The Economic Implications of Demographic Change

A Report Commissioned by the Department of Social and Family Affairs

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Goodbody Economic Consultants
Ballsbridge Park, Ballsbridge, Dublin 4
• Tel: 353-1-6410482 • Fax: 353-1-6682388
www.goodbody.ie/consultants/ • e-mail – econsultants@goodbody.ie

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Executive Summary

The purpose of this report is to improve the understanding of the long term demographic and economic consequences of an ageing Irish population. In particular, it is to provide an understanding of how the sustainability of the state pension system will be affected by an ageing society. By creating a model of demographic and economic change and investigating the consequences of adjusting key variables, it provides insights into how the sustainability of pensions might change under a variety of circumstances and what policy steps might be effective in addressing difficulties.

This report considers previous research on the economic consequences of demographic ageing and possible policy responses. A cohort population model is used to project the Irish population, categorised by age and sex, in five year intervals between 2002 and 2052. The results of the population projection are combined with assumptions regarding participation, employment rates and productivity to project a range of variables including output growth. In addition, a range of dependency measures are derived, indicating the likely ratios of those in employment to dependants. The projection exercise is complemented by the testing of a range of alternative assumption scenarios, which indicate the relative sensitivity of the projections to the relevant variables.

Demographic Projections

The central projections indicate that Ireland's population will reach 5 million by 2017 and exceed 6 million by 2042. Population growth is expected to moderate over the projection period, slowing significantly after 2022. Average annual population growth over the period is projected to be 1.0 per cent.

Currently, the majority of the population are of working age and there are relatively few people aged 65 or older. By 2037 the most populous age groups will be those in their 50s and the number over 65 will be dramatically higher compared to 2002. By 2052 there will be significant numbers of those in the oldest age groups of 80-84 and 85+.

The population projections contain some lumpiness. By 2052 there will be population bulges at three distinct age groups, the oldest bulge being the cohort of people born during the Irish baby boom of the 1970s and early 80s and subsequent population bulges where 'echoes' of that baby boom occur.

The effects of population bulges are significant, as large cohorts arrive at particular life stages at once. Consequently, the increase in the number of people of pensionsable age will occur in an uneven fashion.

Economic Projections

Annual output growth is predicted to decrease from above 5 per cent per annum initially to just over 2.7 per cent by 2052. Growth in output per capita is projected to fall from 3 per cent per annum to close to 2 per cent over the projection period.

As the demographic burden increases over the period, output growth moderates too. However, the reduction in output growth will not be particularly severe, and the significant rates of growth still occurring will help society meet the needs of an ageing population.

The output growth projections are heavily dependent on the rate of productivity growth. A failure of the Irish economy to achieve strong rates of productivity growth will result in lower output growth. The need to achieve sustained increases in productivity will become increasingly important, as the demographic projections show that employment growth will cease to be a significant contributor to output growth towards the end of the projection period.

Annual employment growth will moderate from near 2 per cent to very low levels towards the end of the projection period, and is actually projected to be negative in the final two projection periods.

Trends in Support Ratios

The nominal Pensioner Support Ratio (PSR) is projected to fall from around 6.3 in 2007 to approximately 2.3 by 2052. The change in the PSR is projected to occur relatively evenly over the period.

The 80+ PSR falls over the projection period too, but its path is less even. The drop in the 80+ PSR is not pronounced initially, but by the middle of the projection period the reduction in the 80+ PSR becomes more significant.

The real PSR is the ratio of people in employment to those over the age of 65. It is termed the real PSR as it more accurately reflects the level of economic dependence by adjusting the working age population to account for participation and unemployment rates. The real PSR is considered more representative, as changes to the level of employment may have significant contributing or countervailing effects on the actual level of dependency.

The real PSR is predicted to fall from 4.2 currently to 1.5 by 2052. The real PSR will not decline to 1991 levels until the 2022-2027 period. This means that the increasing burden, while significant, will be within the range of recent experience for approximately another 20 years. Moreover, the total support ratio will not fall to 1991 levels until 2042. This analysis serves as a reminder that the future change in the demographic structure should not be regarded as having catastrophic economic impacts even in the medium to long term.

Sensitivity of PSRs to Demographic Factors

The central assumption scenario assumes that the Total Fertility Rate will drop from 1.98 in 2002 to 1.85 by 2011. An alternative higher fertility scenario assumes the TFR will increase to 2.2 by 2017 and remain constant for the remainder of the projection period. A lower fertility scenario assumes a drop in the TFR to 1.5 by 2017.

Different fertility assumptions have no discernable effects on the real PSR until 2032. This lag exists between the change in fertility rates and the effect on the PSR because it takes many years for a change in the number of births to begin to have an effect on the labour market.

Increasing the fertility rate to 2.2 does not produce a pronounced increase in the real PSR by 2052. It is clear that an increase in fertility rates to above the 2.1 replacement ratio will not be sufficient to restrain the real PSR from falling to low levels.

Initially, any increase in the population due to higher fertility will act as a drag on output per capita growth. Increased fertility moderates the growth in output per capita initially, eroding the overall capacity to pay for old age dependants in the short run as childhood dependency increases. However, as the increased numbers of children grow up and enter the workforce, they then act to boost output per capita growth.

High net migration can raise the real PSR somewhat, however it cannot reverse the underlying downward trend. While migrants swell the working age population, these workers will themselves inevitably age too. Migrant inflows may be useful in moderating imbalances between those of working age and those above, but very high sustained net migration would be required to reverse the underlying trend of falling PSRs.

Increased female participation will bring about a marginal increase in the real PSR. The effects of increased participation are transitory and can only be achieved once.

One of the most commonly suggested and widely expected policy responses to the issue of demographic ageing is an increase in the retirement age. If the retirement age were to be increased progressively to 68 years by 2032, the real PSR would rise from 1.5 to 1.9 at the year 2052. This has the largest impact on the real PSR of any of the demographic scenarios considered. Generally, output growth rates are greater the higher the retirement age. Increased retirement ages increase the capacity to support the ageing population.

Sensitivity of PSRs to Economic Factors

The central assumption assumes that unemployment will gradually increase from low levels in 2002, resulting in an average rate of 6 per cent for the whole period. An alternative assumption of high unemployment assumes that joblessness will increase rapidly over the first 20 years of the projection period, leading to an average rate of 10 per cent over the projection period. An additional assumption of reduced net migration was required in the case of high unemployment, as it would be inconsistent to assume sustained net migration with poor employment prospects.

The comparatively high rate of unemployment of 10 per cent coupled with reduced net migration induces a significant reduction in the real PSR.

The central projection assumes labour productivity growth of 2.8 per cent per annum. An alternative lower productivity growth figure of 1.8 per cent was assumed. In the absence of any assumptions regarding any direct links between productivity growth and population or participation, the real PSR does not vary with reduced productivity growth.

A reduction in productivity growth by one percentage point would have a significant impact on per capita output growth, reducing it by approximately one per cent in each period. This demonstrates the importance of productivity growth in enhancing the capacity of the economy to accommodate high PSRs.

A set of projections based on unfavourable migration, employment and productivity assumptions was made to provide a counterpoint to the central assumption scenario. The difference in the real PSR between the central and unfavourable scenario is not pronounced over the first two decades of the projection period. However, the difference becomes significant in the last two decades of the projection. The projected real PSR of 1.2 by 2052 is at the lowest level of any of the projections.

1. Introduction

State pension systems are typically financed on a 'pay as you go' basis. This means that the current cohort of pensioners receive state pensions financed by the payroll tax contributions of the current cohort of workers. Pay as you go differs from systems in which each cohort saves for its own retirement, as is the case in private pension schemes.

To date, pay as you go systems have been sustainable. High fertility rates in the past resulted in employment growth that ensured there was a large number in the working age cohort relative to those receiving pensions. However, as a result of declining fertility rates, the rate of natural increase has fallen in many developed economies, even becoming negative in certain countries. A consequence of falling fertility is a reduction in the growth of the working age population. As a result, those set to retire in the future will not have the benefit of such a proportionately large pool of working age people to support their pensions as today's pensioners do.

In addition to falling fertility, human longevity continues to increase. Increases in life expectancy mean that pensioners now live longer, requiring pension support for longer too. This exacerbates the financial sustainability problems that pay as you go systems will face.

The objective of this report is to improve the understanding of the long term demographic and economic consequences of an ageing Irish population. In particular, it is to provide an understanding of how the sustainability of the state pension system will be affected by an ageing society. By creating a model of demographic and economic change and investigating the consequences of adjusting key variables, it provides insights into how the sustainability of pensions might change under a variety of circumstances and what policy steps might be effective in addressing difficulties.

An important innovation of this report is the use of a measure of dependency that captures not only demographic but also economic factors to present a more representative metric of the impact of changing population structures on pension sustainability. This measure, termed the real pensioner support ratio, is explained in Section 3.5.

In light of impending difficulties for pay as you go systems there has been widespread debate on how pension systems should be reformed to ensure sustainability. This report does not directly address the policy questions of how pension benefits should be financed or structured. Rather, it addresses the underlying demographics and broad economic consequences of an ageing Irish population. The information contained in this report will be of direct use when considering the policy questions surrounding pay as you go schemes identified above.

The CSO published Population and Labour Force Projections 2006-2036 in December 2004. The CSO document contains population projections under a range of fertility and migration scenarios until 2036 and labour force projections until 2016. These medium term projections provide an indication of support ratios in demographic terms. However, a more thorough analysis of population ageing requires both a longer projection horizon and consideration of support ratios in a broader context of employment conditions and economic growth.

This report presents projections over a longer time period and complements the demographic analysis with projections of possible employment levels and economic growth to 2052. By placing the demographic analysis in a broader context this report provides more meaningful measures of dependency.

Making projections over such a long time horizon is a tentative exercise and requires assumptions about many variables. Consequently, it is necessary to consider the potential outcomes under differing assumption scenarios. In addition, some variables may be influenced by policy choices, accordingly it is necessary to consider the likely consequences of alternative policy strategies.

Section 2 of this report contains a brief review of the literature concerning pensioner support ratios and the sustainability of public finances. Section 3 presents a central projection scenario for Ireland's population, employment levels and output growth and various measures of dependency and sustainability. The description of the central scenario is supported by a discussion of the assumptions used. Section 4 considers a number of alternative scenarios arising from differing assumptions and policy variables. Section 5 combines the analysis from the two previous sections in a discussion of the policy implications of demographic change. Section 6 contains a summary of the key findings and outlines further questions.

2. The Existing Literature

The contributions to the literature on the consequences of population ageing come from a variety of different perspectives. Some focus on demographic aspects of the issue and policies that might sustain higher support ratios, others address the possible impact on asset prices, and some discuss the likely labour market consequences. However, there is little work that provides a comprehensive review of the issue from its demographic origins to the totality of likely economic consequences.

Many commentators acknowledge the distinction between the increases in longevity of individuals and the broader demographic ageing of developed country populations chiefly caused by falling fertility rates, both of which contribute to the problem of falling support ratios. It is widely felt that these changes are the result of a permanent shift in population structures and future support ratios will be lower than they are today. One commentator notes that Pensioner Support Ratios of 2 to 3 will be common in the future, compared to current ratios typically in excess of 4 in developed countries (Coleman, 2002).[1]

The discussion of the policy options to sustain high PSRs primarily focuses on demographic variables such as fertility and migration. The general view is that even with favourable changes to demographic variables it will not be feasible to maintain current high PSRs. It has been noted that polices to increase fertility rates tend not to work (FitzGerald, 2004). The literature notes that a return of fertility levels to replacement rates will be insufficient to raise PSRs dramatically. One projection notes that an increase in fertility to the replacement rate in the UK would only yield a PSR of 2.75 by 2050 (Coleman, 2002). In addition, the very high fertility rates required to maintain high PSRs would bring their own significant demographic burdens in terms of child support ratios.

Comments on sustained migration as a mechanism to address PSRs are equally pessimistic. The OECD notes that to maintain the current demographic balance would require "enormous increases in net migration" (Cotis, 2005). Others comment that migration is not an ideal solution, as it has what is described as a low 'demographic advantage', meaning that the average age of migrants tends to only be marginally below those of the indigenous population.

The literature makes some comment regarding the measurement of support ratios. One paper notes that while the division of the population into the working age population and young and old dependants is objective, it inadequately appraises real dependency rates, due to actual participation rates of different age groups. For example, many young adults do not participate in

[1] The pensioner support ratio (PSR) is the ratio of people of working age (15-64) to those of retirement age and older (65+).

the labour force as they are engaged in education and older people may retire before they are entitled to a state pension. For instance, the actual average retirement age in the UK was quoted as 58, as opposed to the notional 65 used in projections (Coleman, 2002).

With regard to the economic consequences of ageing, the literature notes that pay as you go systems are likely to become unsustainable. One paper notes that the increases in income tax required to fund benefits would be so high that they would seriously discourage labour force participation, compounding the problem of falling support ratios (Weil, 2006).

The existing literature notes the possible shift in consumer demand as a result of population ageing, commenting that the balance of consumption will shift from goods to services. Such a change in the balance of consumer demand would result in further shifts in the sectoral balance of employment away from manufacturing towards services. The productivity implications of this demand and consequent employment shift are noted, principally that higher service consumption will lead to lower labour productivity growth for the economy, as service sector productivity growth tends to be weak (Oliveira Martins et al, 2005).

Much of the discussion about the economic impact of demographic ageing addresses the prospects for asset prices. There appears to be no firm conclusions in the literature regarding what the actual effect will be. Some commentators speculate that there could be a serious asset price crash as a result of significant cohorts cashing in assets for retirement simultaneously. Others speculate that an older population could result in a shortage of savings, possibly leading to inadequate capital investment and difficulties in maintaining capital to labour ratios. However, international capital flows are expected by some to have a stabilising influence on asset prices and capital to labour ratios (Carone et al, 2005).

Changes in longevity are also addressed in the literature. Contrary to previous assumptions, it seems that the increases to longevity are continuous rather than converging towards any finite threshold. This raises questions regarding the financing of care in advanced age. There is some literature that suggests that health care requirements increase not with age, but with proximity to death (Layte, 2006). This implies that increases in longevity do not imply ever increasing costs of elderly care provision. However, it appears research on this topic is still relatively new and firm conclusions have yet to be established.

3. The Central Demographic and Economic Projection

3.1 Introduction

A central scenario of demographic change, labour force participation and productivity growth was used to provide a basis around which to consider different outcomes. The assumptions used to construct the central scenario were largely based on those employed by the CSO. This provides a base for analysis that is broadly consistent with projections made by the CSO and other predictions based on the CSO work.

Initially, a demographic model is used to project Ireland's population structure at five year intervals until 2052. Assumptions regarding changes in labour force participation and unemployment rates are then used to derive likely employment levels from the population projections. Assumptions regarding the sectoral share of employment and productivity growth are then used to derive output growth.

This section first describes the demographic model used to project population. It goes on to describe the labour force, unemployment and productivity assumptions that are used to derive output projections.

3.2 The Demographic Model

A demographic model was constructed to project Irish population, split by sex and into five year age groups at five year intervals. The base population data used for the model is that supplied by the 2002 census. 2006 census data was not used as detailed demographic results are not yet available. In addition, the model requires assumptions regarding fertility and mortality. These supporting assumptions were taken from the CSO Population and Labour Force Projections 2006-2036 publication and other CSO statistical releases. Assumptions regarding the future migration flows are not those used by the CSO, but figures from the forthcoming Mercer report on the financial position of the Social Insurance Fund. Once the model was fully specified it was used to project population for 10 periods up until 2052.

