An evaluation of policies to reduce fiscal pressure induced by population ageing in Australia

Bell, William Paul

Griffith University

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An Evaluation of Policies to Reduce Fiscal Pressure Induced by Population Ageing in Australia

William Paul Bell
Graduate Diploma in Teaching
Bachelor of Science

Department of Accounting, Finance and Economics
Griffith Business School
Griffith University

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Synopsis

Population ageing increases fiscal pressure by increasing the aged to working-age ratio, which simultaneously reduces the growth in government revenue and increases government social outlays. This study evaluates proposed tax and economic growth policies to meet the population ageing induced fiscal pressure in Australia.

The research in this thesis attempts to clarify inconsistencies between these policy proposals.

The literature indicates there are currently two contrasting tax policies recommended to cope with the fiscal pressure induced by an ageing population. The first recommendation known as a ‘pay as you go’ policy (PAYGP) involves progressively increasing taxes to meet increases in fiscal pressure. The second proposal is for a reduction in taxes or ‘tax-cut policy’. It is part of the government’s current policy mix to meet the fiscal pressure, along with an economic growth policy, and no cuts in government services. This study assesses the compatibility of a growth policy to reduce fiscal pressure and a tax-cut policy to increase economic growth. In addition, the proposition that growth in after-tax GDP per capita will continue to overwhelm any tax increases under a PAYGP is assessed under more stringent conditions.

Sensitivity analysis on a simulation model is used to investigate the effect of the tax and the economic growth policies on fiscal pressure and after-tax GDP per capita. This simulation model is based upon the Productivity Commission’s (2005a) model. Fiscal pressure sensitivity analysis investigates: increases in the labour force participation rate (LFPR) and the retirement age; changes in the labour productivity growth rate (LPGR); changes in the mortality, net overseas migration, and total fertility rates; and changes in the tax rate as a percentage of GDP. A 'Tax elasticity of the labour supply' (TELS) is used to simulate the disincentive/incentive effects of increases/decreases in the tax rate. The 'After-tax GDP per capita' sensitivity analysis investigates the PAYGP by measuring sensitivity to the LPGR and the TELS.

Analysis of the policy proposals resulted in the following conclusions. A tax-cut policy to increase the LFPR and LPGR is counterproductive in reducing fiscal pressure but sustainable during the demographic gift phase of population ageing. The PAYGP remains workable with continued growth in after-tax GDP per capita even at a low LPGR and high TELS values. A PAYGP has a greater growth in after-tax GDP per capita than a non-PAYGP with a slightly lower LPGR. Productivity policies to increase the LPGR are ineffective at reducing fiscal pressure but enhance a PAYGP. Participation policies to increase the LFPR and the retirement age are very effective at reducing fiscal pressure. Population policies are only slightly effective or ineffective in reducing fiscal pressure. A suitable policy mix to meet the fiscal pressure includes participation policies to increase the LFPR and a PAYGP enhanced with productivity policies to increase the LPGR to cover the remaining fiscal pressure.

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Statement of Originality

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the dissertation itself.

William Paul Bell

Abbreviations

ABS	Australian Bureau of Statistics
ADR	Aged Dependency Ratio
AIHW	Australian Institute of Health and Welfare
ALGA	Australian Local Government Association
ATMWE	Average Total Male Weekly Earnings
ASP	Age and Service Pensions
CDR	Child Dependency Ratio
CPI	Consumer Price Index
DEST	Department of Education, Science and Training
DEWR	Department of Employment and Workplace Relations
DHA	Department of Health and Ageing
DSP	Disability Support Pension
DVA	Department of Veteran Affairs
EGM	Endogenous Growth Model
ERP	ABS (2004f, table 9) Estimated Residential Population
EU	European Union
FaCS	Department of Family and Community Services
FTE	Full-time equivalent
FTB	Family Tax Benefit
GDP	Gross Domestic Product
GFS	ABS (2005c) Government Finance Statistics
GST	Goods and Services Tax
HECS	Higher Education Contribution Scheme

