female rates were increased to match those of the males (where male rates were higher), with the exception that for women between 20 and 29 their participation rates were held at a maximum of 90% of the male rates for those age groups. The results are also shown in Table 6, where it can be seen that the higher participation resulted in only a modest and statistically insignificant decline in the mean projected share of social expenditure in GDP.

5.3 Changes in Standard Deviations of Social Expenditures

The standard deviations of the growth rates of major categories of social expenditure were estimated from historical data, as discussed earlier (see Table 1). Their size reflects considerable uncertainty. They contribute significantly to the overall confidence band around social expenditure projections. By 2051, the 5 and 95 percentile bands around the mean estimate of 31.0% are from 21.1% to 44.7%. To explore what would happen if the variability in social expenditure programmes were lower in the future, two sets of simulations were made. For the first simulation, all the standard deviations were set to zero; this provides a useful point of comparison since the variation arises entirely from demographic and labour market distributions. In the second simulation, the standard deviations were reduced by 50 percent.

The effects on the final distributions of social expenditures are shown in Table 7. When the standard deviations of social expenditures are set to zero, the 5 and 95 percentile bands for the ratio of social expenditure to GDP in 2051 are reduced to 25.3% to 37.4%. The confidence intervals therefore remain substantial, reflecting the high standard deviations on participation and unemployment rates.

Table 7 - Projected social expenditure ratios for different standard deviations

		Historical SD	SD set to Zero[a]	SD set to 50 %
2011	Mean	23.1	23.1	23.1
	SD	2.1	1.2	1.5
	5 %ile	20.0	21.2	20.8
	95 %ile	26.8	25.2	25.6
2031	Mean	29.5	29.5	29.5
	SD	5.3	2.7	3.5
	5 %ile	22.1	25.3	24.2
	95 %ile	39.0	34.2	35.5
2051	Mean	31.0	30.9	30.9
	SD	7.5	3.7	4.8
	5 %ile	21.1	25.3	23.7
	95 %ile	44.7	37.4	39.3

Note: [a] Variability only contributed by population, labour force participation rate, unemployment rates and productivity

5.4 Higher Growth Rates of Social Expenditure

The initial benchmark results, based on the assumption that real unit costs of social expenditure grow on average at the same rate as overall productivity, were important to isolate the pure effect of population ageing. However, this assumption is unlikely to be true. This subsection considers a different set of assumptions. This alternative uses historical annual rates of growth of real per capita social expenditures over the last 40 years, reported in Table 1 above.[31] The average annual changes exceed 1.5%, the rate of growth used in the benchmark simulations, by a considerable margin. The resulting projections are summarised in Table 8; detailed results with standard deviations for all 14 categories and for males and females are shown in Appendix Table 7.

Table 8 - Summary of projected social expenditures by major categories for historical growth rates

Categories		Projected Shares					
		of Social Expenditure			of GDP		
		2002	**2021**	**2051**	**2002**	**2021**	**2051**
Health	1-7	0.26	0.30	0.35	0.06	0.10	0.20
Education	8	0.20	0.18	0.18	0.04	0.06	0.10
NZ Superannuation	9	0.21	0.26	0.26	0.05	0.08	0.14
Social Security and Welfare	10-13	0.25	0.21	0.18	0.06	0.07	0.10
Unemployment	14	0.09	0.06	0.03	0.02	0.02	0.02
Total		1.00	1.00	1.00	0.23	0.32	0.55

Total social expenditures rise to a mean of over 55% of GDP by 2051. Health costs alone represent 35% of total social expenditure and rise from 6% of GDP in 2001 to a projected level of 20% by 2051. It is immediately evident that these results are improbable. When the uncertainty is taken into account there is a 5% chance that social expenditures could exceed 78% of GDP in 2051 if the costs per capita were to continue to grow in real terms at their historical rates and productivity in the economy were to grow on average at no more than its historical rate. It is most unlikely that the growth rates of social expenditures in past decades could be sustained without intolerable fiscal pressures.In fact it could be argued that, with the exception of health costs, the annual average growth rates of the other major groups of social expenditure have been slowing through time, and the rates over the last decade are below those of earlier periods, or the 1960 to 2000 span as a whole. Were this the case and were the more recent levels of higher productivity growth to prove sustainable over a very long period, then conceivably current policy settings might be manageable.

Unlike some other items, (as shown in Appendix Figure 4) the annual rates of growth in health costs, while showing some variability, do not appear to have abated. The following section explores further the impact of the growth in health expenditures.

[31] In the case of the growth of unemployment benefits, we used data for 1980 to 2000.

5.5 Changes in Future Health Costs

The results of Section 4 show that increased health costs represent a significant share of the projected rise in social expenditures. This is particularly so if per capita social expenditures were to continue to grow at their historical rates. This section further explores the growth in health costs, and extends the basic model to allow for differential growth rates of health expenditures by age groups.

It has been stressed that the growth rates in real per capita public health expenditures have been highly variable; see Appendix Figure 4. As shown in Table 9 the selection of the historical period influences the annual average estimated growth rate in health expenditures. Most accounts of long-term changes in medicine and health make the period around World War II a watershed. It therefore probably makes sense to look at average growth rates from then until the present. As is apparent in Table 9, this gives a growth rate of around 3% per year. The corresponding average for the entire OECD for 1960-1995 is around 4.7% per year (Mayhew 2000b).[32]

Table 9 - Average annual change in real per capita public spending on health, for selected periods

Period	Average
1862-2000	0.043
1950-2000	0.029
1960-2000	0.031
1970-2000	0.030
1980-2000	0.021
1990-2000	0.026

Source: NZ Treasury; unpublished data from the Long Term Data Series

For present purposes it is necessary to eliminate the contribution of population ageing to this expenditure growth. Strictly speaking, this cannot be done without knowing the age-profile of spending in the past. A Ministry of Health report (Johnston and Teasdale 1999) nevertheless makes an estimate, presumably by assuming a constant age-profile. The report's estimate is that ageing was responsible for about 0.4 percentage points in expenditure growth per year between 1977 and 1997. Mayhew (2000a: Table 2.3) derives an estimate of 0.35 percentage points per year for the OECD during the years1960 to 1995.

Subtracting an ageing component of 0.4% per year from an average growth rate of 3.0% per annum gives an adjusted rate of increase in per capita public spending on health of 2.6%. This is rounded to 2.5%, a figure in line with international estimates.[33] Mayhew (2000a: Table 2.3) assumes an underlying growth rate of 3.0% for the OECD over the period 1995-2050.

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[32]This figure was obtained by subtracting the adjustment for 'population volume' from the 'health care expenditure growth per annum'.
[33]The US Congressional Budget Office assumes that per capital Medicare expenses will eventually grow at about 1.1% faster than per capita incomes (Lee and Miller 2001).

Table 10 presents a comparison of the projected level of social expenditures as a share of GDP under three different growth rates for health costs. In the benchmark estimates all social expenditures grow at 1.5%, equal to the rate of labour productivity growth. In the second case all social expenditures grow at their historical rates, which implies health costs grow at 3.1% (a figure which is not adjusted for the effect of population ageing). In the third case, health costs for all age groups grow at 2.5% while other categories of social expenditure continue to grow at 1.5% per year. Even in the third case, where only health costs are permitted to grow at a higher rate, the projected mean level of social expenditures rises substantially compared with the benchmark case; yet because of the large degree uncertainty, the differences are not statistically significant.

The projections have all assumed that any given rate of growth in health costs applied to all age groups. There is a possibility that the costs for the elderly will rise more steeply than those for younger age groups.[34] Recognising this, the projection model was modified to allow for the annual growth rates for all categories of social expenditure category to vary with age. The mean growth rates for health expenditures in the higher age groups were thereby allowed to be higher than the corresponding rates for lower ages. However, the standard deviation of the growth rate for each age group was set equal to the common value previously used for each social expenditure category (as there was insufficient information on which to base any differences). This increase in the number of distributions from which random draws are made raises a question regarding the correlation between age groups (with the values being jointly normally distributed). Indeed, the earlier projections are equivalent to an equal mean growth rate for each age group, combined with an implicit assumption that the values are perfectly correlated. The allowance for a lower degree of correlation is expected to reduce the standard deviation of the ratio of aggregate social expenditure to GDP, since the selection of higher than average values in one age group in a particular year can be partially offset by the selection of lower than average values for other age groups. For this reason, the two extremes of zero and perfect correlation between the growth rates in different age groups were examined.

Table 10 - Effect on social expenditure as a share of GDP for differing growth rates of per capita health costs

		Benchmark	Historical	Health 2.5%, other 1.5 %
2011	Mean	23.1	25.7	24.3
	SD	2.1	2.3	1.5
	5 %ile	20.0	22.2	21.9
	95 %ile	26.8	29.7	26.7
2021	Mean	25.8	32.2	29.0
	SD	3.6	4.4	2.6
	5 %ile	20.6	25.8	25.0
	95 %ile	32.2	40.1	33.4
2031	Mean	29.5	41.4	36.2
	SD	5.3	7.1	3.9
	5 %ile	22.1	31.3	30.2

[34] Cutler and Sheiner (2002) raise the possibility that health costs for the very old will not rise so fast if the incidence of disability among the group declines. Other factors include the extent to which there may be more aged couples (as single individuals make more use of nursing homes).

		Benchmark	Historical	Health 2.5%, other 1.5 %
	95 %ile	39.0	54.0	43.1
2041	Mean	30.8	49.0	42.4
	SD	6.6	9.9	5.4
	5 %ile	21.8	35.1	34.3
	95 %ile	42.9	67.0	51.6
2051	Mean	31.0	55.0	47.8
	SD	7.5	12.5	6.6
	5 %ile	21.1	38.8	37.7
	95 %ile	44.7	78.3	59.3

Table 11 - Effects of allowing growth rates of social expenditure to vary by age

		g_{ij}=1.5		g_{ij} varying by age	
		ρ =1.0[a]	ρ =0.0	ρ =1.0	ρ =0.0
2011	Mean	23.1	23.1	23.6	23.6
	SD	2.1	1.4	2.1	1.4
	5 %ile	20.0	20.8	20.3	21.3
	95 %ile	26.8	25.5	27.2	26.0
2021	Mean	25.8	25.8	27.3	27.3
	SD	3.6	2.4	3.7	2.4
	5 %ile	20.6	22.1	21.9	23.5
	95 %ile	32.2	29.8	33.8	31.5
2031	Mean	29.5	29.4	32.4	32.5
	SD	5.3	3.4	5.5	3.6
	5 %ile	22.1	24.3	24.6	27.0
	95 %ile	39.0	35.3	42.5	38.8
2041	Mean	30.8	30.8	35.9	35.9
	SD	6.6	4.2	7.1	4.7
	5 %ile	21.8	24.5	25.9	28.8
	95 %ile	42.9	38.1	49.2	43.9
2051	Mean	31.0	30.9	37.7	37.9
	SD	7.5	4.7	8.2	5.4
	5 %ile	21.1	24.0	26.5	29.7
	95 %ile	44.7	39.0	52.7	47.2

Note: [a] Benchmark case
gij refers to the projected growth rate of the i-th category of social expenditure (i=1,...,14) for the j-th age group (j=1,...,19)
ρ refers to the correlation coefficient of growth rates between age groups.