The model essentially replicates the model used by the CSO for their population and labour force projections. When using a common set of assumptions to the CSO model, the model used here produces projections that are very similar, but not identical to the CSO results. On aggregate the population results are very close, but there are small discrepancies at the age specific level. These differences arise from small methodological differences in constructing the demographic models and the application of the assumptions. A graphical comparison of the population projections from the CSO and the model used here using a common set of assumptions is shown in Figure A.1 in Appendix 1.

The purpose of constructing a model independent of the CSO's is twofold. Firstly, it allows the projecting of population and support ratios beyond the CSO's 2036 horizon and labour force projections beyond the CSO's 2016 horizon. Secondly, the model allows manipulation of the assumptions to project a range of different projections other than those provided by the CSO.

3.3 The Demographic Assumptions

Longevity

The CSO's Population and Labour Force Projections 2006-2036 uses one set of mortality assumptions, two different migration scenarios and three different fertility scenarios. The mortality assumption states that the increases in longevity observed for men and women between 1986 and 2002 will generally continue to occur in the future. However, young men and women between 15 and 24 experienced some deterioration in their survival rates over the period as a whole. It is considered that this period is a poor indicator of future trends for these groups. Accordingly, the survival rates of these groups were improved inline with the increases in survival rates observed more recently between 1996 and 2002. These CSO mortality assumptions were adopted in this report.

Migration

The two different migration scenarios considered by the CSO, M1 and M2, describe a high and low net migration path respectively. The assumed numbers of net migrants under both scenarios are given in Table 3.1. below. Both migration scenarios depict a tailing off of net migration levels from about 30,000 net immigrants between 2002 and 2006 over the projection period.

Table 3.1: CSO Migration Scenarios

	Annual Net Migration (1000s)	
	M1	M2
2003-2006	30	30
2007-2011	30	20
2012-2016	30	10
2017-2021	20	5
2022-2026	20	5
2027-2031	15	5
2032-2036	15	5

Source: CSO Population and Labour Force Projections 2006-2036.

Ireland has experienced very large inward net migration flows in recent years, with net migration in 2006 estimated to be nearly 70,000. Consequently, the migration assumptions adopted by the CSO in 2004 have not proved accurate. Accordingly, this model adopts alternative migration assumptions that account

for the scale of the recent inflows and assume higher levels of net migration in the medium term than either the CSO M1 or M2 scenarios.

The central net migration assumptions employed in the model are presented in Table 3.2 below. These assumptions are the same as those used by the forthcoming Mercer report in to the financial position of the Social Insurance Fund. For the period 2003 to 2006 Migration is assumed to be as per the CSO migration estimates for each year. From 2007 to 2010 annual net migration of 40,000 is assumed. From 2011 onwards net migration falls to levels effectively the same as those assumed under the CSO MI scenario.

Table 3.2: Central Migration Assumption

	Annual Net Migration (1000s)
2003-2006	As per CSO Annual Estimates
2007-2010	40
2011-2015	30
2016-2025	20
2021-2025	20
2026-2052	15

It is understood that the Mercer report will not contain specific assumptions of the balance of immigration and emigration, just the net migration figures. The model employed here requires assumptions regarding the actual number of immigrants and emigrants, as they are assumed to have different demographic profiles. Emigration is assumed to be a steady 17,000 per annum over the whole period, and immigration falls over the period to yield the net migration figures above.

Fertility

The Total Fertility Rate (TFR) stood at 1.98 in 2003. F1 represents the CSO's high fertility scenario, by which fertility increases to 2.0 by 2011 and remains constant thereafter. The CSO's medium fertility scenario, F2, assumes fertility will decline to 1.85 by 2011 and remain constant thereafter. F3, the CSO's low fertility assumption sees the TFR fall to 1.7 by 2011 and remain constant thereafter.[2]

The central projection for the model developed here uses the F2 fertility assumption, as it is considered likely that Ireland's fertility rate will decline somewhat, given that it is high relative to European fertility rates. The stable TFR of 1.85 attained by 2011 is continued on throughout the projection period to 2052.

[2] It should be noted that even the CSO's low fertility assumption of a TFR of 1.7 is high by European standards. In 2005 the TFR was estimated at 1.52 on average for the EU25 and it ranged from 1.24 in Poland to 1.94 in France.

3.4 The Labour Force Assumptions

3.4.1 Participation

The CSO restricted its labour force projections to 2016, noting the degree of uncertainty when projecting changes in labour force participation over a long period. While the uncertainty about changes in participation is acknowledged, this report makes assumptions going forward in order to facilitate long term projections. The participation assumptions employed in this model for 2002-2016 are the same as those adopted by the CSO. In the central projection, participation after 2016 is simply assumed not to change from the levels reached by 2016.

To briefly summarise the CSO participation assumptions: further reductions in the marriage rate are assumed, which has implications for female participation, as married women have lower participation rates. Female participation rates for both married and unmarried women are assumed to increase, the increase for married women is larger, especially those in their 50s. Male participation rates are not assumed to increase significantly, as they are already high by European standards. Small increases in male participation are assumed for men in their late 50s and early 60s.

In addition to assumptions regarding changes in participation in the prime earning years, the CSO also assumes increases in education participation of late teens and those in their early 20s. While some changes are assumed regarding the participation of students themselves, the overall effect is assumed to be a reduction in participation of younger workers.

3.4.2 Unemployment Rates

Deriving projections of the level and growth of employment from the labour force requires an assumption regarding the rate of unemployment. Clearly it is not possible to provide meaningful forecasts of the likely unemployment rate until the middle of the century. However, a credible scenario of modestly increasing unemployment, with an average of 6 per cent across the period was used for the central projection. Selected unemployment rates for the period are given in Table 3.3 below.

Unemployment rates were applied to the different age and sex categories according to the average distribution over the 1998-2005 period. The distribution of unemployment was assumed to be uniform across all sectors of employment for the sake of simplicity.

Table 3.3: Unemployment Rate Assumptions

	Unemployment Rate (%)
2002	4.4
2012	5.2
2022	6.0
2032	6.4
2042	6.5
2052	6.5

3.4.3 Sectoral Distribution of Employment

Different sectors of the economy demonstrate different levels of productivity growth. Accordingly, employment must be segregated by sector before productivity figures can be applied to derive output growth statistics. The broad sectoral distribution of employment for three years in the last decade is shown in Table 3.4 below. The table shows that the share of employment in the service sector has been increasing, while that of agriculture and, to a lesser extent, industry has been falling. Service sector employment now accounts for two thirds of Irish employment. This trend conforms to international experience of other developed economies and is expected to continue.

Table 3.4: Sectoral Distribution of Employment in Ireland

	Proportion of Total Employment (%)		
	1998	2002	2006
All Employment			
Agriculture	9.0	7.0	5.8
Industry	28.6	27.9	27.3
Services	62.4	65.1	66.9
Males			
Agriculture	13.2	10.8	9.1
Industry	36.9	38.2	39.1
Services	49.9	51.0	51.8
Females			
Agriculture	2.6	1.7	1.3
Industry	16.2	13.5	11.3
Services	81.3	84.8	87.4

Source: CSO

Table 3.4 also shows that service sector employment accounts for a very large proportion of female employment and has grown over the period detailed. It is expected that as female participation increases, most of these new jobs will be created in the service sector. Consequently, the service sector is expected to further increase its share of female employment.

International evidence on the sectoral distribution of employment from developed countries indicates that the sectoral share of services could increase considerably. Currently, OECD countries with the highest share of service sector employment have rates in excess of 75 per cent, with agricultural employment typically in the range of 2-6 per cent.

In light of current international trends, an assumption of service sector employment increasing over the period to 78 per cent was used, with agricultural employment falling to 3 per cent, the remaining 19 per cent remaining in industry.

3.4.4 Labour Productivity Growth

Labour productivity growth assumptions allow output growth projections to be derived from employment growth. Productivity growth differs between sectors, tending to be higher in industry than in services. This difference is largely due to the labour intensity of the service sector and the lack of scope for automation.

Productivity growth can be difficult to measure for a number of reasons, including insufficient data, intangible inputs and outputs and transfer pricing behaviour. In addition, measuring changes in productivity over a certain time period can capture idiosyncratic effects that are particular to the period, not representative of long term trends.

Despite these measurement difficulties, Forfás recently published estimates of Irish productivity and its growth. For the period 1990-2003, Forfás report estimates of overall annual productivity increase of 3.3 per cent. Indications are that over this period agriculture achieved annual labour productivity growth of approximately 2.3 per cent, industry achieved approximately 6.0 per cent growth and the service sector had growth of 1.8 per cent (Forfás, 2006)

The overall productivity of the economy is likely to change as the sectoral balance continues to shift. The expansion of the service sector is widely expected to reduce overall productivity growth over the projection period. For the sake of transparency in the model it was decided to apply one single productivity growth rate over the whole period. An average growth rate was derived which accounted for the probable changes over the period due to sectoral shifts. The rate applied was for annual labour productivity growth of 2.8 per cent, somewhat below the overall productivity growth rate of 3.3 estimated by Forfás for the period 1990-2003.

3.4.5 Projection Methodology

The projection methodology used to derive support ratios and economic growth rates from a model of population is summarised in Figure 3.1. below. The projection sequence progresses as follows: Initially the population is divided up into the working age population and dependants; participation rates are then applied to the working age population to determine the size of the labour force; unemployment rates are then applied to the labour force to derive total employment; employment growth rates, calculated on the basis of the levels of employment, are combined with labour productivity growth assumptions to derive output growth assumptions; finally, projections of population and output growth are used to derive output per capita growth rates.

Economic output is the product of employment and labour productivity. If either employment or labour productivity increase, output will increase. Consequently, employment and productivity growth are the two components of economic growth. Economic growth can be estimated from the underlying rates of employment and productivity growth. The following expression describes output growth in terms of employment and labour productivity growth, where g indicates the growth rate of the given variable.

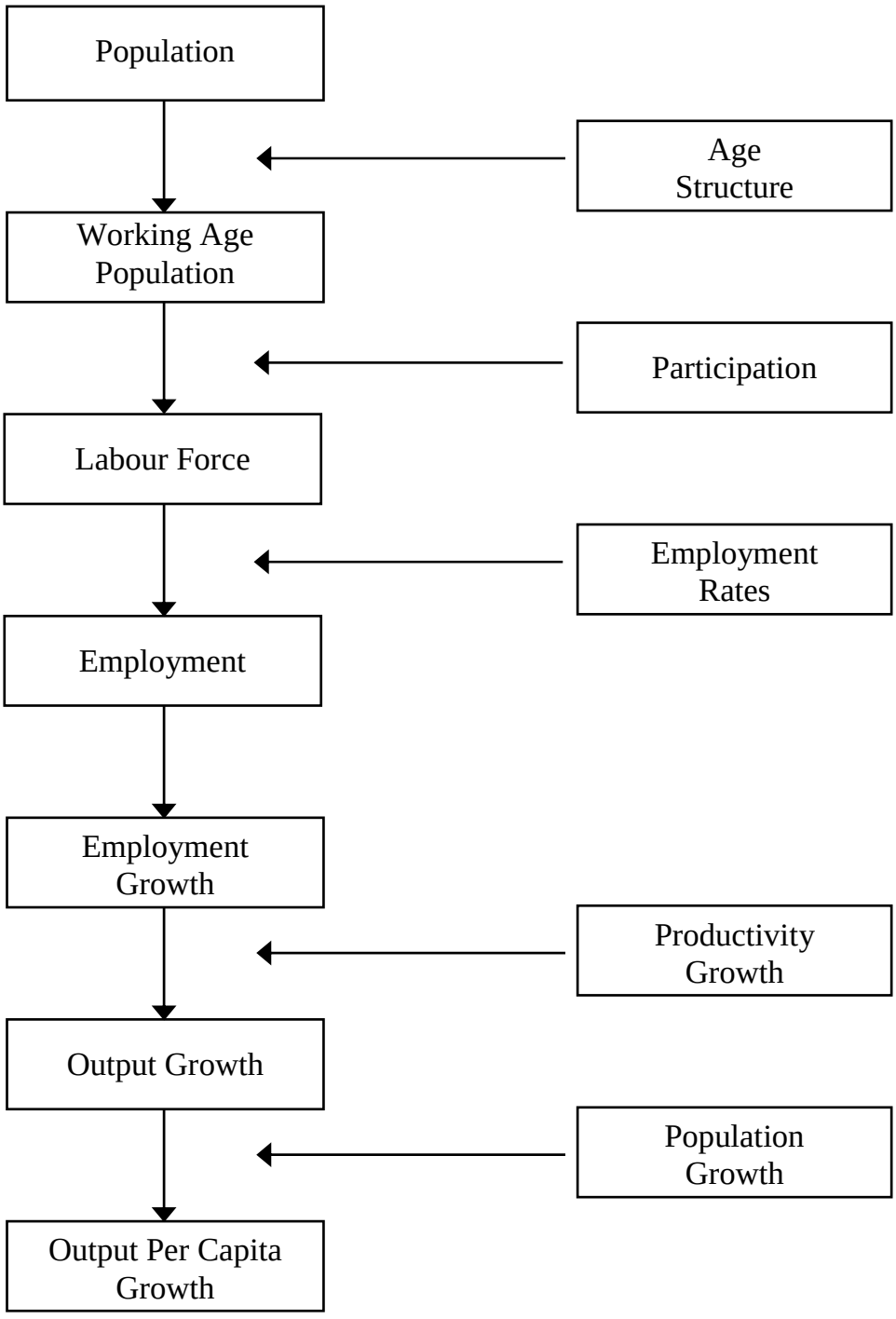
$$g_{output} = g_{employment} + g_{labourproductivity} + (g_{employment} \cdot g_{labourproductivity})$$

Output per capita growth is derived using the following expression.

$$g_{outputpercaptia} = \frac{g_{output} + 1}{g_{population} + 1} - 1$$

The greater the increase in population growth for a given output growth rate, the lower per capita output growth will be. Output growth per capita is the chief measure of increases in living standards. Importantly, growth in output per capita will determine the increase in resources required to support dependants.

Figure 3.1: Projection Methodology



3.5 Results

3.5.1 Introduction

The model produces both demographic and economic projections. Some of the results are purely demographic, in that they only concern population and its structure. Other results are a mix of the demographic and economic projections. Importantly, in the context of an ageing society, measures of dependency provide some indication of the viability of future age structures. Measures of dependency have typically been expressed in purely demographic terms. However, this report presents other measures of dependency quantified in economic terms. Consequently, the results are presented here are first the headline demographic results, then the derived economic forecasts are presented, finally various measures of dependency are presented.

3.5.2 Headline Demographic Results

The central projections indicate that Ireland's population will reach 5 million by 2017 and 6 million by 2042. Table 3.5 below summarises the projected population under the central set of assumptions. A complete set of results by sex and age for the complete projection period is contained in Appendix 1. These data are also represented in Figure 3.2. below. The graph shows that population growth is expected to moderate over the projection period, slowing significantly after 2022. Average annual population growth over the period is projected to be 1.0 per cent.