HFE	Horizontal Financial Equalisation
LCH	Life-cycle Hypothesis
LC-PIH	Life-Cycle-Permeant-Income Hypothesis
LFPR	Labour Force Participation Rate
LPGR	Labour Productivity Growth Rate
MFP	Multifactor Productivity
NOM	Net Overseas Migration
NPV	Net Present Value
NZ	New Zealand
OECD	Organisation for Economic Cooperation and Development
PAYGP	Pay As You Go Policy
PBS	Pharmaceutical Benefits Scheme
PC	Productivity Commission
PIH	Permanent Income Hypothesis
PPS	Parenting Payment Single
RBA	Reserve Bank of Australia
Series A	ABS (2003b, table a9) Population Projection – High
Series B	ABS (2003b, table b9) Population Projection – Medium
Series C	ABS (2003b, table c9) Population Projection – Low
Series II	ABS (2004i) Household and Family Projections Series II
SCRGSP	Steering Committee for the Review of Government Service Provision
SFP	Single Factor Productivity
SPP	Special Purpose Payment
SS&W	Social Security and Welfare

TELS	Tax Elasticity of the Labour Supply
TDR	Total Dependency Ratio
TFR	Total Fertility Rate
TFP	Total Factor Productivity
TRIM	Treasury (1992) Income Retirement Model
UK	United Kingdom
US	United States of America
VET	Vocational Education and Training

Health Premium	Health premium above real growth in GDP per capita
Cumulative NOB	Cumulative NPV of the NOB for 'All levels of government'

When the term 'state' is used it refers to territory also.

1 Introduction

This study examines the effect of population ageing on fiscal pressure over the next fifty years in Australia and the policies proposed to meet that pressure. Fiscal pressure measures the difference between government expenditure and revenue. Population ageing is a process whereby the proportion of the population who are aged increases over time. Government social outlays are the government's expenditures on education, health, and 'Social security and welfare' (SS&W). Population ageing may increase government social outlays and reduce government revenue growth, thereby increasing fiscal pressure.

The OECD (1996) notes that an increase in fiscal pressure may affect many countries, most notably Italy, Greece, Japan and Germany, who have more pronounced population ageing than Australia. Each country funds retirement differently. These differences have major implications for their projected fiscal pressure. The German government is contractually committed to pay retirees generous pensions, which has major consequences for intergeneration transfers. By contrast, in Japan people have higher personal saving and private pensions so moderating the fiscal pressure. Australia sits in between these two extremes.

The OECD (2003) views population ageing and the induced fiscal pressure as a crisis requiring action. However Australian studies argue there is less cause for concern. Day and Dowrick (2004) claim the need for action is exaggerated as there are many ameliorating factors that may reduce fiscal pressure. Guest and McDonald (2000, p. 11) advocate tax increases to meet the fiscal pressure and believe large policy changes are unwarranted. Guest and McDonald (2000) propose a pay as you go policy (PAYGP) of progressively raising taxes to cover increases in fiscal pressure. They calculate that increases in economic growth (standard of living) will more than offset the tax increases. The Treasury (2002, p. 66) advocates decreases in spending growth and/or increases in taxes to cover the projected pressure. The Treasurer (2004, pp. 8, 13-6, 25-6) and Secretary to the Treasurer (Henry 2004, p. 6) advocate tax-cuts and increases in the labour force participation rate (LFPR) to increase economic growth.

It is clear from a revision of the literature that there are uncertainties about the size of the problem and what policy responses are correct.

1.1 Objectives

The research in this study attempts to clarify several issues: first to evaluate whether economic growth policies and proposed changes to tax policy will meet fiscal pressure induced by population ageing; second to investigate whether the 'Tax elasticity of the labour supply' (TELS) has an impact on the proposed policies; third to examine the PAYGP under more realistic assumptions; fourth to examine alternative health expenditure projection methods and their impact on fiscal pressure projections; and fifth to investigate the fiscal pressure the Commonwealth government and state government will face.