The first two columns of Table 11 show the benchmark case for the two extreme values of the correlation across ages. The mean estimates remain virtually unchanged but the standard deviations are reduced. The final two columns allow growth rates to vary by age; health expenditures were assumed to grow at 2% for those from 0-64 and 3.5% pa for those 65 and over. All remaining categories of social expenditure were held to the benchmark growth rate of 1.5%. The accelerated growth rate of elderly health costs adds some 7 percentage points to the mean share of GDP with the standard deviations again varying according to the assumption about the correlation across age groups. A detailed breakdown of the components of health costs for the case of a unit correlation coefficient (third column in Table 11) is given in Appendix Table 8.

6 Conclusions

This paper has projected social expenditures in New Zealand over 50 years, based on a stochastic approach using 14 categories of social spending, decomposed by age and gender. By allowing for uncertainty about fertility, migration, mortality, labour force participation and productivity, and all categories of social spending, it has been possible to generate forecasts with accompanying confidence bands. The results show that there is considerable uncertainty and future projections have wide confidence intervals.

This uncertainty has implications for fiscal policy and the management of the Crown debt. The Fiscal Responsibility Act 1994 states that, as a principle of responsible fiscal management, a New Zealand government should ensure total Crown debt is at a prudent level by ensuring total operating expenses do not exceed total operating revenues. In the face of uncertain levels of future expenditure, the best that can be achieved is to estimate the ex ante cash budget balance needed to achieve an actual cash budget balance, at a given level of probability (Buckle, Kim and Tam 2001). To the extent that the approach adopted in this paper can improve the estimates of the probability distribution surrounding key areas of government expenditure, then it should be possible to make more reliable estimates of the ex ante budget balance needed to sustain a particular level of the Crown's debt.

It would however be premature to conclude from these results that increased outlays will constitute a burden on society. First place, the well-being of older citizens is presumably enhanced by the receipt of health and pension benefits. Offsetting this is the loss to those who must bear higher rates of taxation to meet the transfers. We have not explored the costs to society of the deadweight losses of extra taxation.[35] Second, as argued by Guest and McDonald (2000) the absolute incomes of future generations will be higher given continued growth in productivity. In fact, even if productivity growth were to remain at its longer term average rate of 1.5%, future workers in 30 years time would be enjoying real incomes more than 50% higher than at present. The implication is that even after allowing for higher relative transfers, they would still have a level of well-being substantially greater than that enjoyed by workers today.

In focussing on the task of explicitly incorporating uncertainty into the projections, we have set aside some other potentially difficult issues. For example, while we have forecast some changes in labour force participation rates, these have relied on projections of past trends. With increased labour scarcity combined with better health and extended life spans, significant increases in the participation rates of older workers may occur. Offsetting that is the increased demand for leisure that comes with higher real incomes. While the demographic projections are based on reasonably disaggregated data, no allowance has been made for other demographic characteristics such as ethnicity or marital status.

The projection model allows for the growth of every category of social spending to differ for every age group. This constitutes a more disaggregated approach than has been applied in other studies. When combined with the extensive stochastic elements this comes at a cost of increased complexity. The empirical work is still at a rudimentary stage. We have often relied on crude assumptions such as the variability of underlying distributions remains constant over time, or across several sub-categories as in the case

[35] Nor do we address the question of the extent to which greater reliance on individual responsibility and private provision of health and retirement benefits might, as in say Australia, USA or the UK, play a greater role in future.

of health spending. Further we have paid scant attention to the question of covariances across categories of spending.

We have relied, like others, on examining the sensitivity of the projections to different assumptions. More remains to be done to explore different policy settings such as adjustments to the age of eligibility for publicly provided retirement benefits or to the criteria for certain classes of welfare benefits. Above all, even after the extensive disaggregation in the present study together with stochastic simulation of over 500 variables, the approach is vulnerable to the criticism that it fails to capture potential behavioural responses to changes in relative prices and incomes. Those advances remain as challenges.

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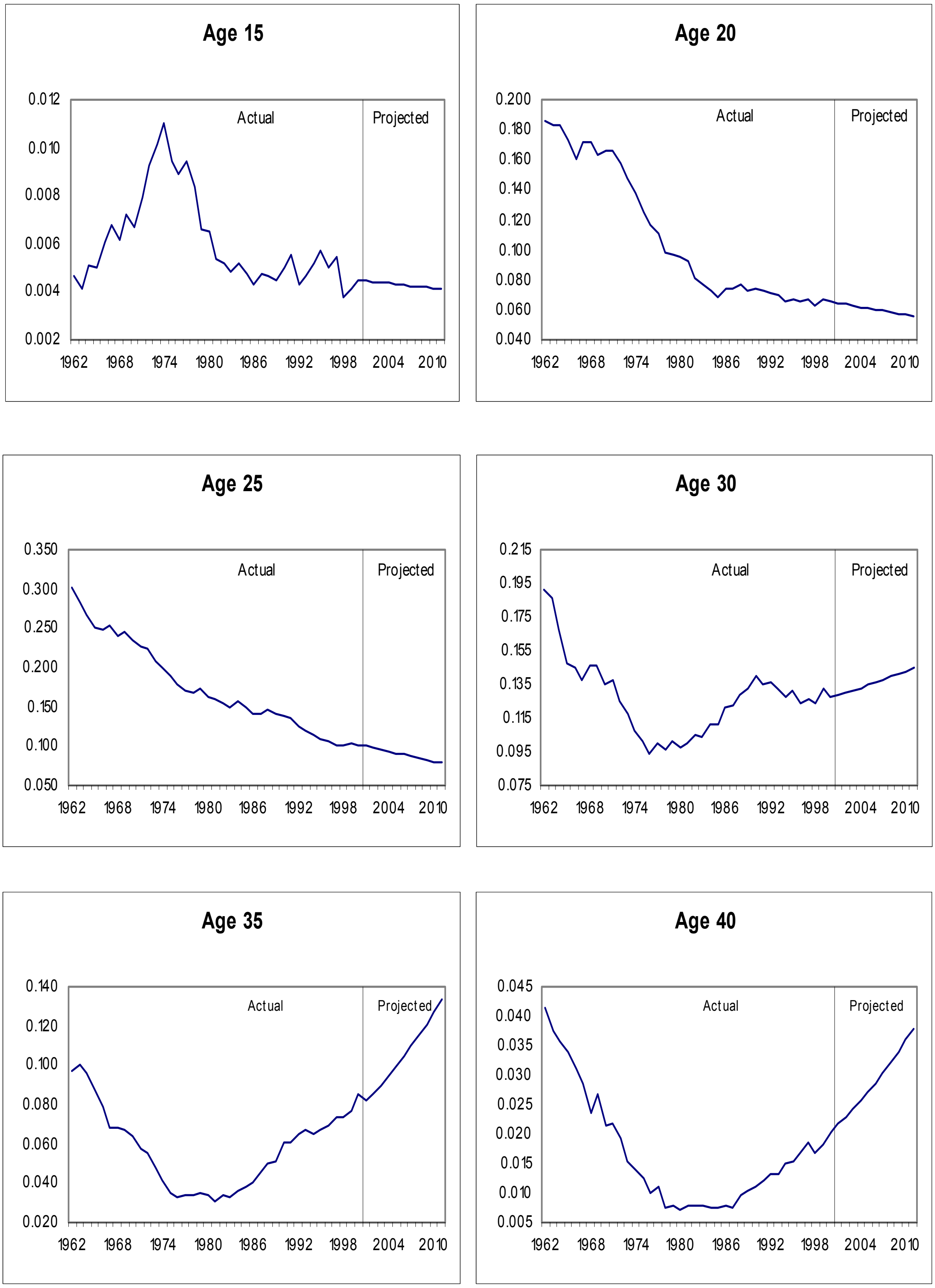
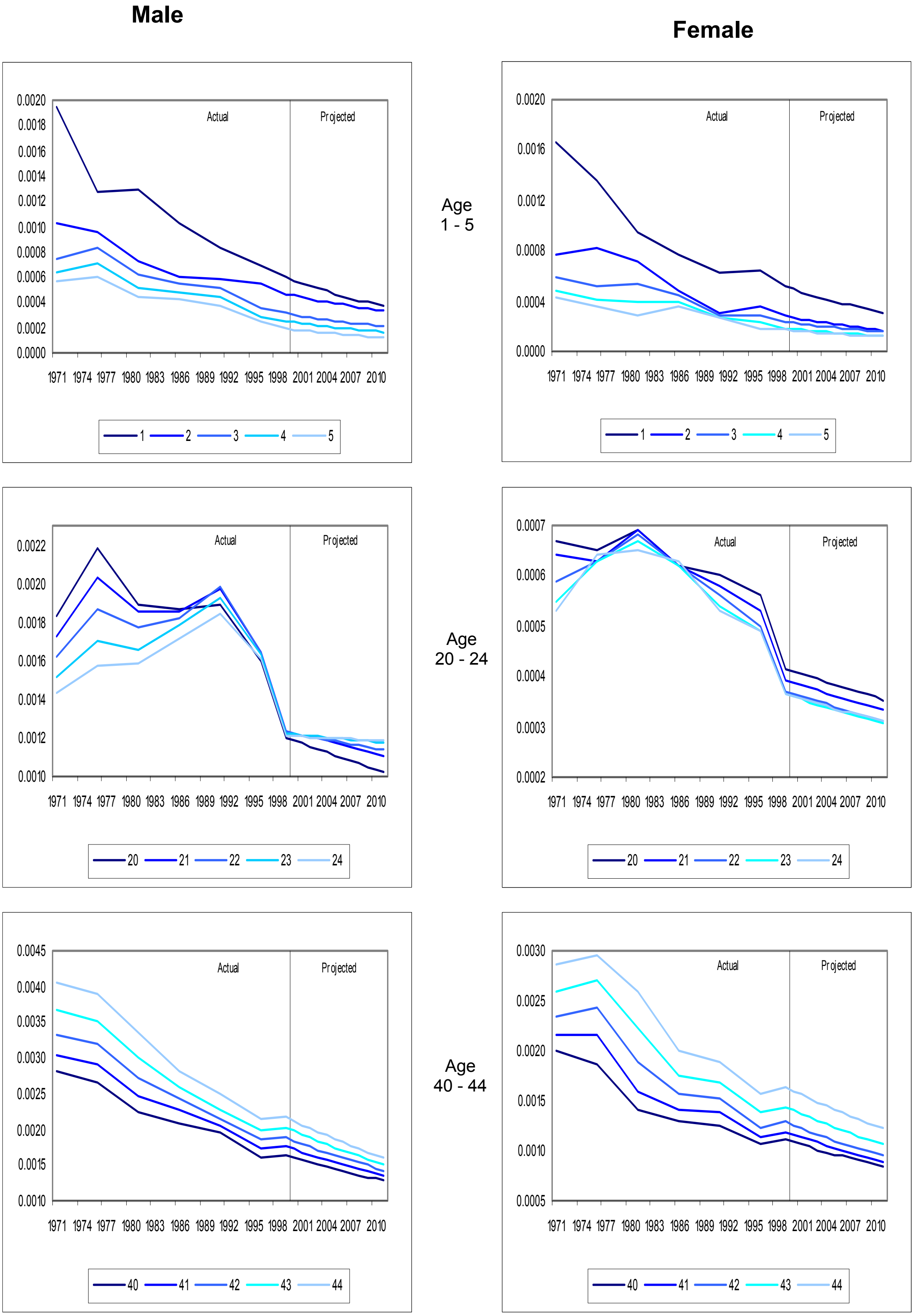
Appendix Figures