Table 3.5: Total Population Projections

Population Projections 2007-2052 (Thousands)			
Year		Year	
1996	3,626	2027	5,489
2002	3,917	2032	5,680
2007	4,308	2037	5,862
2012	4,679	2042	6,039
2017	4,996	2047	6,201
2022	5,262	2052	6,338

Source: Goodbody Economic Consultants

Figure 3.2: Population 1991-2052

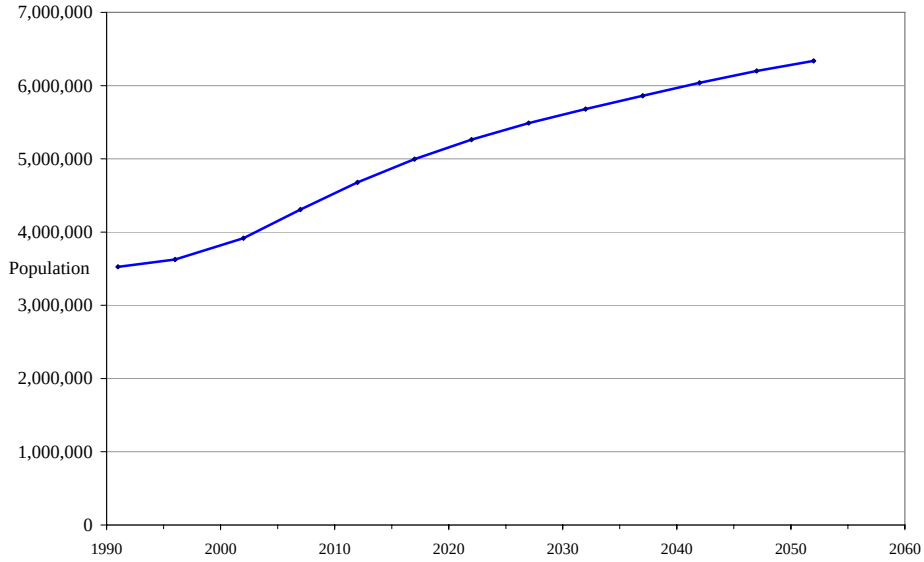


Table 3.6 below details life expectancy at birth for men and women over the projection period. It shows that male life expectancy is expected to increase more rapidly than that for females. However, it is projected that female longevity will still exceed that of males at the end of the period, by a significant margin of 4 years.

Figure 3.3 below illustrates the age-sex distribution of the population at 2002, 2037 and 2052. The diagrams illustrate the changing demographic structure of the Irish population. The population pyramid for 2002 illustrates the favourable demographic situation of Irish population in recent years. It shows that the bulk of the population are of working age and there are relatively few people aged 65 or older. In addition, the diagram illustrates the differences in the male and female population over 75 years of age, owing to longer female longevity.

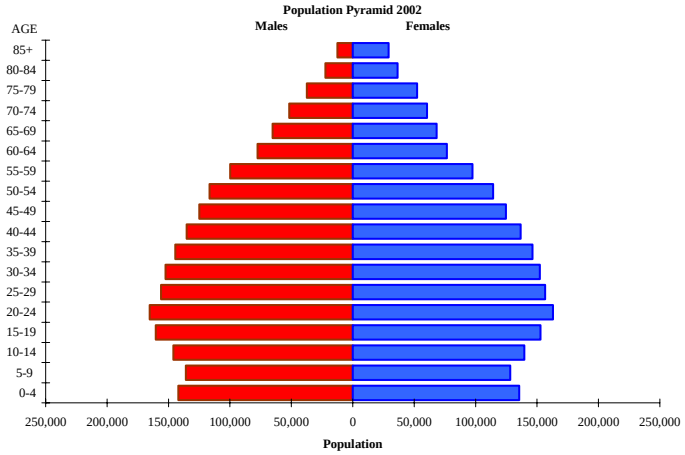
Table 3.6: Projected Life Expectancy at Birth

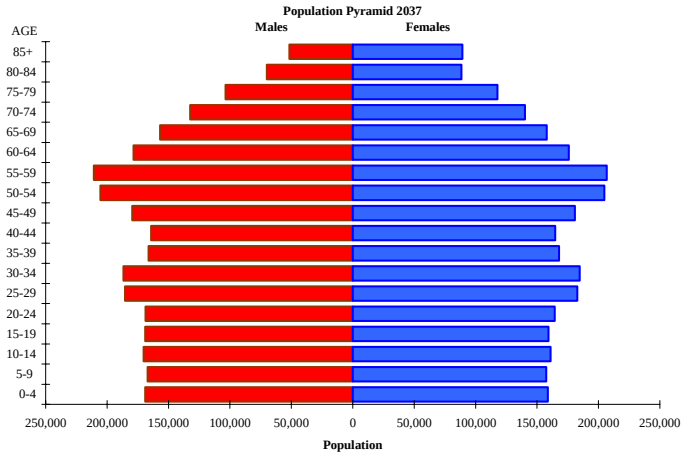
	Males	Females
2002	75.1	80.3
2012	76.9	81.8
2022	78.6	83.2
2032	80.1	84.5
2042	81.5	85.7
2052	82.7	86.8

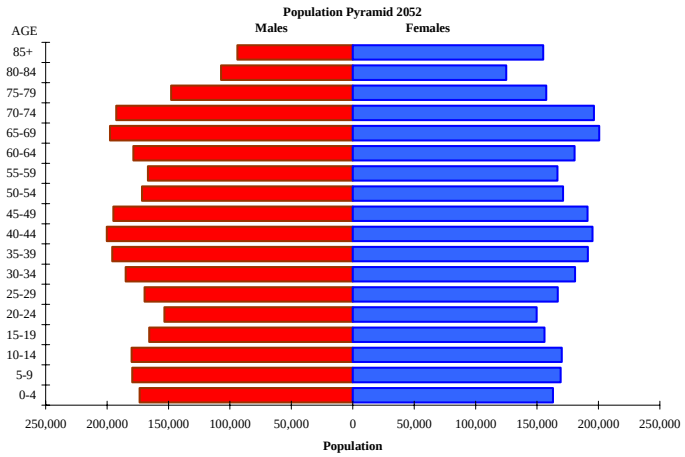
Source: CSO and Goodbody Economic Consultants

The population pyramid for 2037 shows the significant changes that will occur to the population structure in coming years. It shows that the most populous age groups will be those in their 50s. The numbers of older people in the population will be dramatically higher compared to 2002.

Figure 3.3: Age and Sex Distribution of Population 2002, 2037 & 2052







The trend of increasing numbers of older people relative to the rest of the population continues as the 2052 population pyramid illustrates. Notably, the projection is for significant numbers of those in the oldest age groups of 80-84 and 85+. It is also notable that the population structure becomes less uniform at younger ages, with reduced numbers in their late teens and early twenties.

The overall shift in population structure is away from 'bottom heavy' youthful populations towards populations with more even distributions across all age groups. There is some lumpiness in the age structure that persists in the projections. This can clearly be seen in the population distribution in 2052. There are population bulges at three distinct age groups. The oldest bulge represents the cohort of people born during the Irish baby boom of the 1970s and early 1980s. The subsequent population bulges are the 'echoes' of that baby boom, constituting the children and grandchildren of the initial boom.

The effects of these bulges are significant, meaning that large cohorts arrive at particular life stages at once. For instance, the 1970s and 1980s baby boom cohort will be approaching the end of their careers by 2037. In the subsequent 15 years that particular population bulge will pass into retirement, as illustrated by the 2052 population pyramid. This means the increase in those of pensionable age will arrive in an uneven fashion over the period.

3.5.3 Principal Economic Results

The main economic results of the model are presented in Table 3.7. below. The second column of the table shows annual average employment growth over 5 year intervals for the projection period. It shows that annual employment growth will moderate from just above 2 per cent to very low levels towards the end of the projection period, and actually contracts in the final two projection periods.

As mentioned above, the model assumes a constant average productivity growth figure for the period. Consequently, changes in employment growth dictate how output growth will evolve within the model over the period. Annual average output growth decreases over the period, from approximately 5 per cent initially, eventually falling below the assumed rate of productivity growth by the final period. In the context of the current growth performance of other European economies, albeit with more mature demographic profiles, these growth rates do not compare unfavourably.

The rate of output per capita growth, given in the final column of the table, is most relevant when considering the implications of growth rates on improvements in living standards. While output growth is forecast to moderate over the projection period, the change in per capita growth in less pronounced. This is due to moderating population growth over the period, meaning growth in living standards outpaces output growth. The table shows that growth in output per capita is projected to fall from 3 per cent per annum to close to 2 per cent over the projection period.

One implication of the results below is that as the demographic burden increases over the period, output growth moderates too. While falling output growth will make meeting the needs of an ageing society more difficult, it should be noted that the reduction in output growth is not particularly severe.

Table 3.7: Principal Economic Growth Rates

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output per capita growth (%)
2002-2007	2.2	5.1	3.1
2008-2012	1.7	4.6	2.9
2013-2017	1.0	3.8	25
2018-2022	0.6	3.4	2.3
2023-2027	0.6	3.4	2.6
2028-2032	0.5	3.3	2.6
2033-2037	0.3	3.1	2.5
2038-2042	0.1	2.9	2.3
2043-2047	-0.2	2.6	2.1
2048-2052	-0.1	2.7	2.2

Source: Goodbody Economic Consultants

The output growth results above should be qualified by stating that they are heavily dependent on the rate of productivity growth. A failure of the Irish economy to achieve strong rates of productivity growth will result in lower output growth. The need to achieve sustained increases in productivity will become increasingly important, as the demographic projections show that employment growth will cease to be a significant contributor to output growth over the period.

3.5.4 Measures of Dependency

Measures of dependency summarise the relative numbers of those who are likely to be economically dependent to those who are not. Dependency is measured here in terms of support ratios. A number of different support ratios are listed here, each is explained before the actual changes and trends are commented on.

Support ratios measure the number of economically non-dependent population to the dependent population.[3] In the context of old age dependency, the pensioner support ratio (PSR) is a commonly used measure. It is the ratio of people of working age (15-64) to those of retirement age and older (65+). The

[3] The support ratio is the inverse of the dependency ratio, another common measure of dependency that compares the number of dependants to the working age population.

PSR is a purely demographic measure of dependency, as it simply compares the numbers of individuals of different ages regardless of their employment situation.

Table 3.8: Support Ratios

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.3	26.6	4.2	2.1
2012	5.8	25.9	4.0	2.0
2017	5.2	24.2	3.6	1.9
2022	4.6	21.9	3.2	1.9
2027	4.2	18.1	2.8	1.9
2032	3.7	14.8	2.5	1.8
2037	3.4	12.4	2.3	1.8
2042	3.0	10.5	2.0	1.6
2047	2.5	8.8	1.7	1.5
2052	2.3	7.5	1.5	1.4

Source: Goodbody Economic Consultants

Table 3.8 above details the PSR over the projection period. It also provides some other measures of dependency. The second measure of dependency listed in the table is the 80+ PSR. It gives the ratio of the working age population to persons aged 80 and above. It provides an indication of the relative increase in the very oldest population, who may have significant care needs. The 80+ PSR is another purely demographic measure of dependency.

The third measure of dependency listed in the table above is the real PSR. The real PSR is the ratio of people in employment to those over the age of 65. It is termed the real PSR as it more accurately reflects the level of economic dependence by adjusting the working age population to account for participation and unemployment rates.

The real PSR is considered more representative, as changes to the level of employment may have significant contributing or countervailing effects on the actual level of dependency. For example, the considerable increase in participation in second and third level education by the youngest members of the working age population has acted to reduce the size of the workforce, thereby reducing the real PSR. The significant increase in participation of females has had the opposite effect, adding to the workforce and boosting the real PSR. The purely demographic PSR cannot reflect these important changes, whereas the real PSR can.

Demographic ageing of the population is highly likely to lead to a deterioration in the real PSR. However, it is important to view future prospects in long term historical context. For example, prior to the mid 1990s Ireland had low rates of female participation and high rates of unemployment. Consequently, while the future demographic situation might be quite different from what has been experienced in the past, if the increases in participation are permanent and low unemployment is maintained, future support ratios might not be too dissimilar in terms of the real PSR.

The real PSR only measures the ratio of the employed to those 65 and over, it does not take into account working age dependants. The transition from a low participation and high unemployment economy to high participation and low unemployment has resulted in less working age dependants, such as homemakers and the unemployed. This reduction in the number of working age dependants is an additional effect that is not recorded in the real PSR, which makes it easier for those working to support the older population.

The final dependency measure featured in the table above is the total support ratio (TSR). It is the ratio of the population aged 15-64 to those aged 0-14 and 65+. The number of children relative to the rest of the population is projected to fall over the period, reducing childhood dependency. However, the TSR has not been adjusted for increasing education participation rates, which is likely to have a countervailing effect on actual childhood dependency of young adult children. The net effect of reducing childhood dependency and increasing pensioner dependency is a decline in the TSR between 2002 and 2052, as the pensioner dependency effect dominates.

The countervailing effects of reducing childhood dependency but increasing pensioner dependency result in proportionately moderate changes in the TSR. However, it is not implied that that the demands of childhood dependency are equivalent to pensioner dependency. It should be recognised that the needs of both types of dependants are distinct and may differ significantly.

While this report uses the real PSR as the primary measure of dependency, it is important not to view pensioner dependency in isolation from other dependent groups in the population. For example, increased levels of childhood dependency will reduce the capacity of the working population to meet the needs of the pensioner population.

3.5.5 Changes in Support Ratios

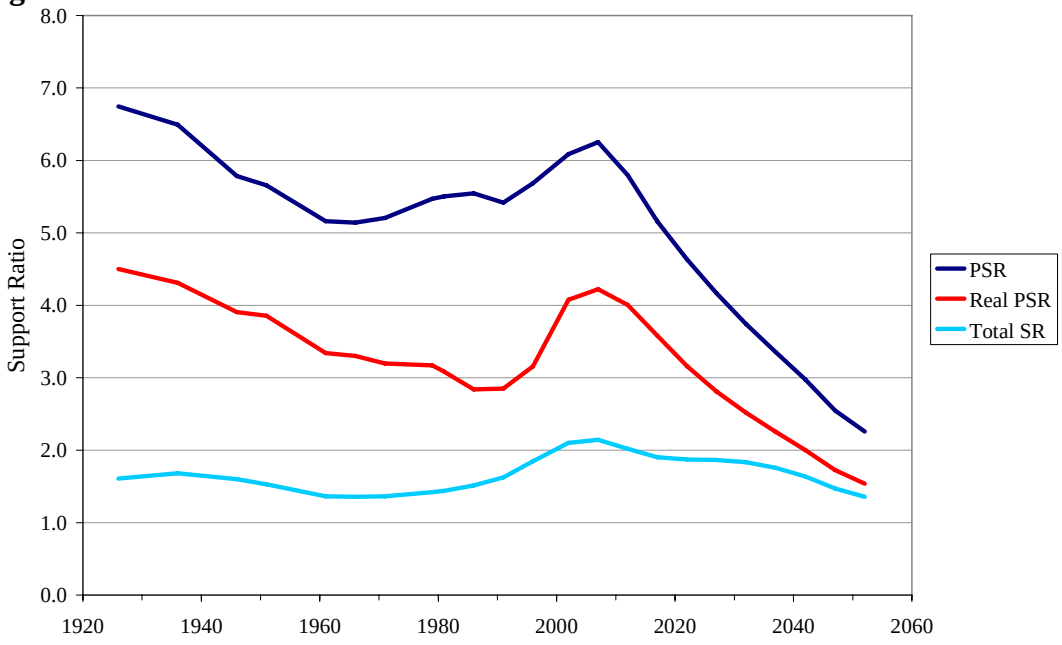
Table 3.8 above shows that the PSR is projected to fall from around 6.3 in 2007 to approximately 2.3 by 2052. The change in the PSR is projected to occur relatively evenly over the period. The 80+ PSR falls over the projection period too, but its path is less even. The drop in the 80+ PSR is not pronounced initially, but by the middle of the projection period the reduction in the 80+ PSR becomes more significant.