This study adds to the literature by extensively investigating the TELS effects on a range of policy proposals within one model; by subjecting the PAYGP to more rigorous tests; and by introducing two new graphical methods as outlined in the methodology.

This study is limited to the extent that savings and international linkages are omitted from the projection. However the savings theory examined in Chapter 2 finds that the population ageing effect on savings is ambiguous. Also Chapter 2 finds that the population ageing effect on international linkages is not conclusive, as other factors appear more significant.

1.2 Significance of the Research

The issues of population ageing and the problem of which policies are best suited to meet the resulting fiscal pressure are important for the citizens in developed economies. Andrieu (1999, p. 29) notes that demographic changes in the 21st century will be greater than at any other time in world history. It may well prove the dominant force shaping world development and policy agendas. Brahs (2001, p. 112) claims the demographic challenge facing countries is daunting but, with prompt action, the provision of suitable pension and health coverage is achievable. The Productivity Commission (2004b, p. xxv) has called population ageing the “biggest foreseeable challenge facing Australia in the next 50 years”. The Productivity Commission (2005a) argues that population ageing creates three related effects: first, a net increase in demand for social outlays and increases in government expenditure on government social outlays; second, a decrease in the proportion of workers causing a decrease the labour supply, which reduces the government’s tax base and revenue; and third, the higher proportion of aged dissaving reduces capital formation, reducing growth, which reduces government revenue growth. These effects without timely and appropriate policy changes to improve growth may combine to create major increases in fiscal pressure and disruptions to household consumption. The Productivity Commission (2004b, p. xxvi) argues population ageing does not constitute a crisis at this stage but its significance should not be underplayed.

This research is significant on a policy level because, as the Treasurer (2004, p. 17) notes, the consequences of making a poor long-term decision will become more difficult to correct with the passage of time. If the government cannot fund social outlays then this research becomes significant on an individual level because with advance warning people will be able to make appropriate plans to cover the future short fall, with moderate adjustments to their lifestyles.

1.3 Study Structure

This study addresses the issues raised above in the following chapters.

The literature review in Chapter 2 introduces Equation (2.1) used throughout this study to describe and model the population ageing effects on GDP. It then covers economic growth and savings theories to predict the effect of population ageing on the economy and to find policy options to reduce fiscal pressure. International linkages and savings are discussed as population ageing is affecting most of Australia's trading partners. This has implications for the current account deficit, capital flows, and world interest rates. The economic growth and savings theories prove ambiguous or inconsistent when applied to population ageing. The chapter thus compares growth rate projections from different simulation models to establish patterns and relates these to the economic theory. The 'Tax elasticity of the labour supply' (TELS) is discussed before it is utilised in a review of economic growth and tax policy proposals to reduce fiscal pressure. The research questions derive from and investigate the proposed policies.

Chapter 3 presents an Australian perspective on the effect of population ageing on the following: the age structure of the population; economic growth and government revenue growth and the linkage between them; the increase in government social outlay expenditure; the decrease in the labour supply per capita; the uncertainty over labour productivity; and the change in savings composition but steady capital formation.

The methodology in Chapter 4 gives an overview of this study's simulation model. A simulation model is chosen to investigate the research questions because Chapter 2 concludes economic theory is unsuitable for structuring population ageing projections. The simulation model does not model savings or capital formation because Chapter 2 shows the population ageing effect on savings is ambiguous and Chapter 3 finds capital formation has been steady, despite large disruptions to the economy. Chapter 4 introduces and explains how the simulation model and sensitivity analysis are used to investigate the research questions. The research questions from Chapter 2 are converted into a form suitable for investigation using the sensitivity analysis methods developed to measure changes in fiscal pressure and in after-tax GDP per capita growth. Chapter 4 finishes with the simulation model's simplifying assumptions.

Appendix A explains in detail the simulation model's source data and projection methods. The identity in Equation (2.1) forms the model's top-level equation. The projection is based upon the ABS (2003b, table 9b) Population Projection (Series B). The model is calibrated using the ABS (2004f, table 9) Estimated Residential Population (ERP) and ABS (2004d) Government Financial Statistics (GFS).