Appendix Figure 1 - Fertility rates for selected ages: 1962-2011



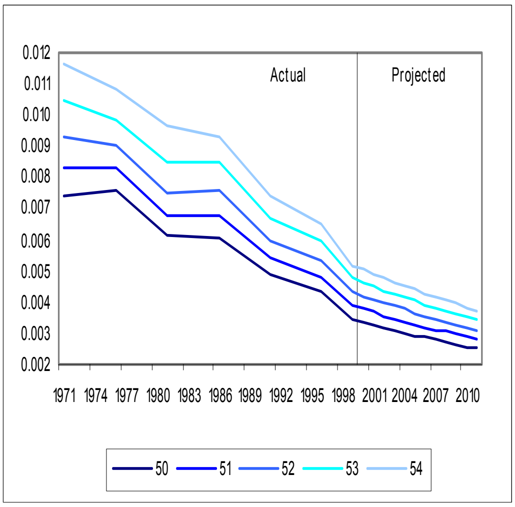
Appendix Figure 2 - Mortality rates: 1971-2011



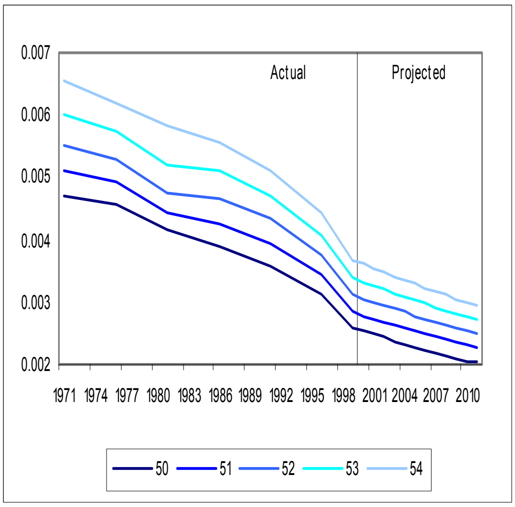
Appendix Figure 2 - Mortality rates: 1971-2011 (continued)