The real PSR also falls between 2002 and 2052. The fall in the real PSR largely follows the pace of the decline in the PSR and the reduction is approximately equiproportionate. The real PSR indicates that there will approximately 1.5 people employed for each old age dependant by 2052, significantly lower that current levels of about 4.

The TSR also declines between 2002 and 2052, although the decline is much less marked than for the other dependency measures shown. The TSR declines relatively slowly initially, but the pace of the reduction increases towards the end of the projection period.

Table 3.8 shows that the PSR will return to its 1991 level some time between 2012 and 2017. The real PSR will not return to its 1991 level until between 2022 and 2027. The TSR is not forecast to fall back to its 1991 level until 2042. These differences in the adjustment time scale illustrate that the choice of support ratio can influence the apparent severity of adjustment. In particular, the PSR implies a more rapid deterioration than the real PSR measure.

Figure 3.4: Irish PSRs 1926-2052



Source: Goodbody Economic Consultants

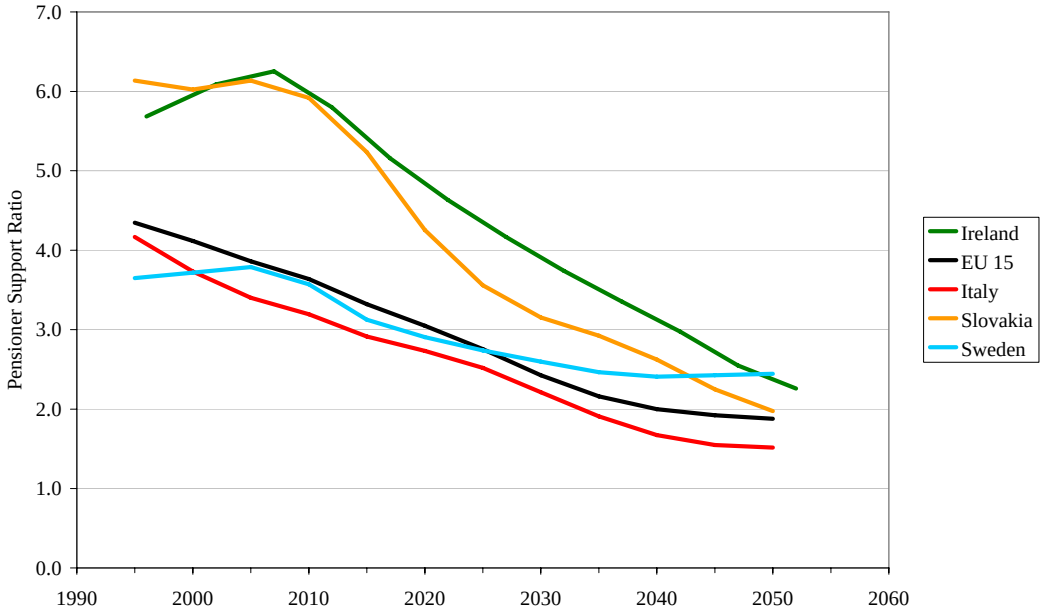
It is revealing to review the projected changes to the support ratios in their long run historical context. Figure 3.4. above illustrates the PSR, real PSR and TSR from 1926-2002, including projections to 2052. The graph shows that the PSR was at high levels above 5 for all of the period recorded since 1926 and that the current levels of above 6 represent a peak. The graph shows that PSRs were actually increasing for much of the period from 1966 to 2002, rising from 5.2 to 6.1. Significantly, the PSR is projected to fall to levels far below those experienced in Ireland historically. In addition, the PSR is projected to decline at a pace faster than has been experienced before.

The graph shows that the real PSR follows similar trends. The real PSR displays a more pronounced peak, as employment growth coupled with demographic effects reduced dependency in the late 1990s.

The TSR is currently at historically high levels. The levels projected for the period 2002 to 2052 are high relative to those experienced for much of the 20th century. However, the composition of the TSR has and will continue to change considerably, with a significant reduction in childhood dependency accounting for higher TSRs.

It is interesting to note that the lowest values of the PSR and real PSR recorded in the last 20 years both occurred in 1991. The PSR and real PSR stood at 5.4 and 2.9 respectively.

Figure 3.5: Selected European PSRs



Source: Eurostat and Goodbody Economic Consultants

The various support ratios are indicators of the capacity of the Irish working population to sustain the older population. A perspective on the real impact may be obtained by considering when future PSRs will decline to past levels. The fact that the real PSR will not decline to 1991 levels until the 2022-2027 period means that the increasing burden, while significant, will be within the range of recent experience for approximately another 20 years. Moreover, the total support ratio will not fall to 1991 levels until 2042. This analysis serves as a reminder that the future change in the demographic structure should not be regarded as having catastrophic economic impacts even in the medium to long term.

It is also useful to consider the changes in support ratios in an international context. Figure 3.5. above graphs the projected changes in European PSRs until the middle of this century. The graph compares the model's central projection of the Irish PSR to Eurostat forecasts of PSRs in other European nations. In addition to an EU 15 average, the PSRs of Italy, Slovakia and Sweden have been selected for inclusion. These nations have been selected in particular as their forecast PSRs serve as notable comparisons.

Currently, Slovakia's PSR is close to that of Ireland and it too is forecast to fall considerably. However, Slovakia's PSR has a different forecast path, with a more rapid decline expected between 2010 and 2025. This illustrates that while Ireland will go through pronounced demographic change, the pace of adjustment will be more moderate in comparison to some other nations.

At present, Italy's PSR is the lowest in Europe and is forecast to fall as low as 1.5 by 2050. As such, Italy serves as an example of a European nation that is experiencing demographic ageing somewhat earlier than most. Consequently, Italy is likely to give an indication of the likely challenges of demographic ageing in advance of changes elsewhere. Ireland's PSR is not projected to fall to the current Italian level until shortly after 2037.

Sweden represents another interesting example. It currently has a low PSR, which is also forecast to fall. However, Sweden's demographic transition is likely to be much less marked than other European nations. Its forecast PSR for 2050 is 2.4, higher than both the Irish and EU 15 figure.

Ireland's current favourable demographic situation is the consequence of a transition phase in its demographics. Ireland's fertility rate has decreased significantly over the past 40 years, but from very high levels. This history of high fertility, well above replacement rates meant there was an ever growing pool of young people to support the older population in the past. However, with the significant fall in the fertility rate, very high PSRs are very unlikely to be experienced again. Therefore, it is unhelpful to consider current PSRs as the norm to which we should strive to return, but rather a result of Ireland's demographic transition from high to lower fertility.

3.6 Summary of Key Points

Demographic Projections

The central projections indicate that Ireland's population will reach 5 million by 2017 and exceed 6 million by 2042. Population growth is expected to moderate over the projection period, slowing significantly after 2017. Average annual population growth over the period is projected to be 1.0 per cent.

Currently the majority of the population are of working age and there are relatively few people aged 65 or older. By 2037 the most populous age groups will be those in their 50s and the number over 65 will be dramatically higher

compared to 2002. By 2052 there will be significant numbers of those in the oldest age groups of 80-84 and 85+.

The population projections contain some lumpiness. By 2052 there will be population bulges at three distinct age groups, the oldest bulge being the cohort of people born during the Irish baby boom of the 1970s and early 80s and subsequent population bulges where 'echoes' of that baby boom occur.

The effects of population bulges are significant, as large cohorts arrive at particular life stages at once. Consequently, the increase in the number of people of pensionsable age will occur in an uneven fashion.

Economic Projections

Annual average output growth is predicted to decrease from above 5 per cent per annum initially, to just over 2.7 per cent by 2052. Growth in output per capita is projected to fall from 3 per cent per annum to close to 2 per cent over the projection period.

As the demographic burden increases over the period, output growth moderates too. However, the reduction in output growth will not be particularly severe, and the significant rates of growth still occurring will help society meet the needs of an ageing population.

The output growth projections are heavily dependent on the rate of productivity growth. A failure of the Irish economy to achieve strong rates of productivity growth will result in lower output growth. The need to achieve sustained increases in productivity will become increasingly important, as the demographic projections show that employment growth will cease to be a significant contributor to output growth over the period.

Annual employment growth will moderate from approximately 2 per cent to very low levels towards the end of the projection period, and is actually projected to be negative in the final two projection periods.

Trends in Support Ratios

The nominal PSR is projected to fall from around 6.3 in 2007 to approximately 2.3 by 2052. The change in the PSR is projected to occur relatively evenly over the period.

The 80+ PSR falls over the projection period too, but its path is less even. The drop in the 80+ PSR is not pronounced initially, but by the middle of the projection period the reduction in the 80+ PSR becomes more significant.

The real PSR is the ratio of people in employment to those over the age of 65. It is termed the real PSR as it more accurately reflects the level of economic dependence by adjusting the working age population to account for

participation and unemployment rates. The real PSR is considered more representative, as changes to the level of employment may have significant contributing or countervailing effects on the actual level of dependency.

The real PSR is predicted to fall from 4.2 currently to 1.5 by 2052. The real PSR will not decline to 1991 levels until the 2022-2027 period. This means that the increasing burden, while significant, will be within the range of recent experience for approximately another 20 years. Moreover, the total support ratio will not fall to 1991 levels until 2042. This analysis serves as a reminder that the future change in the demographic structure should not be regarded as having catastrophic economic impacts even in the medium to long term.

4. Evaluation of Alternative Scenarios

4.1 Introduction

The results above show the projected demographic and economic situation under a central assumptions scenario. These assumptions dictate the values that important parameters in the model take. In reality these parameters may vary for a number of reasons, including the changing choices of individuals regarding issues such as fertility or participation, the influence of prevailing economic conditions or active policy measures on the part of government.

Irrespective of the reasons for the differences in the parameters, it is important to show the consequences of altering the assumptions employed by the model. This section presents a number of alternative scenarios and compares the results to the central scenario. The degree to which the results change in response to the alternative assumptions gives an indication of the sensitivity to the parameter in question.

For the sake of clarity and ease of comparison, only one assumption is changed at a time, allowing for meaningful comparisons to the central scenario. Two exceptions to this rule are made. The first is a high unemployment scenario, in which immigration is also assumed to moderate as a consequence of weak job prospects. It was necessary to change these two assumptions simultaneously in this case, as it would have been inconsistent to assume sustained immigration in the presence of high unemployment. The second is an 'unfavourable environment' scenario, in which a number of assumptions are altered to less favourable alternatives.

The assumptions can be divided into two categories. The first contains demographic assumptions, those that affect the demographic structure of the population. The second is of non-demographic assumptions, those that influence the labour market or the growth in productivity. Changes to demographic assumptions will have both demographic and economic consequences. Changes to the non-demographic assumptions will not have direct demographic consequences, but will have direct economic consequences. It is highly likely that changing economic conditions will have indirect demographic effects, but these are not included in the model.

Each of the alternative assumption scenarios will be presented with accompanying alternative model results. The alternative assumption scenarios are summarised as follows: There are two alternative fertility assumptions, one of fertility rates higher than the central assumption, the other of lower fertility rates. There are two alternative migration scenarios, both employing recent CSO estimates of migration between 2002 and 2006, one with a modest reduction in net immigration, the other with a significant reduction.

4.2 Alternative Demographic Assumptions

In each of the alternative assumptions scenarios only the assumption in question will be altered unless otherwise stated. All other assumptions will be as per the central assumption scenario. In each case the primary demographic and economic results are presented.

4.2.1 Alternative Fertility Scenarios

The central assumption scenario assumes that the TFR will drop from 1.98 in 2002 to 1.85 by 2011. An alternative higher fertility scenario assumes that the TFR will increase to 2.2 by 2017 and remain constant for the remainder of the projection period. A lower fertility scenario assumes a drop in the TFR to 1.5 by 2017. The central, lower and upper fertility assumptions are summarised in Table 4.1 below.

The lower fertility assumption of 1.5 was chosen as this approximates the current European average TFR. Ireland last experienced a TFR near the higher assumption of 2.2 during the late 1980s. This rate of 2.2 is in excess of the replacement fertility rate of 2.1 which a population requires to sustain itself without immigration. It is not considered likely that Irish fertility would recover to this level of its own accord. However, it was considered possible that concerted policy efforts could raise the TFR to such levels. A longer time period for the adjustment of fertility was specified in the case of the alternative assumptions, given the magnitude of the changes specified.

Table 4.1: Central and Alternative Fertility Assumptions

	CSO F2	Low Fertility	High Fertility
2002	1.98	1.98	1.98
2003-2007	1.94	1.88	2.02
2008-2012	1.87	1.72	2.10
2013-2017	1.85	1.56	2.17
2018-2052	1.85	1.50	2.20

Results – Fertility Scenarios

Table 4.2 below details the resulting real PSR under the central, low and high fertility assumption. In this case the PSR is reported to 2 decimal points due to the small differences between figures. There are no discernable differences in the real PSR until 2032. After 2032 the real PSR is moderately lower for the low fertility assumption and somewhat higher for the high fertility assumption.

The lag between the change in fertility rates and the effect on the PSR owes to the fact that it takes many years for increased numbers of births to begin to have a positive effect on the labour market.

It is notable that the differences in the real PSR by 2052 are not particularly significant, given that the changes in the fertility rates are relatively large. It is clear that an increase in fertility rates to above the 2.1 replacement rate will not be sufficient to restrain the real PSR from falling to low levels.

Table 4.2: Support Ratios

	Real PSR		
	Central Assumption	Low Fertility	High Fertility
1991	2.85	2.85	2.85
2002	4.08	4.08	4.08
2012	4.01	4.01	4.01
2022	3.16	3.16	3.16
2032	2.52	2.51	2.54
2042	2.00	1.95	2.08
2052	1.54	1.44	1.66

Some commentators in the debate over demographic ageing see increasing fertility as the main method for increasing support ratios. The indications from the projections run counter to that view.

Table 4.3: Principal Economic Growth Rates

	Annual Average GDP Growth per capita (%)		
	Central Assumption	Low Fertility	High Fertility
2002-2007	3.1	3.1	3.1
2008-2012	2.9	2.9	2.8
2013-2017	2.5	2.6	2.3
2018-2022	2.3	2.5	2.1
2023-2027	2.6	2.8	2.4
2028-2032	2.6	2.8	2.6
2033-2037	2.5	2.5	2.5
2038-2042	2.3	2.2	2.4
2043-2047	2.1	2.0	2.2
2048-2052	2.2	2.1	2.3

Table 4.3 above details the projected output per capita growth rates under the alternative fertility scenarios. The lower fertility scenario sees higher output per capita growth in the middle of the projection period relative to the central projection, followed by lower growth later. Initially population growth will be lower, resulting in higher output per capita. However, following 2037, lower

fertility will result in lower labour force growth, acting as a drag on output growth. The converse is observed in the high fertility scenario. Initially the increase in the population due to higher fertility will act as a drag on output per capita growth, but as the increased numbers of children grow up and enter the workforce, they then act to boost output per capita growth.