The discount rate sensitivity analysis in Appendix C evaluates the effect of alternative discount rates on the simulation model. A discount rate is used in the sensitivity analysis technique to measure fiscal pressure. The analysis finds that the discount rate has a small effect on absolute fiscal pressure but does not alter the conclusions, which are based on changes in fiscal pressure.

Chapter 5 presents the results obtained from running the simulation model in Chapter 4. First, the baseline projection as a percent of GDP and the baseline parameter values are detailed. This provides a forecast of events without intervention. Second, a baseline comparison is made between this study and the Treasury (2002), the Productivity Commission (2005a), and Guest and McDonald (2000). The reason for the baseline comparison is to make sure it is suitability for sensitivity analysis. Appendix B presents the baseline comparison in detail. The comparison finds that this study's baseline is comparable and suitable for sensitivity analysis. Third, the research question results are presented. These results come from applying the sensitivity analysis techniques to measure changes in fiscal pressure and in after-tax GDP per capita growth.

The discussion in Chapter 6 covers the meaning and implications of the results from Chapter 5. The conclusion in Chapter 7 consolidates the possible policy applications and recommendations from the research questions discussed in Chapter 6. Chapter 7 also lists suggestions for further research. These suggestions were developed throughout this study.

2 Literature Review

2.1 Introduction

This chapter reviews the current understanding of how population ageing increases fiscal pressure. Economic growth and savings theories are examined to provide insight on policies proposed to reduce fiscal pressure. The research questions are drawn from the proposed policies and the insights gained.

Fiscal pressure increases as government revenue decreases and/or government expenditure increases. Both expenditure and revenue are affected by population ageing. Population ageing may increase government expenditure because many government social outlays per capita increase with age. Population ageing may decrease government revenue growth because population ageing may decrease savings and the labour supply which in turn could decrease economic growth. This assumes tax revenue is a fixed proportion of GDP. The Treasurer (2004) notes that policy options to reduce fiscal pressure include increasing economic growth, increasing taxes, issuing government bonds, and decreasing government services. These options are examined in more detail in section (2.7).

This chapter covers the following: economic growth theory; savings theory; international linkages; the sensitivity of the labour supply to tax rate changes; policy proposals to reduce fiscal pressure; and the research questions. Chapter 3 builds on the literature review by examining government social outlays, labour supply, and labour productivity from an Australian perspective.

2.2 Growth Theory and Population Ageing

Growth theory is important to the population ageing induced fiscal pressure because it could help explain its causes and provide potential solutions. Growth theory is dominated by two models and their descendants – a neo-classical model proposed by Solow (1956) and an Endogenous Growth Model (EGM) proposed by Romer (1986). Each theory has undergone refinement, notably Solow (1957) and Romer (1990; 1994), with the EGM mutating to give variants on the original form.

Arrow (1962) distinguishes between economic growth caused by increases in knowledge, and economic growth caused by increases in capital per labour and increases in the population. Solow and Romer both accepted the importance of Arrow's (1962) work but their models' most notable difference is the treatment of knowledge or total factor productivity (TFP). The Solow Model treats the change in TFP exogenously and EGM treats the change endogenously.

The following section reviews the GDP identity, the demographic gift, types of productivity, the Solow model, the Solow effect, growth equations, augmented Solow model, EGM, and Solow-EGM debate.

2.2.1 GDP Identity Equation of Labour Supply and Productivity

Guest (2004a, p. 8) uses the decomposition identity in Equation (2.1) to analysis the implications of population ageing for economic growth. Population ageing reduces GDP per capita by decreasing the 'Hours worked per capita'. This reduces because the aged dependency ratio (ADR) – the aged to working-age ratio increases. The aged consume more government social outlays per capita and produce less tax revenue than the working-age thereby increasing fiscal pressure. Equation (2.1) suggests two solutions: increase the labour productivity rate and/or increase the labour supply per capita.

$$Y/N = Y/L \times L/N \qquad (2.1)$$

Where
Y = GDP
L = Total hours worked per annum (Labour supply)
N = Total Population Number
Y/N = GDP per capita
Y/L = GDP per hour worked (Labour productivity rate)
L/N = Hours worked per capita (Labour supply per capita)

Increasing the labour supply per capita can be achieved by decreasing the unemployment rate, increasing the retirement age, increasing the labour force participation rate (LFPR), and increasing the number of average hours worked. Achieving an increase in the labour productivity rate is more controversial as the review of the Solow model and EGM will show later.