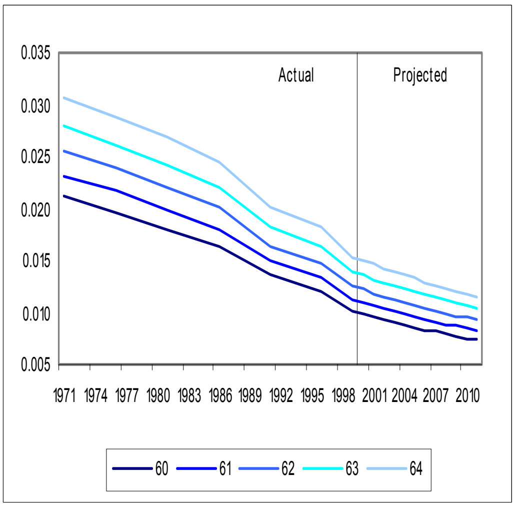
Male

Female

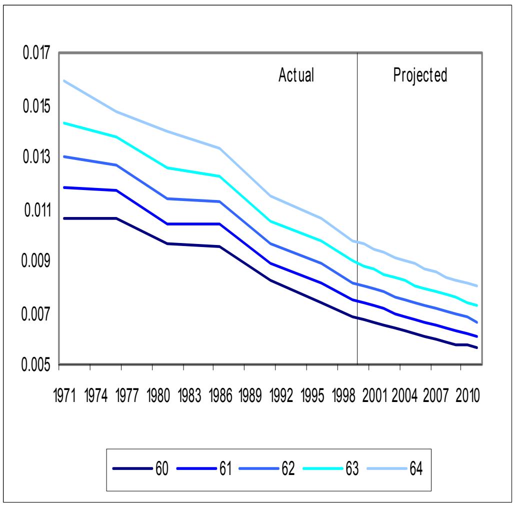


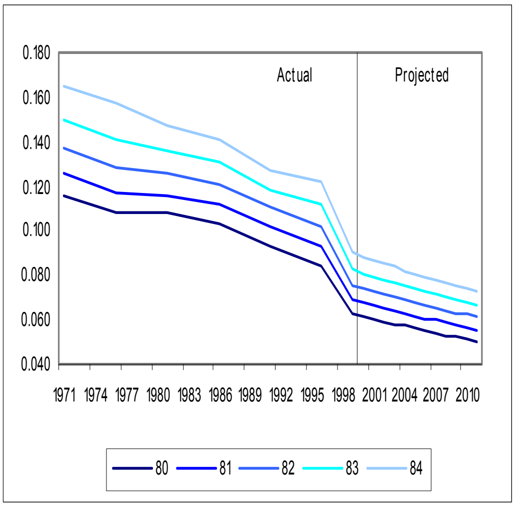
Age
50 - 54



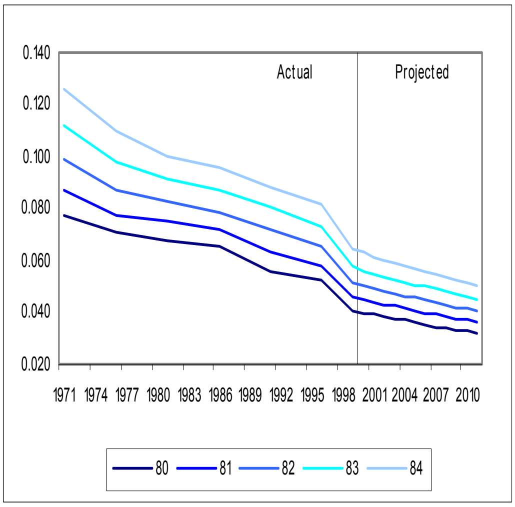


Age
60 - 64

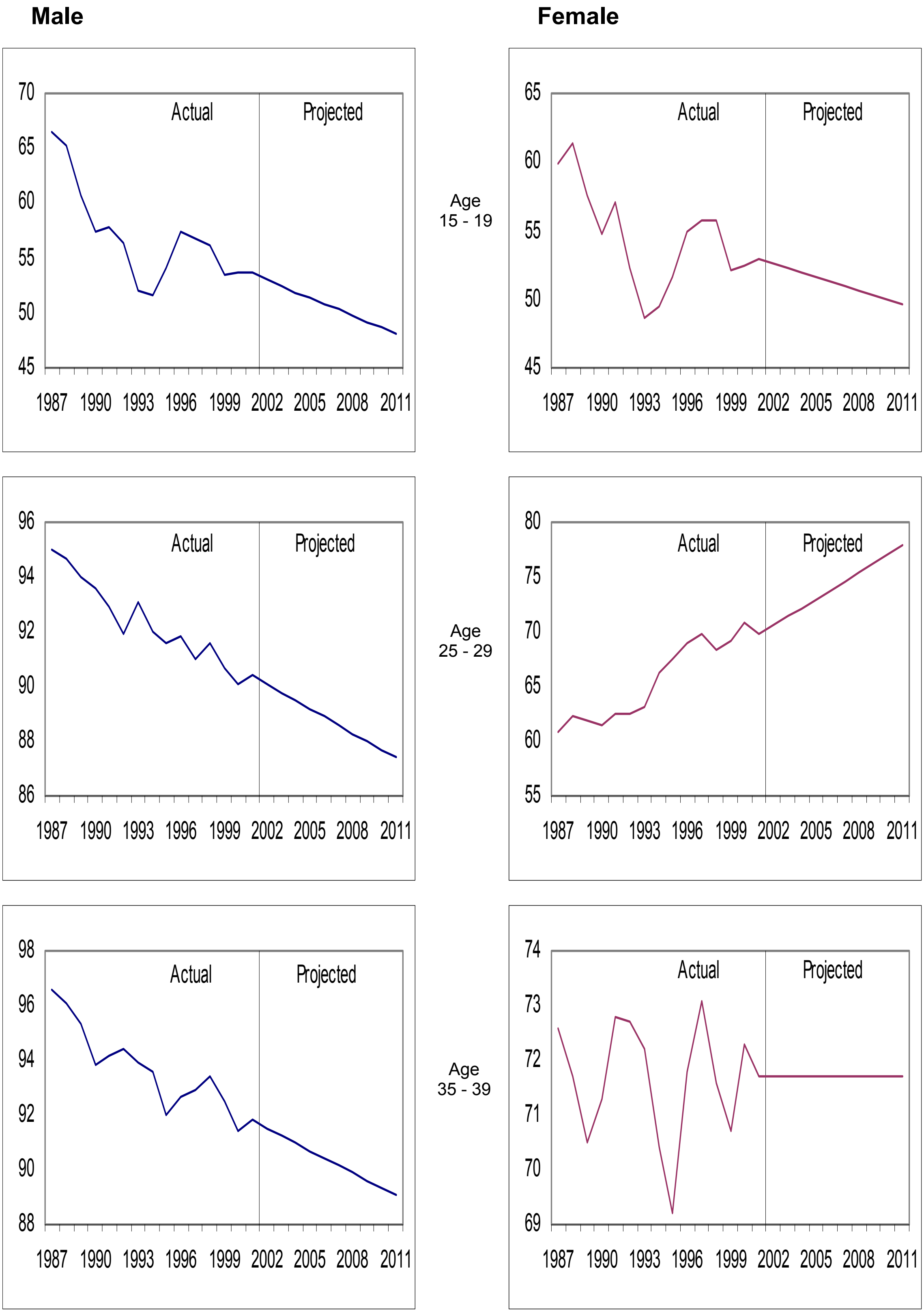




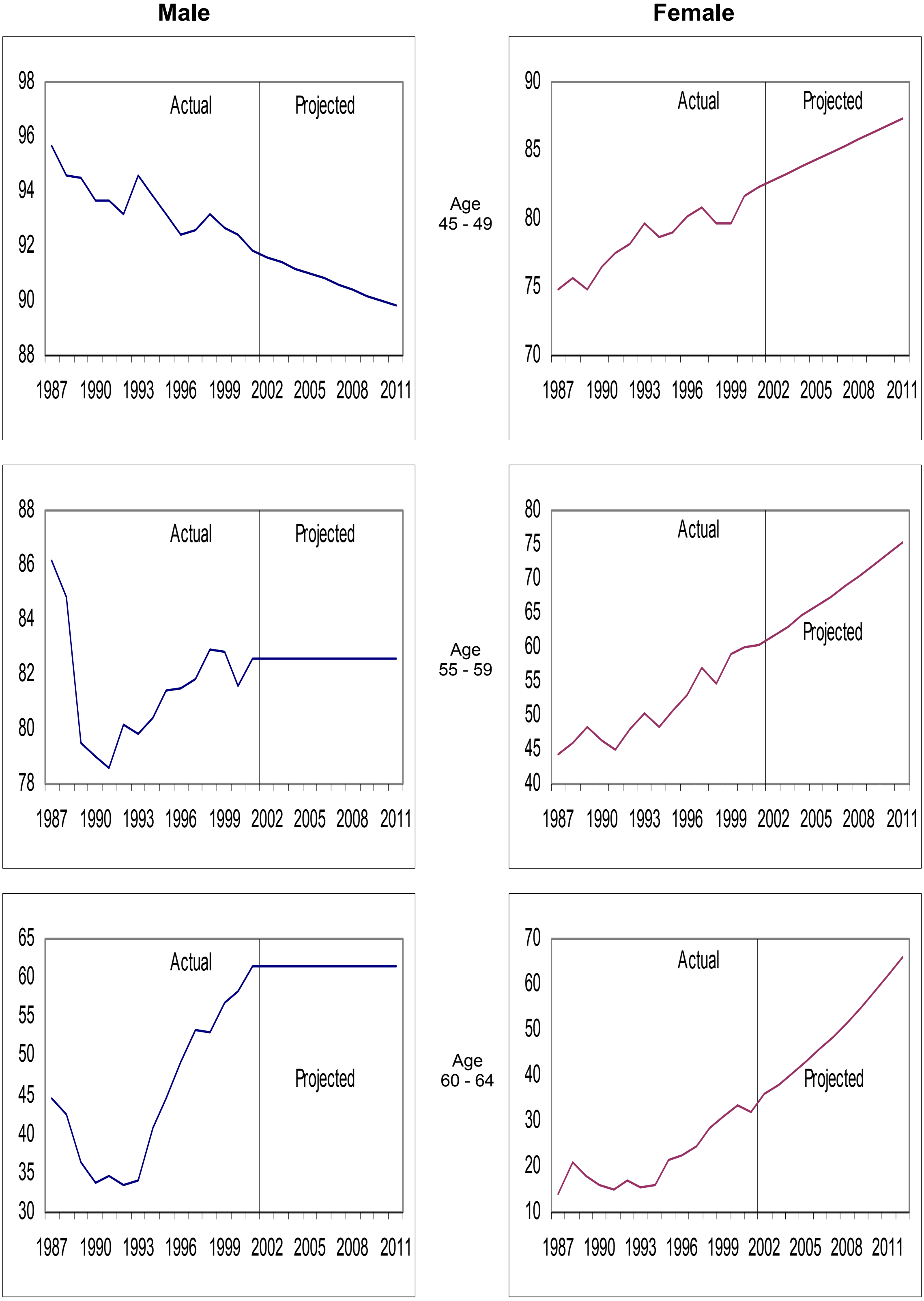
Age
80 - 84



Appendix Figure 3 - Labour force participation rates: 1987-2011



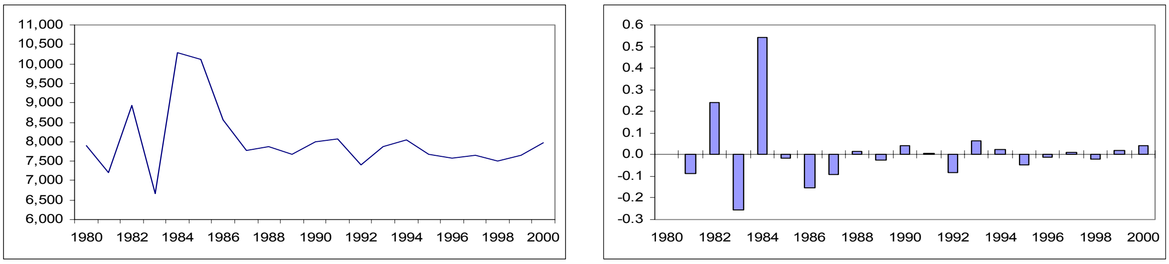
Appendix Figure 3 - Labour force participation rates: 1987-2011 (continued)



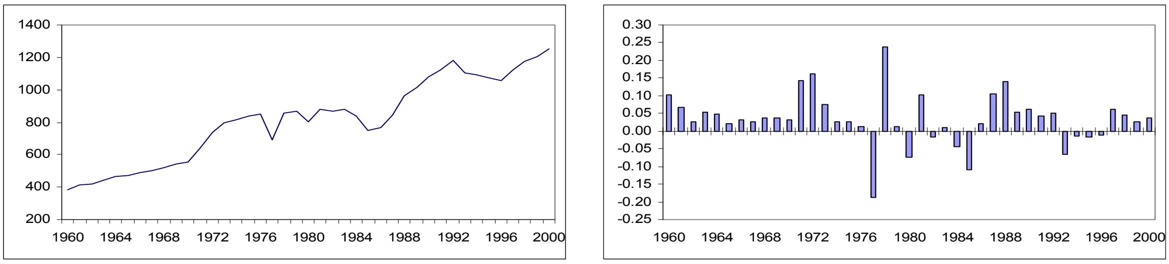
Appendix Figure 4 - Historical trends in major categories of social expenditures

Real expenditure | Annual proportional change

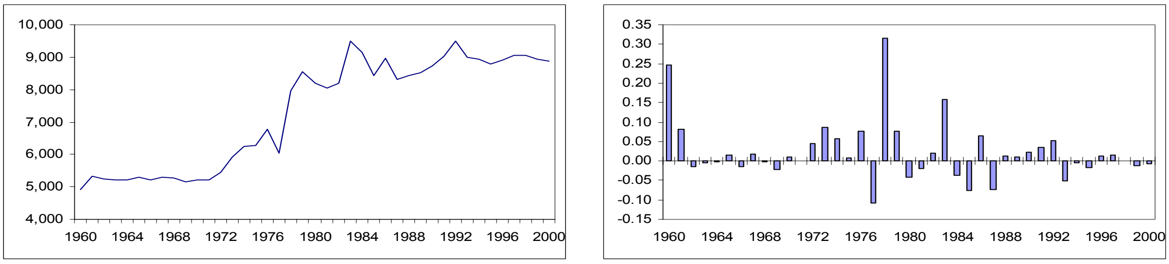
Unemployment (per Recipient)



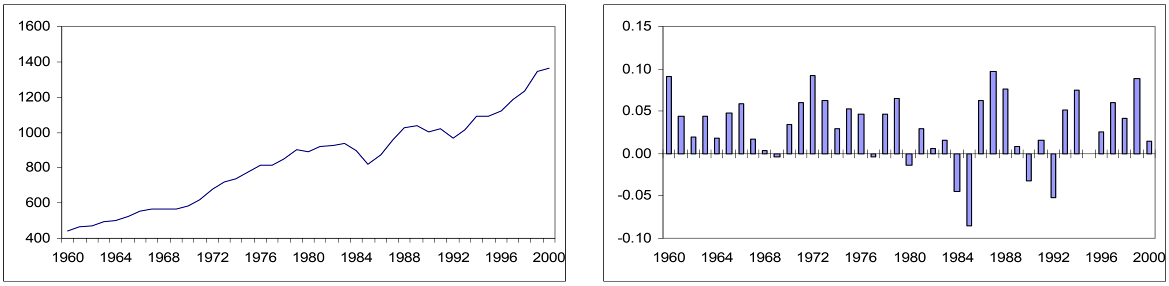
Education (per Capita)



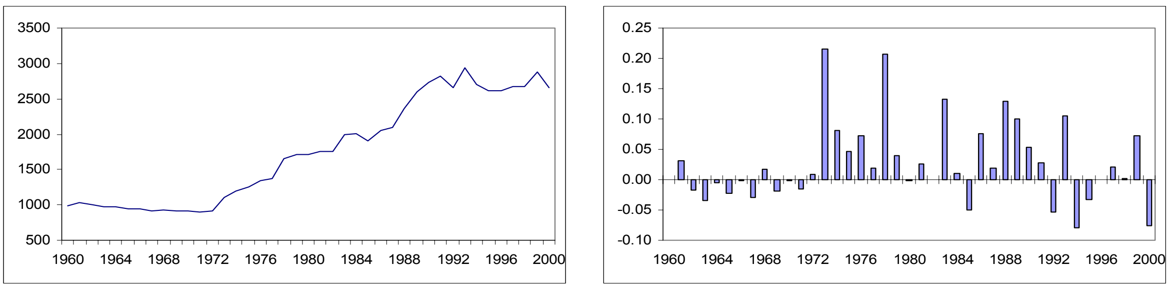
Superannuation (per Recipient)