The output per capita figures reveal an effect that is not evident in the real PSR, as increasing fertility increases childhood dependency, eroding the overall capacity to pay for old age dependants in the short run. However, the increased numbers of young people eventually contribute to increased labour force growth, which enhances the capacity to support older people in the long run.

4.2.2 Alternative Migration Scenarios

Two alternative migration scenarios were assumed, one high and one low, detailed in Table 4.4 below. Both make use of the CSO estimates of migration between 2002 and 2006. The low scenario then assumes a fall in the numbers of net migrants from 2007 to 35,000 and a further fall to 20,000 by 2011 and zero net migration by 2016. The high scenario sees the current high level of net migration tapering off slowly after 2010, stabilising at around 30,000 per annum by 2026.

Table 4.4: Central and Alternative Migration Scenarios

	Annual Net Migration (1000s)		
	CSO M1	Low Migration	High Migration
2002-2006	45	45	45
2007-2010	40	35	70
2011-2015	30	20	50
2016-2025	20	0	40
2026-2052	15	0	30

Results – Migration Scenarios

The projected real PSRs under the different migration assumptions are presented in Table 4.5 below. Compared to the central assumption, the real PSR is lower throughout the projection period under the low migration scenario and higher under the high migration scenario. The differences observed by the end of the projection period are significant, indicating that migration is relevant to the issue of support ratios.

Comparison between the central assumption and the high migration scenario shows that high net migration will ensure that the real PSR is somewhat higher, however it cannot reverse the underlying downward trend. This effect results from the fact that while additions to the population in the form of migrants swell the working age population, these workers will themselves

inevitably age too. This underlines the fact that while migrant inflows may be useful in moderating imbalances between those of working age and those above, very high and probably increasing net migration would be required to reverse the underlying trend of falling PSRs.

Table 4.5: Support Ratios

	Real PSR		
	Central Assumption	Low Migration	High Migration
1991	2.9	2.9	2.9
2002	4.1	4.1	4.1
2012	3.9	4.0	4.2
2022	3.1	3.0	3.4
2032	2.4	2.3	2.8
2042	2.0	1.8	2.3
2052	1.5	1.3	1.8

The reduction in the real PSR in the case of low migration relative to the central scenario implies that a steady flow of immigrants is more desirable than a sudden burst. The large additions to the working age population currently being experienced could exacerbate the problem of a glut of people in the current working age population relative to younger cohorts to follow. If the current high levels of migration are followed by a sharp reduction, the demographic situation will worsen by the middle of the century as the current cohort of working age migrants retire.

Table 4.6: Principal Economic Growth Rates

	Annual Average GDP Growth per capita (%)		
	Central Assumption	Low Migration	High Migration
2002-2007	3.1	3.1	3.1
2008-2012	2.9	2.9	3.0
2013-2017	2.5	2.4	2.5
2018-2022	2.3	2.2	2.4
2023-2027	2.6	2.5	2.6
2028-2032	2.6	2.6	2.7
2033-2037	2.5	2.4	2.6
2038-2042	2.3	2.1	2.4
2043-2047	2.1	1.9	2.2
2048-2052	2.2	2.1	2.2

The economic consequences under the alternative migration scenarios are detailed above in Table 4.6 It shows that there are unlikely to be significant differences in the growth of living standards across the different assumption scenarios for the most part. The table does indicate that output per capita growth is projected to be lower in the final decade of the projection period under the scenario of a sharp reduction in migration. Comparison between the central and high migration assumptions indicates that high levels of migration will not result in a significantly enhanced capacity to support the older population, on the basis of per capita output growth.

4.2.3 Alternative Participation Assumptions

The CSO assumptions include an increase in female participation rates. However, the assumption still leaves Irish female participation rates behind those currently prevailing in Scandinavian countries. Accordingly, an alternative scenario of female participation converging on Scandinavian rates was specified. Table 4.7 below contains a summary of the female and total participation rates at selected points over the projection period.

Under the alternative assumption, age specific female participation rates increase gradually between 2002 and 2016. The net effect on overall participation can be seen Table 4.7 below. Overall female participation is higher at each point in time compared to the CSO's assumptions. The decrease in female participation from 2022 onward is a consequence of the demographic ageing of society, despite the increased age specific participation rates.

Table 4.7: Participation Assumptions

	CSO Participation		Alternative Participation	
	Females	Total	Females	Total
2002	55	65	55	65
2012	60	69	65	71
2022	61	69	67	72
2032	59	67	66	71
2042	58	66	65	70
2052	57	65	64	69

Results – Increased Participation

The real PSR under the central and alternative participation assumptions are given in Table 4.8 below. The table shows that increased female participation would bring about a marginal increase in the real PSR.

Table 4.8: Support Ratios

	Real PSR	
	Central Assumption	Increased Participation
1991	2.9	2.9
2002	4.1	4.1
2012	4.0	4.1
2022	3.2	3.3
2032	2.5	2.7
2042	2.0	2.1
2052	1.5	1.6

Table 4.9 below gives an indication of the likely impact on per capita output growth. It shows that most of the benefit in terms of increased output growth falls in the early half of the projection period. This is a consequence of the assumption that the increase in participation occurs in the first 15 years and the pace of increase in the labour force will be the same in both scenarios in the latter half of the projection period.

Table 4.9: Principal Economic Growth Rates

	Annual Average GDP Growth per capita (%)	
	Central Assumption	Increased Participation
2002-2007	3.1	3.2
2008-2012	2.9	3.5
2013-2017	2.5	2.8
2018-2022	2.3	2.4
2023-2027	2.6	2.6
2028-2032	2.6	2.7
2033-2037	2.5	2.5
2038-2042	2.3	2.3
2043-2047	2.1	2.1
2048-2052	2.2	2.2

The increase in per capita output growth in the case of increased participation, albeit concentrated only in the early half of the projection period, indicates greater capacity to support the dependent population.

4.3 Alternative Economic Assumptions

4.3.1 Alternative Unemployment Assumptions

The central assumption assumes that unemployment will gradually increase from low levels in 2002, resulting in an average rate of 6 per cent for the whole period. An alternative assumption of high unemployment assumes that joblessness will increase rapidly over the first 20 years of the projection period, leading to an average rate of 10 per cent over the projection period. Table 4.10 below indicates the profile of increasing unemployment rates under both scenarios.

Table 4.10: Unemployment Assumptions

	Unemployment Rate (%)	
	Central Assumption	High Alternative
2002	4.4	4.4
2012	5.2	8.6
2022	6.0	10.0
2032	6.5	10.8
2042	6.5	10.8
2052	6.6	10.9

While it was considered desirable to change only one assumption from the central set of assumptions at a time to ensure clarity, when assuming a high unemployment scenario it was necessary to also use an assumption of low net migration. The migration assumption employed is the low net migration scenario as detailed in Table 4.4 above. The additional assumption of reduced net migration was required in the case of high unemployment, as it would be inconsistent to assume sustained net migration with poor employment prospects.

Results – Increased Unemployment Rates

Table 4.11 below describes the impact of high unemployment coupled with moderating immigration. The results show that the increase in the unemployment rate takes a number of years to impact on the real PSR. The comparatively high rate of unemployment of 10 per cent coupled with reduced net migration induces a significant reduction in the real PSR. However, poor employment prospects could also reduce participation rates, which have not been altered in this projection, so the true impact of high unemployment could be even more significant.

Table 4.11: Support Ratios

	Real PSR	
	Central Assumption	High Unemployment
1991	2.9	2.9
2002	4.1	4.1
2012	4.0	3.8
2022	3.2	2.9
2032	2.5	2.2
2042	2.0	1.7
2052	1.5	1.2

The projected consequences for output per capita growth of high unemployment and the associated moderation in migration are detailed in Table 4.12 below. The tables show that the most significant impact of increased unemployment on output growth would be in the first 5 years of the projection period. As the table reports the growth in output per head, not the level of output per head, the figures are possibly misleading. The lack of apparent difference in growth rates in later years could mask more significant differences in the level of output per head under different employment scenarios.

Table 4.12: Principal Economic Growth Rates

	Annual Average GDP Growth per capita (%)	
	Central Assumption	High Unemployment
2002-2007	3.1	2.4
2008-2012	2.9	2.8
2013-2017	2.5	2.3
2018-2022	2.3	2.2
2023-2027	2.6	2.4
2028-2032	2.6	2.6
2033-2037	2.5	2.4
2038-2042	2.3	2.1
2043-2047	2.1	1.9
2048-2052	2.2	2.0

4.3.2 Alternative Productivity Assumptions

The central projection assumes labour productivity growth of 2.8 per cent per annum. An alternative lower productivity growth figure of 1.8 per cent was assumed. Given the current labour productivity estimates, it is unlikely that a reduction in employment in the manufacturing sector, which tends to have higher productivity growth than the service sector, could result in such a low overall rate of labour productivity growth. However, a reduction in manufacturing sector employment coupled with a more widespread drop in productivity growth could cause productivity growth to fall to1.8 per cent.

A drop in labour productivity growth would not have any direct demographic impact. It is possible that a fall in labour productivity could have indirect demographic consequences. For example, reduced productivity growth would probably result in slower wage growth, which could in turn result in less net migration or labour force participation. However, in the absence of any assumptions regarding any direct links between productivity growth and migration or participation, the real PSR does not vary with reduced productivity growth. Consequently, the real PSR is not reported in this case.

Results – Reduced Productivity Growth

Table 4.13 below shows the output per capita growth projections in the central and low productivity growth scenarios. It is clear from the table that the reduction in productivity growth by one percentage point would have a significant impact on per capita output growth, reducing it by approximately one percentage point in each period. The table provides a demonstration of the importance of productivity growth in ensuring sustained increases in living standards.

Table 4.13: Principal Economic Growth Rates

	Annual Average GDP Growth per capita (%)	
	Central Assumption	Low Productivity Growth
2002-2007	3.1	2.1
2008-2012	2.9	1.9
2013-2017	2.5	1.5
2018-2022	2.3	1.3
2023-2027	2.6	1.6
2028-2032	2.6	1.6
2033-2037	2.5	1.5
2038-2042	2.3	1.3
2043-2047	2.1	1.1
2048-2052	2.2	1.2

4.3.3 Increased Pension Age

One of the most commonly suggested and widely expected policy responses to the issue of demographic ageing is an increase in the retirement age. Three options are considered here. The first is to increase the retirement age to 66 in 2012 and to leave it unchanged for the rest of the period. The second to increase the retirement age to 66 in 2012 and to further increase it to 67 in 2022 and to then leave it unchanged. The third assumption is to further increase the retirement age to 68 in 2032.

A number of simplifying assumptions were required to derive the PSR and output growth rates under the assumption of increasing retirement ages. One of these assumptions was that the participation rates of those above 65 in the workforce are the same as the 60-64 cohort.

Results – Increased Pension Ages

While increasing the retirement age does not directly influence the actual demographic profile of the population, it naturally changes the PSR. Table 4.14 below details the real PSR under the central assumption scenario and the three alternatives. The table shows that increasing the retirement age increases the real PSR in each case. The increase in the real PSR is progressively larger as the pension age increases.

It is notable that the real PSR of 1.9 by 2052 under the extension of the retirement age to 68 is the highest under any of the alternative assumptions considered here. While it would be mistake to imply any equivalence of the feasibility or likelihood of the different assumptions, the relative increase in the PSR between different assumptions is of obvious policy relevance.

Table 4.14: Support Ratios Low Fertility

	Real PSR			
	Central Assumption	66 by 2012	67 by 2022	68 by 2032
1991	2.9	2.9	2.9	2.9
2002	4.1	4.1	4.1	4.1
2012	4.0	4.4	4.4	4.4
2022	3.2	3.4	3.7	3.7
2032	2.5	2.7	2.9	3.2
2042	2.0	2.1	2.3	2.5
2052	1.5	1.6	1.7	1.9

Table 4.15 below details the different rates of output per capita growth. The growth rates are reported to two decimal places due to the small differences. The main result from the table is that there generally is little difference in the growth rates. Generally, output growth rates are greater the higher the retirement age. Consequently, increased retirement ages increase the capacity to support pensions.

Table 4.15: Principal Economic Growth Rates

	Annual Average GDP Growth per capita (%)			
	Central Assumption	66 by 2012	67 by 2022	68 by 2032
2002-2007	3.11	3.11	3.11	3.11
2008-2012	2.89	3.02	3.02	3.02
2013-2017	2.47	2.49	2.49	2.49
2018-2022	2.33	2.29	2.48	2.48
2023-2027	2.56	2.52	2.53	2.53
2028-2032	2.64	2.69	2.71	2.92
2033-2037	2.47	2.48	2.50	2.51
2038-2042	2.28	2.30	2.33	2.35
2043-2047	2.10	2.10	2.15	2.20
2048-2052	2.23	2.22	2.21	2.22

4.3.4 Unfavourable Economic Conditions

The central projection scenario depicts the demographic and economic consequences of an ageing population under a set of quite favourable assumptions. The assumed unemployment rate of 6 per cent is low in comparison to rates currently experienced in other developed countries. In addition, the productivity growth rate of 2.8 per cent is high relative to rates experienced in OECD countries recently and the central migration scenario assumes sustained immigration over the projection period.[4]

Accordingly, a set of projections based on unfavourable migration, employment and productivity assumptions was made to provide a counterpoint to the central assumption scenario. The assumptions made in the unfavourable conditions scenario include: the low migration scenario detailed in Table 4.4; the base level of female participation assumed in the central assumptions scenario; the high unemployment scenario detailed in Table 4.10; and the low labour productivity growth figure of 1.8 per cent per annum. These assumptions are summarised in Table 4.16. below.

[4] Estimates of OECD labour productivity growth for 1995-2005 are approximately 2 per cent per annum.

Table 4.16: Unfavourable Conditions Assumptions

Migration	Net migration falling to zero by 2016
Participation	Baseline CSO participation assumption
Unemployment	10 per cent average unemployment rate
Productivity Growth	1.8 per cent labour productivity growth

Results – Unfavourable Economic Conditions

The results of this set of unfavourable assumptions are presented in Tables 4.18 and 4.19 below. The difference in the real PSR between the central and unfavourable scenario is not pronounced over the first two decades of the projection period. However, the difference becomes significant in the last two decades of the projection. The projected real PSR of 1.2 by 2052 is at the lowest level of any of the projections in this report.

Table 4.17: Support Ratios

	Real PSR	
	Central Assumption	Unfavourable Scenario
1991	2.9	2.9
2002	4.1	4.1
2012	4.0	3.8
2022	3.2	2.9
2032	2.5	2.2
2042	2.0	1.7
2052	1.5	1.2

Table 4.18 below contains the projected results for output per capita growth under the central and unfavourable scenarios. The table shows that output growth would be much lower under the unfavourable assumptions. By the end of the projection period, the increases in living standards would be less than half of those under the central assumptions. Such low growth in output per capita would seriously exacerbate the challenges in meeting the needs of an ageing population, significantly reducing the capacity to support pensions.

The analysis shows that an unfavourable set of economic conditions would have a negative effect on the demographic situation as measured by the real PSR. However, the really significantly negative effect of poor economic conditions would be on output per capita growth.