2.2.1.1 Demographic Gift

Guest (2004a, p. 8) notes the demographic gift is a temporary decrease in fiscal pressure or increase in budget surpluses. The demographic gift mechanism is opposite to the population ageing effect increasing fiscal pressure as described above. The phenomenon is caused by a decrease in the total dependency ratio (TDR) – the sum of the child dependency ratio (CDR) and ADR. This is happening currently as the bulk of the baby-boomers are of working-age. The maximum labour supply per capita or minimum TDR is expected around 2011. Afterwards the population ageing continues which may increase the TDR decreasing the labour supply per capita and the GDP per capita.

Jackson and Felmingham (2004), Guest (2004a), Cutler et al. (1990, p. 53) note the beneficial effects of early population ageing as the labour supply per capita increases.

Bloom and Williamson (1998, p. 429) also notes the relation between the demographic gift and increased economic growth. Cutler et al. (1990, pp. 60-1) discuss the policy option of using the demographic gift to ameliorate projected fiscal pressure increases.

2.2.2 Productivity Growth

Growth in labour productivity is a potential solution to fiscal pressure. This section discusses measures of productivity growth namely the labour productivity growth rate (LPGR) and growth in total factor productivity (TFP) because this study uses the LPGR and the Solow model and EGM discussed next use growth in TFP.

Maddison (1995, p. 33) notes the following six sources of productivity growth: technical progress; accumulation of capital in which technical progress needs to become embodied; improvement in human skill, education and organisational skills; economies of scale; structural change; and the relative scarcity or abundance of natural resources. He notes all these causal factors are interrelated and thus are difficult to isolate and measure. This creates a need to develop more measurable forms of productivity growth.

The economic growth theory literature uses the following measures of productivity: total factor productivity (TFP); multifactor productivity (MFP); single factor productivity (SFP); labour productivity; and capital productivity.

2.2.2.1 Total Factor Productivity

Dornbusch et al. (2002, p. 51) notes growth in TFP measures the rate of improvement of technology or technical progress. Dornbusch et al. (2002, pp. 551-2) defines growth in TFP as the rate at which the productivity of inputs increases. The Solow residual measures growth in TFP as the change in level of production that can not be accounted for by a change in factor inputs. The ABS (2002b) notes that TFP is the most comprehensive measure of productivity, which takes account of all inputs to production. Typically, the inputs are classified into capital (K), labour (L), energy (E), materials (M) and services (S). Ideally, all the output and input measures are adjusted for quality change. Estimates of TFP are available for very few countries as this approach demands a lot of data.

2.2.2.2 Multifactor Productivity

The Productivity Commission (2004b, p. 33) notes MFP is a measure of the efficiency with which both labour and capital are used. The ABS (2002b) notes that MFP is the most comprehensive measure of productivity available for Australia at present. Ideally, the labour input measure should be adjusted for quality improvements such as 'human capital', but this is not done at present, so such improvements are encompassed in the MFP measure.

2.2.2.3 Single Factor Productivity

The ABS (2002b) observes that the most common SFP measures are labour productivity (the ratio of output to labour input) and capital productivity (the ratio of output to capital input). MFP is superior to such single-factor measures because the latter may be distorted by substitutions between capital and labour inputs. The annual percentage increase in the labour productivity rate is the LPGR, the productivity growth measure used in this study.