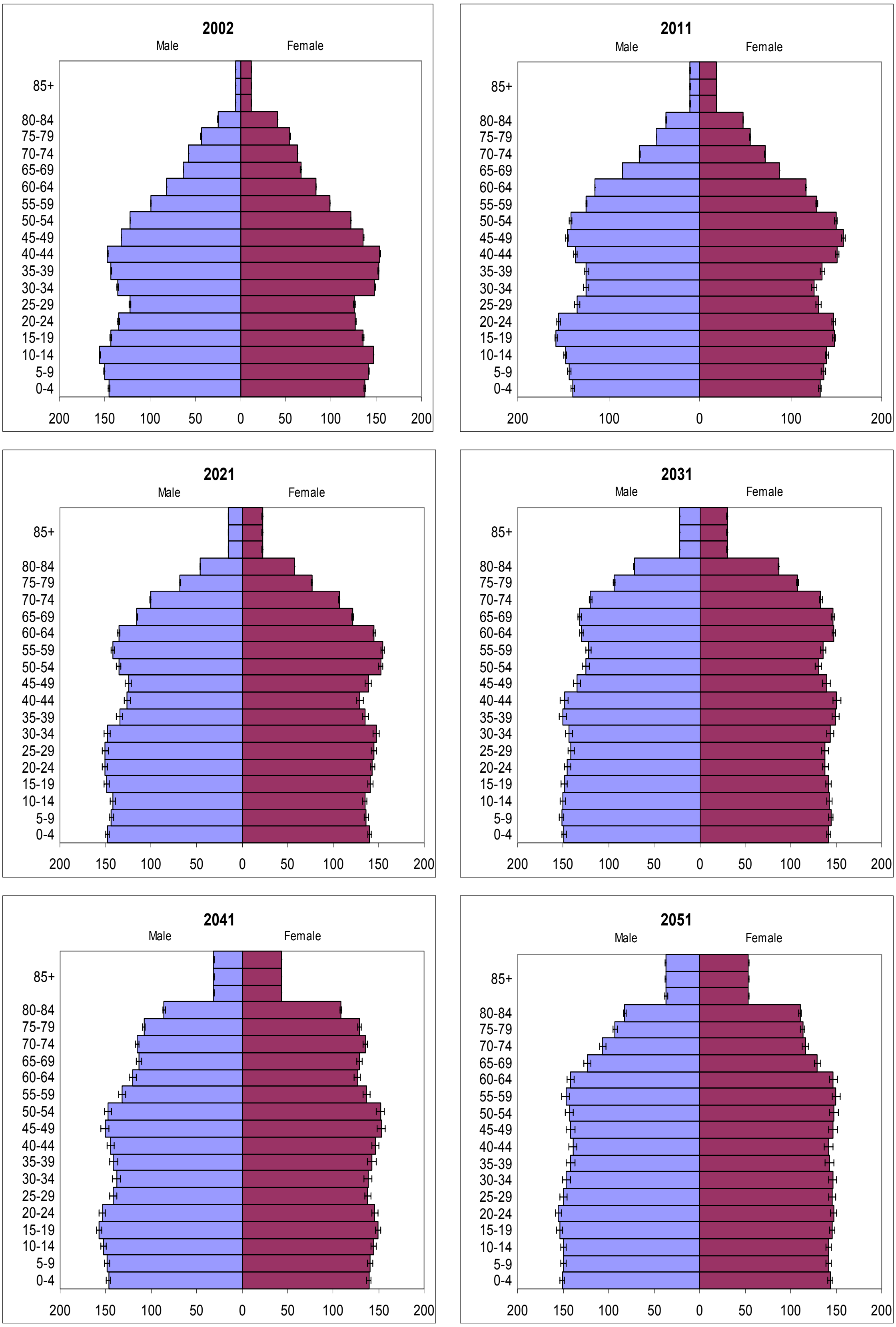
Health (per Capita)



Social Security and Welfare (per Capita)



Appendix Figure 5 - Population projections by age group and gender: 2002-2051

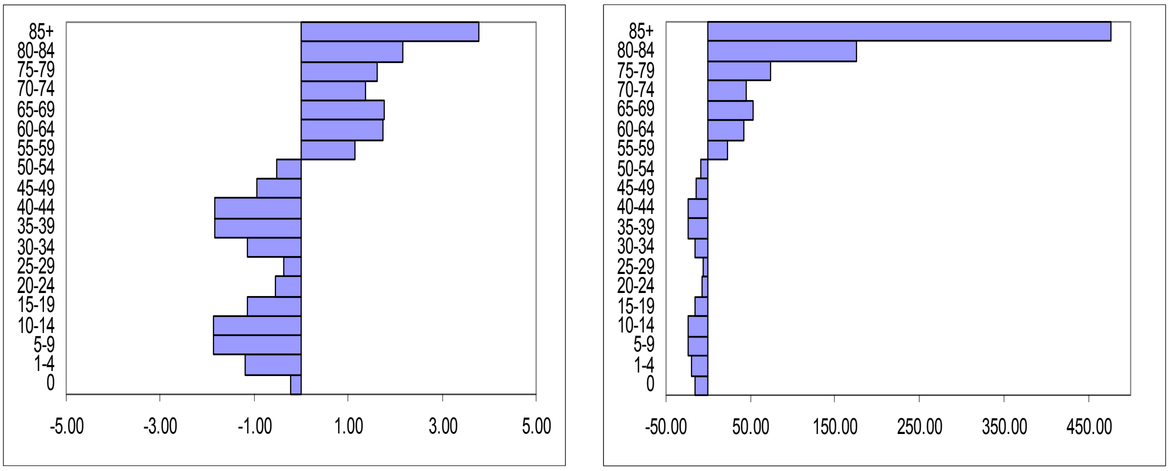


Note: Population is measured in thousands

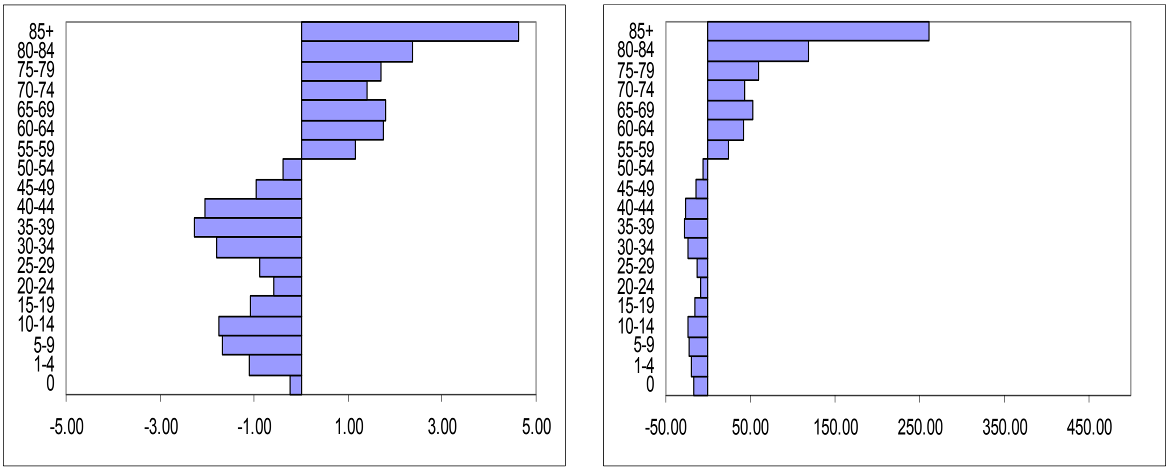
Appendix Figure 6 - Changes in the age structure of the population between 2001 and 2051