Table 4.18: Principal Economic Growth Rates

	Annual Average GDP Growth per capita (%)	
	Central Assumption	Unfavourable Scenario
2002-2007	3.0	1.4
2008-2012	2.9	1.8
2013-2017	2.5	1.3
2018-2022	2.4	1.2
2023-2027	2.5	1.4
2028-2032	2.6	1.6
2033-2037	2.4	1.4
2038-2042	2.3	1.1
2043-2047	2.1	0.9
2048-2052	2.3	1.0

4.4 Summary of Key Points

Sensitivity of PSRs to Demographic Factors

The central assumption scenario assumes that the Total Fertility Rate will drop from 1.98 in 2002 to 1.85 by 2011. An alternative higher fertility scenario assumes the TFR will increase to 2.2 by 2017 and remain constant for the remainder of the projection period. A lower fertility scenario assumes a drop in the TFR to 1.5 by 2017.

Different fertility assumptions have no discernable effects on the real PSR until 2032. This lag exists between the change in fertility rates and the effect on the PSR because it takes many years for a change in the number of births to begin to have an effect on the labour market.

Increasing the fertility rate to 2.2 does not produce a pronounced increase in the real PSR by 2052. It is clear that an increase in fertility rates to above the 2.1 replacement ratio will not be sufficient to restrain the real PSR from falling to low levels.

Initially, any increase in the population due to higher fertility will act as a drag on output per capita growth. Increased fertility moderates the growth in output per capita initially, eroding the overall capacity to pay for old age dependants in the short run as childhood dependency increases. However, as the increased numbers of children enter the workforce, they then ultimately act to boost output per capita growth in the long run.

High net migration can raise the real PSR somewhat, however it cannot reverse the underlying downward trend. While migrants swell the working age population, these workers will themselves inevitably age too. Migrant inflows may be useful in moderating imbalances between those of working age and those above, but very high sustained net migration would be required to reverse the underlying trend of increasing PSRs.

Increased female participation will bring about a marginal increase in the real PSR. The effects of increased participation are transitory and can only be achieved once.

One of the most commonly suggested and widely expected policy responses to the issue of demographic ageing is an increase in the retirement age. If the retirement age were to be increased progressively to 68 years by 2032, the real PSR would rise from 1.5 to 1.9 at the year 2052. This has the largest impact on the PSR of any of the demographic scenarios considered. Generally, output growth rates are greater the higher the retirement age. Increased retirement ages increase the capacity to support the ageing population.

Sensitivity of PSRs to Economic Factors

The central assumption assumes that unemployment will gradually increase from low levels in 2002, resulting in an average rate of 6 per cent for the whole period.

An alternative assumption of high unemployment assumes that joblessness will increase rapidly over the first 20 years of the projection period, leading to an average rate of 10 per cent over the projection period. An additional assumption of reduced net migration was required in the case of high unemployment, as it would be inconsistent to assume sustained net migration with poor employment prospects. The comparatively high rate of unemployment of 10 per cent coupled with reduced net migration induces a significant reduction in the real PSR.

The central projection assumes labour productivity growth of 2.8 per cent per annum. An alternative lower productivity growth figure of 1.8 per cent was assumed. In the absence of any assumptions regarding any direct links between productivity growth and population or participation, the real PSR does not vary with reduced productivity growth.

A reduction in productivity growth by one percentage point would have a significant impact on per capita output growth, reducing it by approximately one percentage point in each period. This demonstrates the importance of productivity growth in enhancing the capacity of the economy to accommodate high PSRs.

A set of projections based on unfavourable migration, employment and productivity assumptions was made to provide a counterpoint to the central

assumption scenario. The difference in the real PSR between the central and unfavourable scenario is not pronounced over the first two decades of the projection period. However, the difference becomes significant in the last two decades of the projection. The projected real PSR of 1.2 by 2052 is at the lowest level of any of the projections.

5. Assessment of Results

5.1 Appraising Demographic Ageing

The PSR is a frequently used measure of the level of dependency of retirees on the working age population. The real PSR used in this report is a more meaningful measure of dependency, especially in relation to the sustainability of a tax funded pension system.

Compared to the PSR, the projected decline in the real PSR is less pronounced. Both the PSR and real PSR were at their lowest levels for the past 20 years in 1991. The PSR will return to its 1991 low more quickly than the real PSR. In addition, the PSR projected for 2052 is approximately 40 per cent of its 1991 low, while the 2052 real PSR is projected to be proportionately higher at about 50 per cent. In short, compared to the PSR the real PSR provides a moderately less demanding projection of the demographic challenge of supporting pensions.

5.2 Impact of Changing Economic Circumstances

The real PSR depends not only on demographics but on economic conditions too. Consequently, it is important to consider the prospects for the real PSR under a variety of economic conditions.

The central projection presented in Section 3 uses an optimistic set of assumptions regarding the rates of employment and productivity growth. Projections of the real PSR under a set of unfavourable economic conditions in Section 4 show how economic conditions might influence the sustainability of state pensions. Less favourable economic conditions would result in lower numbers of workers and reduced output growth to support retired dependants.

It is important that projections of dependency be made under differing economic circumstances, as economic conditions will affect the ability of the economy to meet the needs of retirees. A purely demographic measure of dependency such as the PSR will not reflect the additional difficulties of a less favourable economic environment. Informed policy planning should be on the basis of expectations of a variety of contingent economic conditions.

5.3 Policy Implications

Section 3 of this report presented the central results of the model and assumptions regarding employment and productivity growth. These results included the PSR, the real PSR and output per capita growth. The results show that Ireland's demographic situation will undergo profound change over the next 45 years. While there will be significant change, these changes are far more advanced in European populations than they are in Ireland. It still will be

many years before Ireland's support ratios are equal to those in other European nations today.

Section 4 reviewed the outcomes in terms of the real PSR and output per capita growth rates under a range of different assumptions. These results show the sensitivity of outcomes to different circumstances and give an indication of the relative effectiveness of different policy options.

The principal conclusions regarding the policy options are summarized under the following headings.

5.3.1 Fertility

The indications are that a significant increase in the Irish TFR to 2.2 would not reverse the decline in the real PSR. Such an increase in fertility would increase the real PSR by about 8 per cent over the central scenario by 2052. While it would moderate the reduction in the real PSR, the results are not that significant given the efforts that presumably would be required for the State to influence individuals' fertility decisions to such a degree.

Evidence from the lower fertility assumption indicates that a fall in the TFR to European levels would appreciably add to the reduction of the real PSR, reducing the 2052 real PSR by about 7 per cent. Consequently, while there may not be a strong rationale to increase fertility rates, there may be arguments to support current levels.

It is also important to remember that while changing fertility rates will have an immediate effect on child support rates, the impact on the pensioner support ratios will be subject to lengthy lags. However, changes to the child support ratios will have an impact on the overall capacity to support pensioners.

5.3.2 Migration

The different migration scenarios considered here indicate that migration can be useful in moderating the impact of population ageing on dependency support ratios. For instance, the high migration scenario would result in a 2052 real PSR 14 per cent higher than the central assumption. However, the evidence indicates that migration is not a panacea for the challenge of population ageing.

While an influx of migrants can boost the working age population over a short period of time, the migrant population will themselves age eventually. Increasingly large flows of migrants would be required to maintain a high ratio of the working age population to retirees. This is probably not feasible, as increasing population growth could bring its own problems of congestion. There could also be significant social and cultural difficulties in integrating very large proportions of foreigners into the indigenous population.

Projections based on high levels of net migration falling off sharply indicate that migratory flows that fluctuate widely over time could be problematic. Migratory flows that add a large number of people to an existing demographic bulge could actually exacerbate the problem. One policy import is that migration flows might be used deliberately to smooth demographic bulges in the population in the long term.

The overall policy implication of the results is that migration can have a beneficial role in relieving falling PSRs, but that it must be considered carefully. If possible, migration should be managed in a way that ensures sustained net migration rather than heavily fluctuating flows in the long run. It should be recognised that uneven migration flows may actually aggravate the problem of demographic ageing. These considerations assume a significant degree of control over migratory flows, which may be absent in an enlarged European Union context.

5.3.3 Participation

The exercise in Section 4 showed that increased participation can raise the real PSR. However, it should be recognised that the scope for increasing participation is limited. Irish male participation rates are already high. Female participation rates could increase towards Scandinavian levels, but once this is achieved further increases are not likely to be feasible. The results indicate that increased female participation would raise the 2052 real PSR by a modest 5 per cent over the central scenario.

Given that much of the scope for increased participation lies with women, careful consideration should be given to any possible policy conflicts between increasing female participation rates and maintaining fertility rates. Policies that promote both child bearing and workforce participation may be necessary if the two goals are to be pursued simultaneously.

5.3.4 Employment

The projection exercise shows that sustained high levels of employment are important in maintaining high real PSRs. In addition, sustained high employment will ensure overall adult dependency is kept low, ensuring greater capacity to support pensions. However, there is little additional policy import from the conclusion that low unemployment is important, as low unemployment is already a key macroeconomic and social policy goal.

5.3.5 Retirement Age

A significant result of the model is that increasing the retirement age has a pronounced effect on the projected real PSR. Progressive increases to the retirement age, staggered over ten year periods can raise the real PSR significantly. In percentage terms, increasing the retirement age to 66, 67 and

68 would increase the 2052 real PSR to 6, 14 and 22 per cent above that of the central scenario respectively.

Given the assumed difficulties with increasing fertility rates, the possible problem of maintaining significant net migration and the limits to increasing participation rates, increasing the retirement age appears an attractive policy in theory. The theoretical appeal of increasing the retirement age is bolstered when the increases in life expectancy and the increasing postponement of the young joining the workforce due to increased education participation are taken into account. If people are living longer and spending longer in education it would seem natural that working lives should be extended.

The policy option of increasing the retirement age also has the benefit of reduced uncertainty. It is relatively easy to project the future retired population, while long run changes to variables such as the fertility rate or net migration cannot be projected accurately.

Table 5.1: Increase in 2052 real PSR

Scenario	Real PSR excess over central scenario (%)
High Fertility	8
High Migration	14
Increased Participation	5
Retirement Age 66	6
Retirement Age 67	14
Retirement Age 68	22

Table 5.1 above details the percentage increase in the 2052 real PSR over the central assumption scenario. It shows that of the alternative assumptions considered, increasing the retirement age is highly effective at raising the real PSR. An increase in the retirement age by two years to 67 will bring about a increase in the real PSR that is larger than that brought about by either an increase in fertility or female participation and almost equal the increase due to a high migration assumption. An increase in the retirement age by 3 years increases the real PSR by more than any other alternative assumption.

5.4 Feedback Effects

5.4.1 Introduction

The model of population, employment and output growth used in this report is relatively simple. It does not feature feedback effects, whereby changes to one variable results in a change in the values of other variables, influencing the output of the model both directly and indirectly. A simple model that omits such feedback effects could overlook some significant results.

There is little discussion in the literature on the nature and scale of possible feedback effects. Consequently, the understanding of them is weak and there is considerable uncertainty regarding their likely effects. While an informed analysis of the issues can indicate what the effects might be, such discussions remain largely speculative. This section describes what feedbacks might prove significant and demonstrates why expectations of their net effects are ambiguous in many cases.

5.4.2 Fertility

One example of a feedback effect is the influence of varying levels of migration on the fertility rate. Ireland has high fertility rates relative to many other developed countries. Fertility rates in the countries of origin of the most recent wave of migrants from EU accession states tend to be very low. It is unclear whether immigrants would adjust their fertility rates upward on arriving or not.

It is understood that fertility can increase in response to improved economic conditions. Consequently, it may be expected that migrants from less prosperous Central and Eastern European nations may increase their fertility on arrival in Ireland. However, if many young working age migrants do not plan to stay in Ireland in the long term, they may postpone families until they return home, in which case migrant fertility is likely to remain low.

Fertility is also likely to be heavily influenced by cultural factors. This would in part account for the relatively high levels of fertility in Ireland relative to comparable European nations. For this reason it may be unreasonable to expect migrant fertility to converge to indigenous levels.

It is also important to acknowledge that there is considerable heterogeneity amongst migrant groups, so fertility rates may vary widely. In the absence of any clear indication on how migration might influence fertility, fertility rates are assumed independent of migratory flows in the model developed here.

5.4.3 Labour Productivity Growth

Another concern is how labour productivity growth might change as the workforce ages. The model assumes no feedback to labour productivity growth from an ageing population. It is assumed to be independent of the aggregate age of the workforce and constant throughout the projection period.

Labour productivity growth has three principal components. The first is capital deepening, which is the increase in capital per worker. The second is labour quality growth, which includes the increase in human capital, such as the rise in the aggregate level of education in the workforce. The third is total factor productivity growth, the increase in output that is not attributed to additional inputs or productivity growth.

Firstly, it is ambiguous if any capital deepening or shallowing will occur as society ages. Capital deepening may occur if a significant increase in saving occurs. The lifecycle model of consumption states that people accumulate capital as they age up until retirement, then while in retirement they dissave. Accordingly, as the population ages, on aggregate the Irish economy may see significant growth in wealth accumulation, not least as a result of ongoing property wealth accumulation. This significant wealth accumulation could lead to capital deepening, increasing the total stock of capital per worker. However, some commentators predict the converse, noting that the dissaving of retirees could result in capital shallowing. It is not clear whether the increased savings effect of older workers, or the dissaving effect of retirees will dominate.

In addition, it is not clear if any increase or decrease in savings on a national level will actually lead to capital deepening or shallowing within Ireland. In an era of highly mobile capital flows it is expected that a domestic surplus or shortfall of capital will result in a flow of investment, out of or into Ireland. Consequently, if there is sufficient international capital mobility and sustained levels of available capital globally, then there may in fact be little significant change to the level of capital per worker.

Secondly, there is some ambiguity about the effects of demographic ageing on labour quality. As older workers who received less formal education retire and are replaced with progressively better educated workers (assuming education participation continues to increase), labour quality growth will be sustained, supporting labour productivity growth. However, this labour quality growth could be offset by a countervailing effect, by which the increased average age in the workforce could drive down labour quality growth, as it is suggested that older workers are less flexible in adopting new work practices.

As the effects of population ageing on labour productivity growth appear ambiguous they were omitted from the model. However, it is important to recognise that there may be some significant effects of demographic ageing on labour productivity growth and hence economic growth.

5.4.4 Composition of Demand

Another possible feedback effect that has not been included in the model is the possible impact of population ageing on demand. Lifetime consumption generally peaks in early middle age before decreasing towards and after retirement. Consequently, there may be uneven changes in consumer demand, as large cohorts approach their peak consumption years and then reduce consumption.

The changes in consumption may affect the type as well as the scale of consumption. It is expected that consumer demand will shift away from goods to services. This change has two causes, the first is that as individuals age they

tend to consume a higher proportion of services and the second is that increases in income tend to lead to increased service consumption.

Large shifts in consumer demand towards services could have important consequences for employment and productivity growth. Increased demand for services will increase employment in the service sector, which is labour intensive. If labour supply is not able to meet the demands of a growing service sector, wage inflation could emerge and threaten the economy's competitiveness. This problem could be particularly acute in specific sectors where skills shortages may arise, such as healthcare. Also, as mentioned above, the service sector tends to have low productivity growth. So the emergence of service dominated consumer demand could result in a slower growing economy.

To conclude, feedback effects are difficult to predict and may vary in their significance. Much broader research would be required to provide a more thorough analysis of the many and varied possible feedback effects. Despite the considerable difficulties in anticipating feedback effects, it is important to acknowledge their potential to significantly influence demographic and economic outcomes.

5.5 The PSR Analysis and Policy-Making

The analysis of PSR ratios depicted above offers insights into the scale of the problem which society may face in making provision for older people. However, in interpreting the results for policy making, there is a need to consider a number of issues that are not directly considered in the analysis. These issues combine to reduce the scale of the problem facing society from falling PSRs.