2.2.3 Solow Model

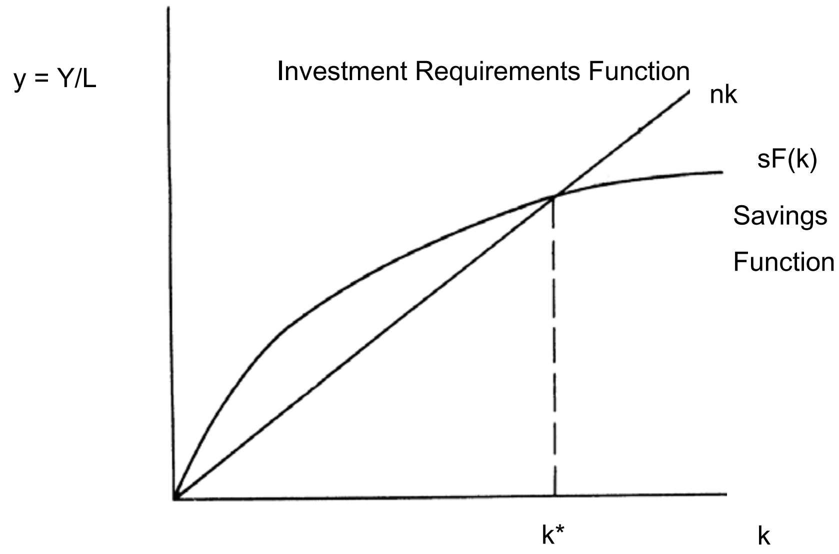
The Solow (1956) model in Equation (2.2) determines a long run equilibrium GDP per capita output and capital to labour ratio given the constants, fraction of GDP saved and population growth rate. Equation (2.2) has three components: the rate of capital per capita formation (dk/dt), the savings function (sF(k)), and the investment requirements function (nk).

$$dk/dt = sF(k) - nk \qquad (2.2)$$

Where
k = Capital to Labour ratio
n = Population growth rate
nk = Investment Requirements Function
s = The fraction of GDP saved
F(k) = GDP per capita
sF(k) = Savings function
dk/dt = Rate of capital formation per capita

Figure 2.1 and Equation (2.2) are used to explain the dynamics and assumption in the Solow model that lead to an equilibrium.

Figure 2.1 Original Solow Model



(Source: Adapted from Solow 1956, p. 70)

The savings and investment requirements functions are shown in Figure 2.1. The rate of capital formation function is the difference between the two lines. Figure 2.1 shows the equilibrium point k* where the savings and investment requirement functions intersect which corresponds to a capital formation of zero. The mechanism driving the economy to this equilibrium point is bidirectional. For any k value below k* the capital formation is positive meaning savings are in excess of investment requirements allowing greater investment per capita so moving k right towards k*. For any k value above k* the capital formation is negative meaning investment requirements are in excess of savings creating reduced investment per capita so moving k left towards k*.

Solow (1956, pp. 68, 91-3) concedes the mechanism assumes frictionless markets and perfect substitution between labour and capital – otherwise capital or labour will be underutilised. This is a departure from reality, and these are strong assumptions that are simply not met.

Solow (1956, pp. 66-7) made further assumptions when deriving Equation (2.2). The savings are a constant fraction of output. The production function simplifies the whole economy by assuming there is one output and two inputs labour and capital. Neither assumption is realistic. Also the Solow model assumes a closed economy as no allowance is made for capital formation by borrowing from overseas. This assumption is not valid for Australia as a small open economy.

Solow's (1956, pp. 67-8) mathematical derivation necessitates the assumption of a fixed relationship between the population (N) and labour supply (L) as the labour supply grows exponentially with the population growth rate (n). The 'L/N is a constant' assumption implies there is full employment so the model does not allow for business cycles and associated unemployment. The 'L/N is a constant' assumption is not consistent with population ageing as was shown in Equation (2.1). The breach of the 'L/N is a constant' assumption is more serious for population ageing than for the business cycle because the L/N ratio decreases for a long period in population ageing whereas the L/N ratio fluctuates for relatively short periods in a business cycle.