Change in the Share of Population | Percentage Change of the Share

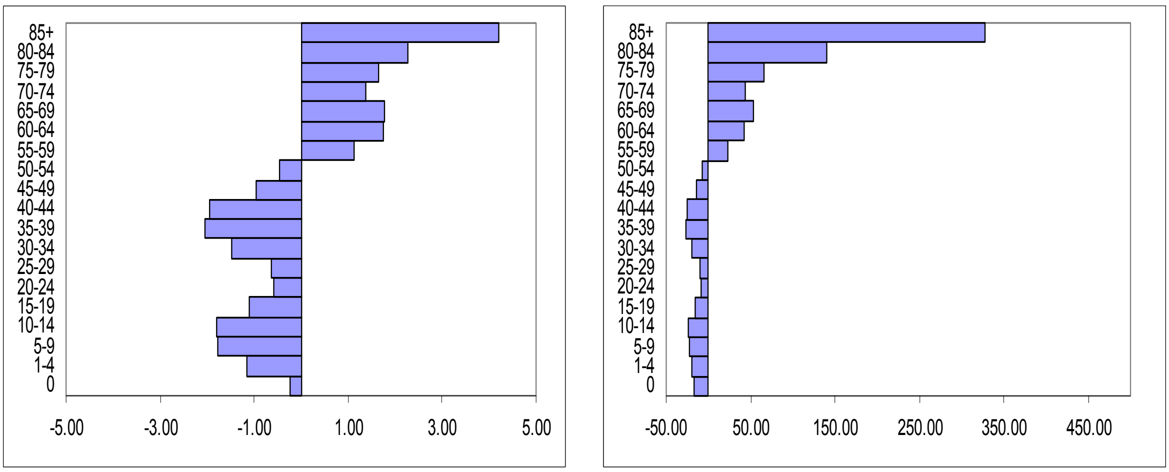
Male



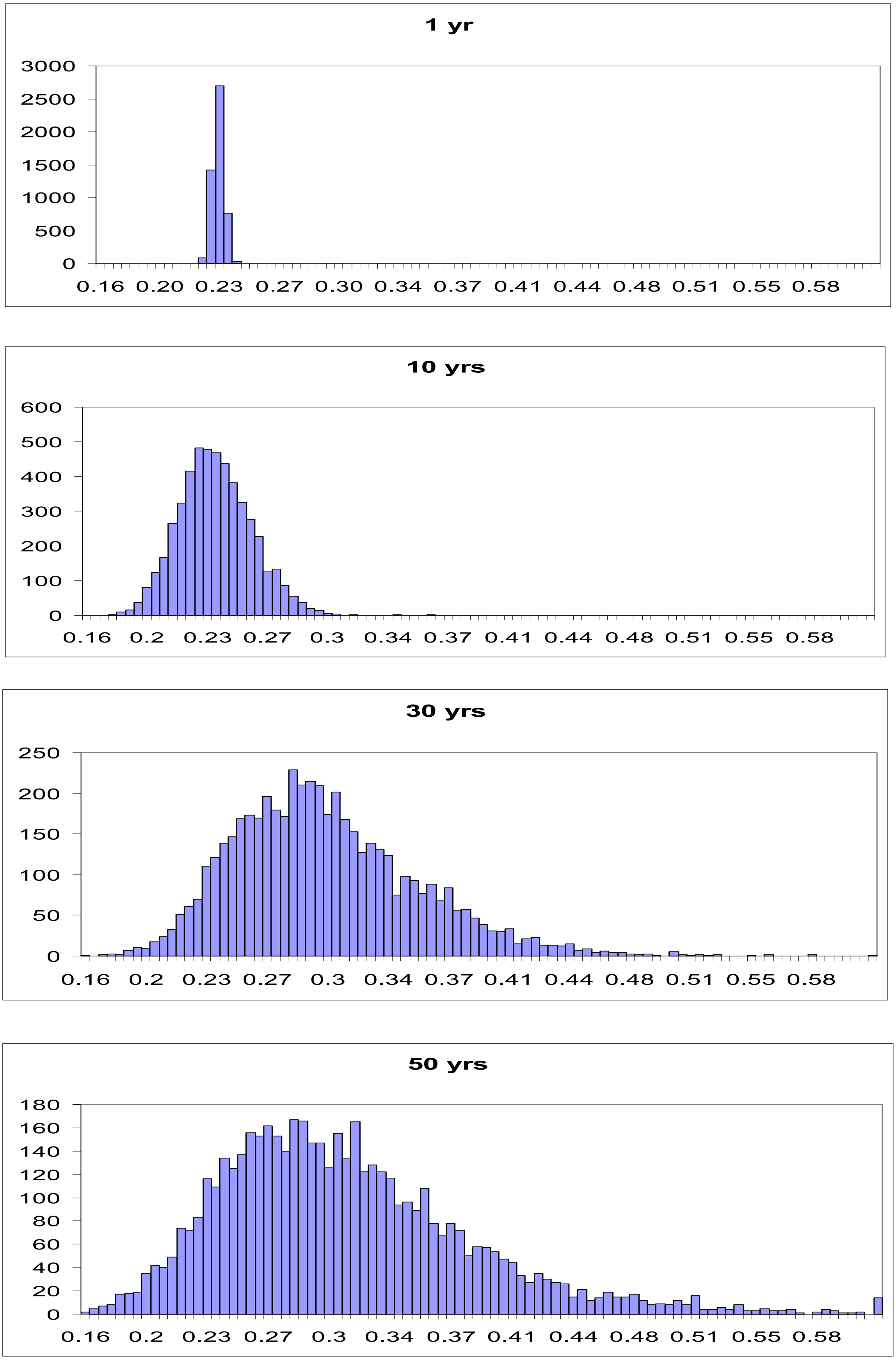
Female



Total



Appendix Figure 7 - Frequency distributions for projected total social expenditure as a share of GDP for 2002, 2011, 2031 and 2051



Appendix Tables

Appendix Table 1 - Basic Demographic Data by Age and Gender

	Male					Female						
Age	P	I	E	M	ΔM/M	P	I	E	M	ΔM/M	F	ΔF/F
0	28170	372	374	0.00656	-0.03801	26950	351	348	0.00489	-0.03778	0	0
1	29330	480	474	0.00060	-0.03894	27490	442	446	0.00051	-0.04061	0	0
2	28840	459	436	0.00047	-0.02785	27120	439	424	0.00028	-0.04164	0	0
3	29470	465	429	0.00031	-0.03295	28000	443	405	0.00023	-0.03371	0	0
4	29140	467	407	0.00025	-0.03478	27880	442	392	0.00018	-0.03290	0	0
5	29500	441	406	0.00019	-0.03838	27690	428	394	0.00017	-0.03052	0	0
6	30080	440	407	0.00018	-0.03694	28360	412	374	0.00014	-0.03299	0	0
7	30260	443	391	0.00017	-0.03532	28440	403	361	0.00012	-0.03551	0	0
8	31100	438	401	0.00016	-0.03435	29000	389	357	0.00012	-0.03374	0	0
9	31570	403	372	0.00016	-0.03197	29490	390	352	0.00012	-0.03193	0	0
10	32250	403	346	0.00019	-0.02455	30470	377	335	0.00012	-0.03139	0	0
11	31110	413	338	0.00021	-0.02062	30160	353	312	0.00014	-0.02615	0	0
12	30300	385	323	0.00027	-0.01572	28860	355	294	0.00016	-0.02381	0	0
13	29690	379	290	0.00033	-0.01499	28010	358	296	0.00021	-0.01757	0	0
14	28900	399	298	0.00044	-0.01274	26740	383	283	0.00028	-0.01315	0.00097	-0.00910
15	28290	484	297	0.00053	-0.01551	27150	457	296	0.00039	-0.00718	0.00445	-0.00835
16	28290	591	361	0.00072	-0.01836	26920	664	385	0.00048	-0.00588	0.01386	-0.01067
17	28450	657	501	0.00091	-0.01991	26900	700	631	0.00054	-0.00512	0.02781	-0.01093
18	28410	802	676	0.00109	-0.01809	26640	767	779	0.00056	-0.00610	0.04518	-0.00491
19	28450	721	695	0.00123	-0.01505	26380	635	699	0.00054	-0.00804	0.05647	-0.00744
20	28580	585	748	0.00120	-0.01342	26660	673	798	0.00042	-0.01340	0.06242	-0.01396
21	27450	624	1167	0.00124	-0.00948	25820	722	1256	0.00039	-0.01417	0.06776	-0.02024
22	26250	741	1397	0.00123	-0.00656	25250	852	1563	0.00037	-0.01463	0.07341	-0.02502
23	24880	859	1592	0.00123	-0.00349	23830	999	1711	0.00036	-0.01395	0.07821	-0.03005
24	24830	990	1668	0.00121	-0.00159	24300	1157	1697	0.00036	-0.01327	0.08741	-0.02877
25	24100	1080	1668	0.00142	0.00303	23910	1307	1621	0.00042	-0.01063	0.09766	-0.02587
26	24210	1153	1540	0.00138	0.00297	24830	1411	1419	0.00043	-0.01157	0.10616	-0.02282
27	24610	1156	1454	0.00135	0.00246	26020	1384	1271	0.00044	-0.01196	0.11689	-0.01578
28	25140	1137	1034	0.00131	0.00139	26750	1268	936	0.00046	-0.01314	0.12583	-0.00764
29	26210	1059	956	0.00128	0.00005	28820	1138	864	0.00048	-0.01415	0.13345	0.00124
30	27090	984	846	0.00129	-0.00098	29920	1088	775	0.00055	-0.01344	0.13821	0.01195
31	27220	790	759	0.00127	-0.00250	29450	788	706	0.00057	-0.01500	0.13595	0.02066
32	27590	700	694	0.00126	-0.00426	29780	703	617	0.00060	-0.01591	0.13015	0.03011
33	27100	703	646	0.00125	-0.00653	29830	665	576	0.00063	-0.01588	0.11799	0.03657
34	27010	682	646	0.00125	-0.00901	29670	644	578	0.00066	-0.01684	0.10470	0.04449
35	27370	682	592	0.00136	-0.00978	29310	623	536	0.00067	-0.01854	0.09075	0.05034
36	28230	610	592	0.00137	-0.01248	29840	577	494	0.00070	-0.02011	0.07326	0.05472
37	29750	556	540	0.00140	-0.01504	31330	548	488	0.00075	-0.02201	0.05617	0.05716
38	30240	521	498	0.00144	-0.01748	32050	507	452	0.00080	-0.02364	0.04206	0.05563
39	30390	520	479	0.00150	-0.01961	32460	460	423	0.00085	-0.02558	0.03138	0.05821
40	29940	516	427	0.00164	-0.02051	31730	435	363	0.00111	-0.02269	0.02113	0.05722
41	29510	431	393	0.00176	-0.02143	30570	391	373	0.00119	-0.02399	0.01323	0.05383
42	29110	396	369	0.00188	-0.02271	30300	535	321	0.00129	-0.02539	0.00787	0.04166
43	27780	388	343	0.00202	-0.02400	28750	505	307	0.00144	-0.02532	0.00456	0.04380
44	27640	381	328	0.00217	-0.02529	28460	462	284	0.00164	-0.02446	0.00222	0.03008
45	27100	349	311	0.00215	-0.02790	27900	425	284	0.00148	-0.02792	0.00116	0.03402
46	26300	296	282	0.00240	-0.02760	27130	400	261	0.00168	-0.02628	0.00048	0.00922
47	25810	284	259	0.00271	-0.02698	26540	354	249	0.00189	-0.02461	0	-0.04702
48	25050	272	267	0.00308	-0.02593	25430	231	248	0.00212	-0.02279	0	-0.04869
49	24750	256	251	0.00349	-0.02504	25140	201	241	0.00236	-0.02120	0	0
50	24610	239	245	0.00347	-0.02696	24530	203	222	0.00258	-0.02001	0	0
51	24550	195	232	0.00387	-0.02658	24600	182	214	0.00284	-0.01900	0	0
52	24390	197	211	0.00431	-0.02651	24050	179	195	0.00311	-0.01839	0	0
53	24230	171	185	0.00475	-0.02685	24370	168	169	0.00338	-0.01840	0	0
54	24290	155	170	0.00520	-0.02737	24250	154	152	0.00368	-0.01850	0	0
55	20420	159	155	0.00623	-0.02597	20530	145	141	0.00440	-0.01675	0	0
56	19370	135	137	0.00684	-0.02620	19510	145	131	0.00478	-0.01671	0	0
57	18530	140	121	0.00755	-0.02629	18460	136	125	0.00520	-0.01671	0	0
58	16740	139	126	0.00839	-0.02600	16830	135	112	0.00567	-0.01658	0	0
59	18320	120	109	0.00938	-0.02551	18610	119	103	0.00619	-0.01653	0	0
60	17950	125	99	0.01005	-0.02592	18320	130	98	0.00684	-0.01641	0	0
61	16700	113	92	0.01122	-0.02546	16930	103	92	0.00748	-0.01669	0	0