The first centres on the capacity of the working population to support the retired population through income transfers. This is partly dependent on the other claims on the incomes of the working population. Table 3.8 estimated a Total Support Ratio (TSR) which took account of the aggregate proportion of both younger and older people, who are dependent on the working age population. The analysis indicated that the total support ratio would continue to rise in the short to medium term and would not fall back to 1991 levels until 2042. This positive trend is related to the declining proportion of children in the population. The fact that the working age population will in future have fewer children to support will raise the rate of growth in the per capita income of the under 65 age group above per capita income growth for the population as a whole. If, for example, pension provision is indexed to per capita income, then the impact of falling PSRs will be partly offset by the increased capacity of society to support such pensions. It would be possible to assess this impact within the model.

The capacity to fund pensions is also related to the extent to which pensions provision keeps pace with real earnings. The real PSR is a poor indicator of

pension affordability, if pensions are inflated at a rate below the real earnings rate of increase. If factor shares to labour remain constant over the long term, then real earnings will rise in line with productivity growth. The analysis has shown, however, that real GDP per capita will grow more slowly than productivity in our base case. If pensions were inflated in line with real GDP per capita, the capacity of the workforce to provide for such pensions would be enhanced. While there would be a negative impact on relative *income* poverty, such a policy would nevertheless ensure that the pension population shares in the fruits of economic growth and thus obtains very real increases in their standard of living.

Finally, the PSR analysis implicitly assesses the capacity of society to support the population of older people out of current income. However, because the base case scenario assumes relatively strong growth in the economy, it may be assumed that this will lead to wealth accumulation. In the Irish context, where home ownership is high, the contribution of inherited wealth is likely to be large for future retiring generations.

With lower fertility rates, future generations reaching retirement age are likely to be in receipt of inherited housing stock that is distributed among a small number of siblings. These will then at pension age have one house and, at least, a significant share in another house. This will create a consumption-in-retirement resource through sale or equity release of the second housing asset. Even if future generations were to dispense with home ownership because of anticipation of inherited housing wealth, this would release resources for savings and investment. Thus, increased ownership of housing assets is an important form of positive feedback that tends to reduce the scale of the pensions problem.

Equally important, of course, is the distribution of inherited housing wealth. Those who are better off are more likely to acquire inherited housing assets, whereas those at the lower end of the income distribution are not. This suggests that while society in general may have the resources to provide for pensions, the problems of pensions for the underprovided element in society remains. This, in turn, has implications for pensions' policy. In such a future, would a means tested approach to state pension provision prove to be more attractive, allowing greater pension provision for those most in need?

6. Findings and Further Issues

6.1 Demographic Projections

The central projections indicate that Ireland's population will reach 5 million by 2017 and exceed 6 million by 2042. Population growth is expected moderate over the projection period, slowing significantly after 2022. Average annual population growth over the period is projected to be 1.0 per cent.

Currently the majority of the population are of working age and there are relatively few people aged 65 or older. By 2037 the most populous age groups will be those in their 50s and the number over 65 will be dramatically higher compared to 2002. By 2052 there will be significant numbers of those in the oldest age groups of 80-84 and 85+.

The population projections contain some lumpiness. By 2052 there will be population bulges at three distinct age groups, the oldest bulge being the cohort of people born during the Irish baby boom of the 1970s and early 80s and subsequent population bulges where 'echoes' of that baby boom occur.

The effects of population bulges are significant, as large cohorts arrive at particular life stages at once. Consequently, the increase in the number of people of pensionsable age will occur in an uneven fashion.

6.3 Economic Projections

Annual average output growth is predicted to decrease from above 5 per cent per annum initially to just over 2.7 per cent by 2052. Growth in output per capita is projected to fall from 3 per cent per annum to close to 2 per cent over the projection period.

As the demographic burden increases over the period, output growth moderates too. However, the reduction in output growth will not be particularly severe, and the significant rates of growth still occurring will help society meet the needs of an ageing population.

The output growth projections are heavily dependent on the rate of productivity growth. A failure of the Irish economy to achieve strong rates of productivity growth will result in lower output growth. The need to achieve sustained increases in productivity will become increasingly important, as the demographic projections show that employment growth will cease to be a significant contributor to output growth over the period.

Annual employment growth will moderate from near 2 per cent to very low levels towards the end of the projection period, and is actually projected to be negative in the final two projection periods.

6.4 Trends in Support Ratios

The nominal PSR is projected to fall from around 6.3 in 2007 to approximately 2.3 by 2052. The change in the PSR is projected to occur relatively evenly over the period.

The 80+ PSR falls over the projection period too, but its path is less even. The drop in the 80+ PSR is not pronounced initially, but by the middle of the projection period the reduction in the 80+ PSR becomes more significant.

The real PSR is the ratio of people in employment to those over the age of 65. It is termed the real PSR as it more accurately reflects the level of economic dependence by adjusting the working age population to account for participation and unemployment rates. The real PSR is considered more representative, as changes to the level of employment may have significant contributing or countervailing effects on the actual level of dependency.

The real PSR is predicted to fall from 4.2 currently to 1.5 by 2052. The real PSR will not decline to 1991 levels until the 2022-2027 period. This means that the increasing burden, while significant, will be within the range of recent experience for approximately another 20 years. Moreover, the total support ratio will not fall to 1991 levels until 2042. This analysis serves as a reminder that the future change in the demographic structure should not be regarded as having catastrophic economic impacts even in the medium to long term.

6.5 Sensitivity of PSRs to Demographic Factors

The central assumption scenario assumes that the Total Fertility Rate will drop from 1.98 in 2002 to 1.85 by 2011. An alternative higher fertility scenario assumes the TFR will increase to 2.2 by 2017 and remain constant for the remainder of the projection period. A lower fertility scenario assumes a drop in the TFR to 1.5 by 2017.

Different fertility assumptions have no discernable effects on the real PSR until 2032. This lag exists between the change in fertility rates and the effect on the PSR because it takes many years for a change in the number of births to begin to have an effect on the labour market.

Increasing the fertility rate to 2.2 does not produce a pronounced increase in the real PSR by 2052. It is clear that an increase in fertility rates to above the 2.1 replacement ratio will not be sufficient to restrain the real PSR from falling to low levels.

Initially, any increase in the population due to higher fertility will act as a drag on output per capita growth. Increased fertility moderates the growth in output per capita initially, eroding the overall capacity to pay for old age dependants in the short run as childhood dependency increases. However, as the increased

numbers of children enter the workforce, they then ultimately act to boost output per capita growth in the long run.

High net migration can raise the real PSR somewhat, however it cannot reverse the underlying downward trend. While migrants swell the working age population, these workers will themselves inevitably age too. Migrant inflows may be useful in moderating imbalances between those of working age and those above, but very high sustained net migration would be required to reverse the underlying trend of falling PSRs.

Increased female participation will bring about a marginal increase in the real PSR. The effects of increased participation are transitory and can only be achieved once.

One of the most commonly suggested and widely expected policy responses to the issue of demographic ageing is an increase in the retirement age. If the retirement age were to be increased progressively to 68 years by 2032, the real PSR would rise from 1.5 to 1.9 at the year 2052. This has the largest impact on the real PSR of any of the demographic scenarios considered. Generally, output growth rates are greater the higher the retirement age. Increased retirement ages increase the capacity to support the ageing population.

6.6 Sensitivity of PSRs to Economic Factors

The central assumption assumes that unemployment will gradually increase from low levels in 2002, resulting in an average rate of 6 per cent for the whole period. An alternative assumption of high unemployment assumes that joblessness will increase rapidly over the first 20 years of the projection period, leading to an average rate of 10 per cent over the projection period. An additional assumption of reduced net migration was required in the case of high unemployment, as it would be inconsistent to assume sustained net migration with poor employment prospects.

The comparatively high rate of unemployment of 10 per cent coupled with reduced net migration induces a significant reduction in the real PSR.

The central projection assumes labour productivity growth of 2.8 per cent per annum. An alternative lower productivity growth figure of 1.8 per cent was assumed. In the absence of any assumptions regarding any direct links between productivity growth and population or participation, the real PSR does not vary with reduced productivity growth.

A reduction in productivity growth by one percentage point would have a significant impact on per capita output growth, reducing it by approximately one per cent in each period. This demonstrates the importance of productivity growth in enhancing the capacity of the economy to accommodate high PSRs.

A set of projections based on unfavourable migration, employment and productivity assumptions was made to provide a counterpoint to the central assumption scenario. The difference in the real PSR between the central and unfavourable scenario is not pronounced over the first two decades of the projection period. However, the difference becomes significant in the last two decades of the projection. The projected real PSR of 1.2 by 2052 is at the lowest level of any of the projections.

6.7 Key Conclusions

The key conclusions of this report are as follows:

- The real PSR is a useful measure of dependency that accounts for changing labour market conditions.
- Both the PSR and real PSR will fall significantly over the next 45 years, but the change will be less pronounced in the case of the real PSR.
- Ireland is currently in a very favourable demographic position that owes to a unique period of demographic transition. Consequently, current support ratios are very unlikely to be achievable in the future.
- Relative to other European nations, Ireland will remain in a more favourable demographic situation despite significant falls in support ratios.
- Support ratios will fall, but they will not fall below levels experienced in the recent past in the short run.
- Improvements to demographic or labour market conditions will not reverse the fall in the real PSR, but may moderate the decline.
- Increases in either fertility or migration are unlikely to solve the problem of demographic ageing.
- Increasing the retirement age can offer significant increases in the real PSR.
- Changing economic conditions will significantly impact on the ability to meet the needs of retired dependants.

Appendix 1.

Figure A.1: Population Projections under M1 F2 Assumptions – Goodbody Economic Consultants and the CSO

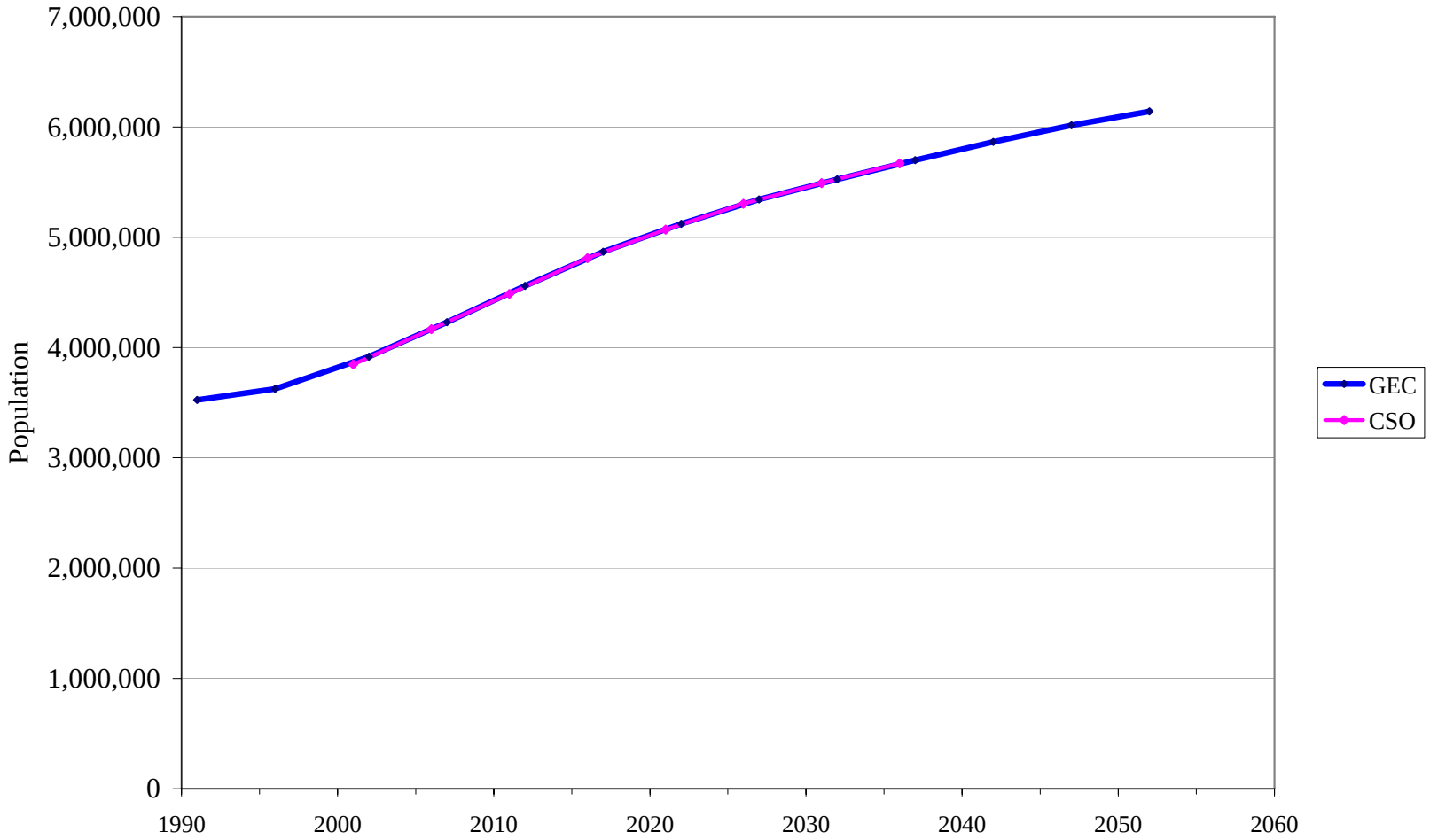


Table A.1: Population Distribution by age 1991-2052

	Population (Thousands)												
Age	**1991**	**1996**	**2002**	**2007**	**2012**	**2017**	**2022**	**2027**	**2032**	**2037**	**2042**	**2047**	**2052**
0-4	274	250	278	338	362	362	348	331	326	338	351	355	350
5-9	319	283	264	291	349	371	369	355	337	333	344	358	362
10-14	348	326	286	272	298	354	375	373	358	341	336	348	361
15-19	335	340	313	276	262	286	341	362	359	344	327	322	334
20-24	267	293	328	346	299	272	288	340	357	354	340	322	318
25-29	246	259	313	391	398	340	306	319	369	385	383	368	351
30-34	249	261	305	345	418	419	357	322	334	383	400	397	383
35-39	238	256	291	323	360	429	428	366	330	341	390	407	404
40-44	226	240	272	301	331	365	433	431	369	333	345	394	411
45-49	188	225	250	277	305	334	367	434	433	371	336	347	396
50-54	157	187	231	253	279	306	334	367	434	433	372	337	349
55-59	143	154	197	230	252	278	304	332	365	431	431	371	337
60-64	135	138	154	194	226	247	273	299	327	361	427	427	369
65-69	131	127	133	147	185	216	237	263	290	318	352	418	419
70-74	109	113	112	120	133	169	200	221	247	274	303	337	401
75-79	84	84	90	92	101	114	147	175	197	222	249	277	311
80-84	49	56	59	64	67	75	87	114	139	159	183	208	235
85+	29	35	42	47	53	60	70	83	110	141	173	210	250
Total	3,526	3,626	3,917	4,308	4,679	4,996	5,262	5,489	5,680	5,862	6,039	6,201	6,338