	Male					Female						
Age	P	I	E	M	∆M/M	P	I	E	M	∆M/M	F	∆F/F
62	15000	117	72	0.01251	-0.02496	15600	104	84	0.00818	-0.01681	0	0
63	14470	101	59	0.01388	-0.02456	14760	93	78	0.00895	-0.01694	0	0
64	13800	91	61	0.01535	-0.02414	14510	89	65	0.00981	-0.01708	0	0
65	13170	84	86	0.01667	-0.02406	13730	81	75	0.01045	-0.01764	0	0
66	12850	80	73	0.01828	-0.02369	13050	75	68	0.01146	-0.01755	0	0
67	12440	72	66	0.02001	-0.02325	12940	63	57	0.01258	-0.01750	0	0
68	12230	55	57	0.02190	-0.02278	13130	58	59	0.01380	-0.01751	0	0
69	12240	60	57	0.02400	-0.02233	12790	51	60	0.01514	-0.01767	0	0
70	12500	44	50	0.02578	-0.02246	13220	51	47	0.01600	-0.01877	0	0
71	11830	49	48	0.02834	-0.02226	12980	43	49	0.01753	-0.01934	0	0
72	11430	36	48	0.03122	-0.02215	12540	44	40	0.01917	-0.02009	0	0
73	11110	37	36	0.03444	-0.02204	12370	36	42	0.02096	-0.02089	0	0
74	10490	31	30	0.03805	-0.02178	11830	32	38	0.02291	-0.02157	0	0
75	9790	25	29	0.04108	-0.02174	11700	31	30	0.02458	-0.02257	0	0
76	9280	24	29	0.04541	-0.02094	11710	26	32	0.02733	-0.02224	0	0
77	8190	27	25	0.05016	-0.01989	10800	31	31	0.03063	-0.02108	0	0
78	7560	15	15	0.05537	-0.01867	10370	19	26	0.03445	-0.02032	0	0
79	7000	13	15	0.06105	-0.01748	10200	19	23	0.03881	-0.01963	0	0
80	6220	9	11	0.06249	-0.01801	9500	15	18	0.04071	-0.02014	0	0
81	5510	8	13	0.06867	-0.01739	9000	15	18	0.04573	-0.01964	0	0
82	4340	9	7	0.07531	-0.01724	7140	12	13	0.05124	-0.01986	0	0
83	3720	6	7	0.08239	-0.01748	6840	10	10	0.05731	-0.02001	0	0
84	3560	4	6	0.08996	-0.01801	6670	10	10	0.06402	-0.02005	0	0
85	3110	4	5	0.09105	-0.02009	5840	7	9	0.06730	-0.02106	0	0
86	2650	2	4	0.09910	-0.02042	5450	5	9	0.07505	-0.02119	0	0
87	2290	2	3	0.10767	-0.01995	4600	6	7	0.08363	-0.02069	0	0
88	1800	1	3	0.11692	-0.01914	4040	3	5	0.09309	-0.01946	0	0
89	1450	2	2	0.12698	-0.01830	3430	4	3	0.10367	-0.01836	0	0
90	1090	1	2	0.16716	-0.01358	2600	1	3	0.16061	-0.01052	0	0
91	790	0	0	0.18191	-0.01299	2310	1	2	0.17861	-0.00984	0	0
92	580	0	1	0.19825	-0.01251	1760	1	1	0.19830	-0.00971	0	0
93	440	1	0	0.21634	-0.01215	1260	1	2	0.21967	-0.00971	0	0
94	310	0	0	0.23634	-0.01177	930	0	0	0.24281	-0.00977	0	0
95	210	0	0	0.31054	-0.00962	800	0	0	0.26065	-0.01260	0	0
96	120	0	0	0.33963	-0.00963	510	1	1	0.28688	-0.01304	0	0
97	80	0	0	0.37156	-0.00973	340	0	0	0.31505	-0.01351	0	0
98	60	1	0	0.40649	-0.00991	230	1	0	0.34524	-0.01391	0	0
99	30	2	1	0.44469	-0.01007	160	2	1	0.37804	-0.01425	0	0

Notes: P = population
I = immigration
E = emigration
M = mortality
∆M/M = proportionate change in mortality
F = fertility
∆F/F = proportionate change in fertility

Appendix Table 2 - Standard Deviations for Mortality, Fertility and Migration

Age	Male Mortality	Female Mortality	Fertility	Migration In	Migration Out
0	0.12725	0.14315	0	34.3	70.5
1	0.12511	0.14026	0	68.3	78.6
2	0.12300	0.13742	0	68.3	79.6
3	0.12093	0.13462	0	71.5	72.9
4	0.11891	0.13187	0	60.1	65.1
5	0.11691	0.12917	0	59.9	94.3
6	0.11496	0.12651	0	66.4	62.1
7	0.11304	0.12390	0	64.7	74.6
8	0.11117	0.12134	0	83.1	57.4
9	0.10933	0.11883	0	81.5	59.6
10	0.10753	0.11636	0	80.1	76.8
11	0.10576	0.11394	0.41241	73.0	75.5
12	0.10404	0.11157	0.55669	69.9	75.0
13	0.10235	0.10924	0.33930	50.9	73.3
14	0.10070	0.10696	0.21066	57.1	74.9
15	0.09909	0.10473	0.11256	45.6	84.0
16	0.09751	0.10255	0.08959	41.6	101.3
17	0.09598	0.10041	0.06755	83.8	161.2
18	0.09448	0.09832	0.06621	111.9	232.8
19	0.09302	0.09627	0.06120	82.4	176.5
20	0.09160	0.09428	0.05768	80.8	121.6
21	0.09022	0.09233	0.04739	97.1	117.0
22	0.08887	0.09043	0.04749	125.6	123.2
23	0.08756	0.08857	0.04713	107.7	110.2
24	0.08629	0.08677	0.03717	103.3	114.6
25	0.08506	0.08501	0.04333	134.9	149.1
26	0.08387	0.08329	0.04706	163.1	173.1
27	0.08271	0.08163	0.05235	231.4	159.7
28	0.08159	0.08001	0.06824	155.1	117.5
29	0.08051	0.07844	0.06368	159.4	119.5
30	0.07947	0.07691	0.07541	148.4	129.8
31	0.07847	0.07544	0.06546	127.6	120.7
32	0.07750	0.07401	0.07037	124.2	136.7
33	0.07657	0.07262	0.07913	89.5	163.1
34	0.07568	0.07129	0.07475	99.9	138.5
35	0.07483	0.07000	0.07723	85.3	111.2
36	0.07402	0.06876	0.07014	109.8	66.3
37	0.07324	0.06756	0.07773	111.6	71.3
38	0.07250	0.06642	0.09348	117.7	87.3
39	0.07180	0.06532	0.09658	113.1	80.3
40	0.07114	0.06427	0.09149	100.9	104.4
41	0.07052	0.06326	0.13267	82.9	75.1
42	0.06993	0.06230	0.13869	83.4	123.9
43	0.06938	0.06139	0.20812	69.5	116.4
44	0.06887	0.06053	0.22994	63.7	114.5
45	0.06840	0.05971	0.29663	65.0	99.4
46	0.06796	0.05894	0.33242	49.5	109.6
47	0.06757	0.05822	0.60132	46.2	92.8
48	0.06721	0.05754	0.51908	45.8	49.6
49	0.06689	0.05691	0.42038	39.6	52.9
50	0.06661	0.05633	0.99268	44.2	35.5
51	0.06636	0.05580	0	47.3	11.2
52	0.06616	0.05531	0	40.9	20.2
53	0.06599	0.05487	0	48.1	16.7
54	0.06586	0.05448	0	32.8	17.8
55	0.06577	0.05413	0	25.3	18.1
56	0.06571	0.05384	0	20.8	10.8
57	0.06569	0.05358	0	13.4	14.4
58	0.06572	0.05338	0	17.2	10.6
59	0.06578	0.05322	0	18.2	13.1
60	0.06587	0.05311	0	13.0	12.8
61	0.06601	0.05305	0	12.7	19.4
62	0.06618	0.05304	0	11.5	16.7
63	0.06639	0.05307	0	14.7	11.2
64	0.06664	0.05315	0	8.7	13.3
65	0.06693	0.05327	0	13.0	9.3
66	0.06726	0.05345	0	10.3	4.7
67	0.06762	0.05367	0	9.7	9.4
68	0.06802	0.05393	0	9.7	7.2
69	0.06846	0.05425	0	8.5	11.0
70	0.06894	0.05461	0	5.6	8.2
71	0.06945	0.05502	0	7.2	4.1
72	0.07001	0.05548	0	7.1	6.3
73	0.07060	0.05598	0	7.2	5.5
74	0.07123	0.05653	0	6.7	5.6
75	0.07189	0.05713	0	7.3	5.2
76	0.07260	0.05777	0	5.2	5.6
77	0.07334	0.05847	0	18.4	13.5
78	0.07412	0.05921	0	7.5	5.7
79	0.07494	0.05999	0	6.0	6.9
80	0.07580	0.06083	0	6.6	4.9
81	0.07669	0.06171	0	6.0	4.6
82	0.07763	0.06263	0	4.3	4.1
83	0.07860	0.06361	0	3.5	3.5
84	0.07961	0.06463	0	3.2	5.0
85	0.08066	0.06570	0	4.3	2.2
86	0.08174	0.06682	0	3.3	2.0
87	0.08286	0.06798	0	3.7	2.2
88	0.08402	0.06919	0	1.8	1.5
89	0.08522	0.07045	0	2.1	1.4
90	0.08646	0.07175	0	1.4	0.8
91	0.08773	0.07311	0	1.2	0.7
92	0.08905	0.07451	0	0.7	0.5
93	0.09040	0.07595	0	1.3	0.7
94	0.09179	0.07745	0	0.4	0.5
95	0.09321	0.07899	0	0.5	0.5
96	0.09468	0.08057	0	0.5	0.5
97	0.09618	0.08221	0	0.4	0.4
98	0.09772	0.08389	0	0.4	1.5
99	0.09930	0.08562	0	0.7	2.0

Notes: In = immigration
Out = emigration

Appendix Table 3 - Means and Standard Deviations of Unemployment and Labour Force Participation Rates

	Unemployment Rates (%)				Labour Force Participation Rates (%)			
	Male		Female		Male		Female	
Age Categories	Mean	SD	Mean	SD	Mean	SD	Mean	SD
0	0	0	0	0	0	0	0	0
1-4	0	0	0	0	0	0	0	0
5-9	0	0	0	0	0	0	0	0
10-14	0	0	0	0	0	0	0	0
15-19	17.3	3.5	15.8	3.2	53.6	5.4	52.9	5.7
20-24	10.7	3.9	8.6	2.5	78.9	1.3	66.8	2.8
25-29	5.5	2.6	5.1	2.0	90.4	0.5	69.8	2.0
30-34	4.3	2.3	6.0	1.5	91.5	0.7	65.9	1.4
35-39	4.1	1.9	4.8	1.3	91.8	0.7	71.7	1.5
40-44	4.3	1.5	4.0	1.2	91.5	0.6	80.0	1.7
45-49	3.6	1.4	3.0	0.9	91.8	0.5	82.3	1.0
50-54	3.6	1.8	3.8	1.4	91.1	1.2	74.3	2.9
55-59	5.3	1.9	3.0	1.1	82.6	2.6	60.4	3.5
60-64	5.3	1.1	0(a)	0.6	61.5	13.7	35.9	16.4
65-69	0(a)	0.8	0(a)	0.5	11.9	16.5	4.5	17.2
70-74		0	0	0	0	0	0	0
75-79		0	0	0	0	0	0	0
80-84		0	0	0	0	0	0	0
85+		0	0	0	0	0	0	0

Note: (a) No data are available for these values. They were assumed to be zero.

Sources: The unemployment rates are those for the base year 2001. The standard deviations are computed from annual data from 1987-2002 using INFOS Series HLFA.SAF1AA to HLFA.SAF1AK (male) and Series HLFA.SAF2AA to HLFA.SAF2AK (females). The labour force participation rates are those for the base year 2001. The standard deviations are the standard errors from the regressions of participation rates on time, using time series data from 1987-2002, and using INFOS Series HLFA.SAE1AA to HLFA.SAE1AK (male) and Series HLFA.SAE2AA to HLFA.SAE2AK (females). The data from INFOS for the oldest age category is for 65+; it was assumed that this applied to the group aged 65-69.

Appendix Table 4 - Social Expenditures per capita: Males

Age group	Age-related health	Medical/ surgical	Mental health	Pregnancy/ Childbirth	Primary diagnostics	Primary general	Public health	Education	NZS	DPB	Sickness benefit	Invalid's benefit	Other benefits	Unemployment benefits[a]
0	175	2,748	32	0	438	714	107	166	0	0	0	0	0	0
1-4	111	284	20	0	295	363	84	1,087	0	0	0	0	0	0
5-9	151	192	27	0	190	150	28	3,707	0	0	0	0	0	0
10-14	150	191	27	0	189	149	28	4,104	0	0	0	0	0	0
15-19	192	275	187	0	111	67	17	3,984	0	0	15	47	524	541
20-24	235	337	228	0	136	82	21	2,586	0	0	224	74	991	2,110
25-29	266	494	259	0	92	51	12	734	0	0	351	271	1,316	1,014
30-34	238	442	232	0	82	45	11	777	0	0	190	195	1,891	1,328
35-39	221	410	215	0	76	42	10	569	0	0	199	310	1,807	1,005
40-44	219	405	213	0	75	42	10	340	0	0	87	285	1,465	871
45-49	142	692	138	0	149	51	5	241	0	0	101	630	693	355
50-54	161	786	156	0	170	58	6	73	0	0	217	342	477	517
55-59	186	911	181	0	197	67	6	80	29	0	422	741	506	1,315
60-64	244	1,191	237	0	257	88	8	15	237	0	356	1,057	789	1,983
65-69	168	2,200	19	0	570	145	8	8	10,963	0	0	0	435	0
70-74	215	2,822	25	0	731	186	10	27	11,132	0	0	0	527	0
75-79	3,464	2,170	12	0	229	78	4	0	10,968	0	0	0	576	0
80-84	4,283	2,684	15	0	283	97	5	0	10,523	0	0	0	626	0
85+	6,084	4,061	22	0	367	117	21	0	10,611	0	0	0	134	0

Note: [a] Unemployment expenditure per recipient

DPB = Domestic Purpose Benefit

NZS = New Zealand Superannuation

Appendix Table 5 - Social Expenditure per capita: Females

Age group	Age-related health	Medical/ surgical	Mental health	Pregnancy/ childbirth	Primary diagnostics	Primary general	Public health	Education	NZS	DPB	Sickness benefit	Invalid's benefit	Other benefits	Unemployment benefits[a]
0	176	2,205	32	0	414	627	113	166	0	0	0	0	0	0
1-4	97	203	7	0	248	300	65	1,087	0	0	0	0	0	0
5-9	132	129	24	9	178	134	44	3,707	0	0	0	0	0	0
10-14	133	130	24	9	180	136	45	4,104	0	0	0	0	0	0
15-19	109	368	106	470	167	87	16	3,984	0	353	40	47	524	562
20-24	139	471	135	600	213	111	21	2,586	0	1,419	295	74	991	1,667
25-29	184	797	179	449	220	102	13	734	0	2,323	289	271	1,316	577
30-34	180	779	175	439	215	100	13	777	0	2,832	131	195	1,891	788
35-39	149	644	145	363	178	82	11	569	0	3,218	157	310	1,807	676
40-44	129	560	126	315	154	72	9	340	0	2,298	69	285	1,465	671
45-49	140	630	137	9	285	120	14	241	26	1,049	110	630	693	322
50-54	148	663	144	9	300	126	15	73	119	322	229	342	477	478
55-59	166	747	162	10	338	142	17	80	445	504	406	741	506	1,181
60-64	192	859	186	12	389	163	19	15	1,969	424	334	1,057	4,789	1,804
65-69	166	1,649	19	0	631	234	8	8	11,021	0	0	0	435	0
70-74	212	2,105	24	0	806	299	10	27	11,043	0	0	0	527	0
75-79	3,510	1,405	13	0	442	136	7	0	10,884	0	0	0	576	0
80-84	4,885	1,956	18	0	615	189	10	0	11,018	0	0	0	626	0
85+	7,423	3,926	27	0	505	175	11	0	11,458	0	0	0	134	0

Note: [a] Unemployment expenditure per recipient

DPB = Domestic Purposes Benefit

NZS = New Zealand Superannuation

Appendix Table 6 - Projected social expenditures by category ($millions) with benchmark growth rates

Category		2021				2051			
		Male		Female		Male		Female	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Health	1. Age Related	1,473	257	1,815	317	3,635	1,034	5,057	1,438
	2. Medical/Surgical	2,636	460	2,614	456	5,143	1,463	5,271	1,500
	3. Mental Health	405	71	307	54	664	195	497	146
	4. Pregnancy/Childbirth	0	0	504	87	0	0	807	234
	5. Primary Diagnostics	631	111	945	167	1,114	318	1,721	492
	6. Primary General	319	56	452	79	544	155	791	225
	7. Public Health	53	9	64	11	88	25	106	30
8. Education		3483.6	3,484	1,129	3,339	1,083	5,672	3,033	5,431
9. NZ Superannuation		5451.76	5,452	1,883	6,772	2,339	11,799	6,690	15,458
Welfare	10. DPB	0	0	2,754	791	0	0	4,460	2,135
	11. Sickness Benefit	402	113	397	111	659	314	632	302
	12. Invalid's Benefit	711	205	754	218	1,176	547	1,200	558
	13. Other Benefits	2,177	625	2,230	640	3,651	1,738	3,743	1,782
	14. Unemployment Benefit	2,068	463	1,319	278	3,372	1,073	2,110	656
Total Social Expenditure		19,811	2,393	24,266	2,814	37,516	7,817	47,285	9,881
Total as share of GDP		0.12		0.14		0.14		0.17	

Appendix Table 7 - Projected social expenditures by category ($millions) with historical growth rates

Category		2021				2051			
		Male		Female		Male		Female	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Health	1. Age Related	1,975	340	2,433	419	7,745	2,168	10,775	3,015
	2. Medical/Surgical	3,535	607	3,505	602	10,957	3,068	11,229	3,144
	3. Mental Health	543	94	412	71	1,413	409	1,058	306
	4. Pregnancy/Childbirth	0	0	675	115	0	0	1,719	490
	5. Primary Diagnostics	846	147	1,267	220	2,373	667	3,667	1,030
	6. Primary General	428	74	607	105	1,159	325	1,685	473
	7. Public Health	71	12	86	15	188	52	226	63
8. Education		4,968	1,579	4,762	1,514	14,165	7,418	13,564	7,106
9. NZ Superannuation		6,283	2,153	7,805	2,674	17,013	9,564	22,289	12,529
Welfare	10. DPB	0	0	3,432	973	0	0	7,869	3,719
	11. Sickness Benefit	501	139	494	137	1,163	548	1,115	525
	12. Invalid's Benefit	886	253	940	268	2,075	953	2,118	972
	13. Other Benefits	2,713	769	2,779	788	6,441	3,028	6,605	3,104
	14. Unemployment Benefit	1,904	427	1,214	257	2,726	871	1,706	532
Total Social Expenditure		24,653	2,906	30,412	3,382	67,417	13,029	85,624	15,819
Total as share of GDP		0.14		0.18		0.24		0.31	

Appendix Table 8 - Projected health costs with higher growth rates for the elderly

	2002				2021				2051			
	Male		Female		Male		Female		Male		Female	
Health Categories	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
1. Age Related	707	0	932	2	1,837	314	2,312	394	6,861	1,910	9,922	2,762
2. Medical/Surgical	1,396	0	1,483	0	3,208	553	3,153	543	9,010	2,532	9,172	2,579
3. Mental Health	272	0	203	0	449	77	341	59	866	247	658	188
4. Pregnancy/Childbirth	0	0	372	0	0	0	554	96	0	0	1,030	290
5. Primary Diagnostics	365	0	552	1	750	129	1,118	193	1,801	494	2,792	765
6. Primary General	209	0	281	1	373	64	531	91	829	234	1,238	349
7. Public Health	37	0	44	0	59	10	72	13	125	36	149	43
Total	2,986		3,868		6,676		8,081		19,491		24,961	
Share of GDP	0.03		0.03		0.04		0.05		0.07		0.09	

Note: Based on assuming that health expenditures for those aged 0-64 and 65+ grow at 2% and 3% pa respectively, and the correlation across age groups is unitary.