Source: Goodbody Economic Consultants

Table A.2: Female Population Distribution by age 1991-2052

	Population (Thousands)												
Age	**1991**	**1996**	**2002**	**2007**	**2012**	**2017**	**2022**	**2027**	**2032**	**2037**	**2042**	**2047**	**2052**
0-4	133	122	136	164	175	175	168	160	158	164	170	172	170
5-9	155	138	128	143	170	180	179	172	164	161	167	174	176
10-14	169	159	140	133	146	172	183	181	174	166	163	169	176
15-19	164	166	153	135	128	141	166	176	174	167	159	156	162
20-24	130	144	163	176	152	137	145	169	176	175	168	159	157
25-29	126	130	157	195	203	173	155	161	183	191	190	182	174
30-34	126	133	152	171	208	212	181	162	168	190	198	196	189
35-39	119	130	146	160	178	213	216	185	165	171	194	201	200
40-44	112	120	137	150	164	180	214	218	186	167	173	195	203
45-49	92	112	125	139	152	165	181	215	218	187	168	174	196
50-54	77	92	114	126	140	152	165	181	215	218	187	168	174
55-59	71	76	97	115	126	139	152	164	180	214	217	187	168
60-64	69	69	77	97	113	124	138	150	163	179	212	216	186
65-69	70	67	68	74	94	110	121	134	147	159	176	209	213
70-74	60	62	60	63	69	88	104	115	128	141	154	170	203
75-79	48	49	52	52	55	62	79	94	105	118	131	144	160
80-84	30	35	37	40	40	44	50	65	78	89	101	114	126
85+	21	24	29	32	37	41	46	54	70	90	109	131	156
Total	1,772	1,826	1,971	2,165	2,350	2,508	2,641	2,756	2,853	2,946	3,035	3,117	3,187

Source: Goodbody Economic Consultants

Table A.3. Male Population Distribution by age 1991-2052

	Population (Thousands)												
Age	**1991**	**1996**	**2002**	**2007**	**2012**	**2017**	**2022**	**2027**	**2032**	**2037**	**2042**	**2047**	**2052**
0-4	141	129	142	174	187	186	179	170	168	174	181	183	181
5-9	163	145	136	148	179	191	190	183	173	171	177	184	186
10-14	179	167	146	139	151	182	193	192	184	175	173	179	186
15-19	171	174	160	141	134	145	175	186	185	177	168	166	172
20-24	136	149	165	170	147	135	143	172	181	180	172	163	161
25-29	121	129	156	196	196	167	151	158	185	194	193	186	177
30-34	123	128	152	174	210	207	176	160	166	193	202	201	194
35-39	119	126	145	163	182	216	211	181	164	170	197	206	205
40-44	114	120	135	151	167	185	219	214	183	166	172	199	208
45-49	95	114	125	138	153	169	186	219	214	184	168	173	200
50-54	80	95	117	127	140	154	169	186	219	215	184	169	174
55-59	72	78	100	116	126	138	152	168	185	218	213	184	168
60-64	66	69	78	97	113	123	135	149	165	182	215	211	182
65-69	61	60	65	73	91	106	117	129	143	159	176	209	206
70-74	49	50	52	57	64	82	96	107	119	133	149	167	199
75-79	36	35	37	40	45	52	68	81	92	104	118	133	151
80-84	19	21	22	24	27	31	37	50	61	70	82	94	108
85+	9	11	12	14	16	19	23	29	40	52	64	78	95
Total	1,753	1,800	1,946	2,143	2,329	2,488	2,621	2,733	2,827	2,916	3,004	3,084	3,151

Source: Goodbody Economic Consultants

Appendix 2.

Alternative Fertility Assumptions

Table A.4: Support Ratios - Low Fertility

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.3	26.6	4.2	2.1
2012	5.8	25.9	4.0	2.0
2017	5.2	24.2	3.6	1.9
2022	4.6	21.9	3.2	2.0
2027	4.2	18.0	2.8	2.0
2032	3.7	14.6	2.5	2.0
2037	3.3	12.1	2.2	1.9
2042	2.9	10.1	1.9	1.7
2047	2.4	8.3	1.6	1.5
2052	2.1	7.0	1.4	1.4

Table A.5: Economic Growth Rates - Low Fertility

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output Growth Per Capita (%)
2002-2007	2.2	5.1	3.1
2008-2012	1.7	4.6	2.9
2013-2017	1.0	3.8	2.6
2018-2022	0.6	3.4	2.5
2023-2027	0.6	3.4	2.8
2028-2032	0.4	3.3	2.8
2033-2037	0.1	2.9	2.5
2038-2042	-0.2	2.6	2.2
2043-2047	-0.6	2.2	2.0
2048-2052	-0.6	2.2	2.1

Table A.6: Support Ratios - High Fertility

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.3	26.6	4.2	2.1
2012	5.8	25.9	4.0	2.0
2017	5.2	24.2	3.6	1.8
2022	4.6	21.9	3.2	1.8
2027	4.2	18.2	2.8	1.7
2032	3.8	15.0	2.5	1.7
2037	3.5	12.8	2.3	1.7
2042	3.1	11.0	2.1	1.6
2047	2.7	9.4	1.8	1.4
2052	2.5	8.2	1.7	1.3

TableA.7: Economic Growth Rates - High Fertility

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output Growth Per Capita (%)
2002-2007	2.2	5.1	3.1
2008-2012	1.7	4.6	2.8
2013-2017	1.0	3.8	2.3
2018-2022	0.6	3.4	2.1
2023-2027	0.6	3.5	2.4
2028-2032	0.6	3.5	2.6
2033-2037	0.6	3.4	2.5
2038-2042	0.4	3.2	2.4
2043-2047	0.2	3.0	2.2
2048-2052	0.3	3.1	2.3

Alternative Migration Assumptions

Table A.9: Support Ratios - Low Migration

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.2	26.6	4.2	2.1
2012	5.7	25.7	4.0	2.0
2017	5.0	23.6	3.5	1.9
2022	4.4	20.9	3.0	1.8
2027	3.9	16.9	2.6	1.8
2032	3.5	13.5	2.3	1.8
2037	3.0	11.2	2.0	1.7
2042	2.6	9.2	1.8	1.5
2047	2.2	7.5	1.5	1.4
2052	1.9	6.2	1.3	1.2

Table A.10: Economic Growth Rates - Low Migration

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output Growth Per Capita (%)
2002-2007	2.2	5.1	3.1
2008-2012	1.5	4.4	2.9
2013-2017	0.6	3.4	2.4
2018-2022	0.0	2.8	2.2
2023-2027	0.1	2.9	2.5
2028-2032	0.1	2.9	2.6
2033-2037	-0.2	2.6	2.4
2038-2042	-0.5	2.3	2.1
2043-2047	-0.8	2.0	1.9
2048-2052	-0.7	2.1	2.1

Table A.11: Support Ratios - High Migration

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.3	26.8	4.3	2.2
2012	6.0	27.0	4.2	2.1
2017	5.4	25.7	3.8	1.9
2022	5.0	23.7	3.4	1.9
2027	4.5	19.9	3.1	1.9
2032	4.1	16.5	2.8	1.9
2037	3.8	14.1	2.5	1.8
2042	3.4	12.2	2.3	1.7
2047	2.9	10.4	2.0	1.6
2052	2.6	9.0	1.8	1.5

Table A.12: Economic Growth Rates - High Migration

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output Growth Per Capita (%)
2002-2007	2.4	5.3	3.1
2008-2012	2.5	5.3	3.0
2013-2017	1.5	4.4	2.5
2018-2022	1.1	3.9	2.4
2023-2027	1.0	3.9	2.6
2028-2032	0.9	3.7	2.7
2033-2037	0.7	3.5	2.6
2038-2042	0.5	3.3	2.4
2043-2047	0.3	3.1	2.2
2048-2052	0.2	3.0	2.2

Alternative Participation Assumptions

Table A.13: Support Ratios - Increased Participation

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.3	26.6	4.2	2.1
2012	5.8	25.9	4.1	2.0
2017	5.2	24.2	3.8	1.9
2022	4.6	21.9	3.3	1.9
2027	4.2	18.1	3.0	1.9
2032	3.7	14.8	2.7	1.8
2037	3.4	12.4	2.4	1.8
2042	3.0	10.5	2.1	1.6
2047	2.5	8.8	1.8	1.5
2052	2.3	7.5	1.6	1.4

Table A.14: Economic Growth Rates - Increased Participation

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output Growth Per Capita (%)
2002-2007	2.3	5.2	3.2
2008-2012	2.3	5.2	3.5
2013-2017	1.3	4.1	2.8
2018-2022	0.6	3.4	2.4
2023-2027	0.6	3.5	2.6
2028-2032	0.5	3.4	2.7
2033-2037	0.3	3.1	2.5
2038-2042	0.1	2.9	2.3
2043-2047	-0.2	2.6	2.1
2048-2052	-0.2	2.6	2.2

Alternative Unemployment Assumptions

Table A.15: Support Ratios - Increased Unemployment and Low Migration

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.2	26.6	4.1	2.1
2012	5.7	25.7	3.8	2.0
2017	5.0	23.6	3.4	1.9
2022	4.4	20.9	2.9	1.8
2027	3.9	16.9	2.5	1.8
2032	3.5	13.5	2.2	1.8
2037	3.0	11.2	1.9	1.7
2042	2.6	9.2	1.7	1.5
2047	2.2	7.5	1.4	1.4
2052	1.9	6.2	1.2	1.2

Table A.16: Economic Growth Rates - Increased Unemployment and Low Migration

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output Growth Per Capita (%)
2002-2007	1.5	4.4	2.4
2008-2012	1.5	4.3	2.8
2013-2017	0.5	3.3	2.3
2018-2022	0.0	2.8	2.2
2023-2027	0.1	2.9	2.4
2028-2032	0.1	2.9	2.6
2033-2037	-0.2	2.6	2.4
2038-2042	-0.4	2.3	2.1
2043-2047	-0.8	2.0	1.9
2048-2052	-0.7	2.1	2.0

Alternative Productivity Assumptions

Table A.17: Support Ratios - Reduced Productivity Growth

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.3	26.6	4.2	2.1
2012	5.8	25.9	4.0	2.0
2017	5.2	24.2	3.6	1.9
2022	4.6	21.9	3.2	1.9
2027	4.2	18.1	2.8	1.9
2032	3.7	14.8	2.5	1.8
2037	3.4	12.4	2.3	1.8
2042	3.0	10.5	2.0	1.6
2047	2.5	8.8	1.7	1.5
2052	2.3	7.5	1.5	1.4

Table A.18: Economic Growth Rates - Reduced Productivity Growth

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output Growth Per Capita (%)
2002-2007	2.2	4.1	2.1
2008-2012	1.7	3.6	1.9
2013-2017	1.0	2.8	1.5
2018-2022	0.6	2.4	1.3
2023-2027	0.6	2.4	1.6
2028-2032	0.5	2.3	1.6
2033-2037	0.3	2.1	1.5
2038-2042	0.1	1.9	1.3
2043-2047	-0.2	1.6	1.1
2048-2052	-0.1	1.7	1.2

Increased Pension Age

Table A.19: Support Ratios - Increased Pension Age 66

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.3	26.6	4.2	2.1
2012	6.3	26.3	4.4	2.1
2017	5.6	24.6	3.9	2.0
2022	5.0	22.2	3.4	2.0
2027	4.5	18.4	3.0	2.0
2032	4.1	15.0	2.7	1.9
2037	3.6	12.7	2.4	1.8
2042	3.2	10.7	2.1	1.7
2047	2.8	9.1	1.8	1.6
2052	2.4	7.7	1.6	1.4

Table A.20: Economic Growth Rates - Increased Pension Age 66

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output Growth Per Capita (%)
2002-2007	2.2	5.1	3.1
2008-2012	1.9	4.7	3.0
2013-2017	1.0	3.8	2.5
2018-2022	0.5	3.4	2.3
2023-2027	0.6	3.4	2.5
2028-2032	0.6	3.4	2.7
2033-2037	0.3	3.1	2.5
2038-2042	0.1	2.9	2.3
2043-2047	-0.2	2.6	2.1
2048-2052	-0.1	2.7	2.2

Table A.21: Support Ratios - Increased Pension Age 67

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.3	26.6	4.2	2.1
2012	6.3	26.3	4.4	2.1
2017	5.6	24.6	3.9	2.0
2022	5.5	22.6	3.7	2.0
2027	4.9	18.6	3.3	2.0
2032	4.4	15.2	2.9	2.0
2037	3.9	12.9	2.6	1.9
2042	3.5	10.9	2.3	1.8
2047	3.0	9.3	2.0	1.6
2052	2.6	7.9	1.7	1.5

Table A.22: Economic Growth Rates - Increased Pension Age 67

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output Growth Per Capita (%)
2002-2007	2.2	5.1	3.1
2008-2012	1.9	4.7	3.0
2013-2017	1.0	3.8	2.5
2018-2022	0.7	3.6	2.5
2023-2027	0.6	3.4	2.5
2028-2032	0.6	3.4	2.7
2033-2037	0.3	3.1	2.5
2038-2042	0.1	2.9	2.3
2043-2047	-0.1	2.7	2.1
2048-2052	-0.1	2.7	2.2

Table A.23: Support Ratios - Increased Pension Age 68

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.3	26.6	4.2	2.1
2012	6.3	26.3	4.4	2.1
2017	5.6	24.6	3.9	2.0
2022	5.5	22.6	3.7	2.0
2027	4.9	18.6	3.3	2.0
2032	4.8	15.5	3.2	2.1
2037	4.3	13.1	2.8	2.0
2042	3.8	11.1	2.5	1.9
2047	3.3	9.5	2.2	1.7
2052	2.8	8.0	1.9	1.6

Table A.24: Economic Growth Rates - Increased Pension Age 68

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output Growth Per Capita (%)
2002-2007	2.2	5.1	3.1
2008-2012	1.9	4.7	3.0
2013-2017	1.0	3.8	2.5
2018-2022	0.7	3.6	2.5
2023-2027	0.6	3.4	2.5
2028-2032	0.8	3.6	2.9
2033-2037	0.3	3.2	2.5
2038-2042	0.2	3.0	2.3
2043-2047	-0.1	2.7	2.2
2048-2052	-0.1	2.7	2.2

Unfavourable Economic Conditions Scenario

Table A.25: Support Ratios - Unfavourable Economic Conditions

	PSR	80+ PSR	Real PSR	TSR
1991	5.4	27.7	2.9	1.6
1996	5.7	26.0	3.2	1.8
2002	6.1	26.4	4.1	2.1
2007	6.2	26.6	4.1	2.1
2012	5.7	25.7	3.8	2.0
2017	5.0	23.6	3.4	1.9
2022	4.4	20.9	2.9	1.8
2027	3.9	16.9	2.5	1.8
2032	3.5	13.5	2.2	1.8
2037	3.0	11.2	1.9	1.7
2042	2.6	9.2	1.7	1.5
2047	2.2	7.5	1.4	1.4
2052	1.9	6.2	1.2	1.2

Table A.26: Economic Growth - Unfavourable Economic Conditions

Period	Average Annual Employment Growth (%)	Average Annual Output Growth (%)	Average Annual Output Growth Per Capita (%)
2002-2007	1.5	3.3	1.4
2008-2012	1.5	3.3	1.8
2013-2017	0.5	2.3	1.3
2018-2022	0.0	1.8	1.2
2023-2027	0.1	1.9	1.4
2028-2032	0.1	1.9	1.6
2033-2037	-0.2	1.6	1.4
2038-2042	-0.4	1.3	1.1
2043-2047	-0.8	1.0	0.9
2048-2052	-0.7	1.1	1.0

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