Solow's (1956, p. 69) derivation necessitates the assumption of a constant returns to scale. Solow (1957, p. 318) found empirical support for the assumption. The constant returns to scale assumption denies policy intervention a role in increasing economic growth via re-allocating capital to TFP enhancing activities such as human capital development and R&D. According to this Solow model any long-term economic growth is cause by population growth only.

2.2.3.1 Total Factor Productivity

Solow (1956) assumes TFP is constant when deriving Equation (2.2). Solow (1956, p. 85) extends this model by adding TFP exogenously as a function of time as in Equation (2.3).

$$Y = A(t)F(K,L) \tag{2.3}$$

Solow (1957) modified the model by including TFP from the onset to show that growth in TFP ($\Delta A/A$) was not theoretically related to k. Also Solow (1957, p. 316) shows that growth in TFP was uncorrelated with k, where growth in TFP merely exhibits random fluctuations in time so supporting the assumptions in Equation (2.3). Thereby theoretically and empirically supporting Solow (1956).

2.2.3.2 Growth Equations

Solow (1957, pp. 312-3) develops two growth equations, Equations (2.4) and (2.5) that relate economic growth to growth in TFP. Equation (2.4) shows that output growth is the sum of TFP growth plus the product of capitals share and capital growth plus the product of labour share and labour growth. Equation (2.5) shows that output per capita is the sum of TFP growth and the product of capital share and capital per capita growth.

Equations (2.4) and (2.5) highlight the importance of TFP growth to economic growth but do not explain the growth in TFP, which remains exogenous. In that regard they are not useful in developing policy to reduce fiscal pressure.

$$\frac{\dot{Q}}{Q} = \frac{\dot{A}}{A} + w_K \frac{\dot{K}}{K} + w_L \frac{\dot{L}}{L} \tag{2.4}$$

$$\frac{\dot{q}}{q} = \frac{\dot{A}}{A} + w_K \frac{\dot{k}}{k} \tag{2.5}$$

Where Q = GDP

q = GDP per capita

A = TFP or level of technology

K = Capital

k = Capital per capita

L = Labour

w_K = Capital share

w_L = Labour share

$w_L + w_K = 1$

2.2.3.3 Solow Effect

The Solow effect would ameliorate the population ageing effect on the economy. Cutler et al (1990, pp. 17-9), Mulligan and Sala-i-Martin (1993, p. 760), Elmendorf and Sheiner (2000, p. 13) describe the Solow effect in relation to population ageing. The effect is a simultaneous compensating decrease in marginal propensity to save (s) and a decrease in the rate of new entrants to the workforce (n) keeping the output and capital to labour ratio approximately constant. Population ageing may reduce the marginal propensity to save. Population ageing has a low total fertility rate (TFR) which reduces new entrants to the workforce. The Solow model in Equation (2.2) illustrates the compensating effects. The required rate of capital formation per capita (dk/dt) is unaltered if there are fewer new entrants into the workforce (n). Furthermore, the marginal propensity to save (s) reduces as there are more aged. In summary, if $\Delta n = \Delta s$

then equilibrium is maintained. The size of the compensating effects is uncertain. Therefore, the size of the Solow effect is uncertain.

$$dk/dt = sF(k) - nk \qquad (2.2)$$

2.2.3.4 Augmented Solow Model with a Knowledge Growth Rate

The Solow model's constant return to scale assumption implies policies to increase economic growth by increasing TFP are ineffectual in the long run. However, the augmented Solow model shows that policies to increase TFP may be effective. Romer, D. (2001, p. 12) makes TFP endogenous in an augmented Solow model by introducing the knowledge growth rate (g), a constant as illustrated in Equation (2.6).

$$dA/dt = gA(t) \qquad (2.6)$$

This is contrary to Solow's (1957, p. 316) findings that TFP merely exhibits random fluctuations in time. Equation (2.7) incorporates the dynamics of knowledge into an augmented Solow model: first by increasing the production function over time; and second by embodying the negative aspects of knowledge acquisition, the absorption of saving that could otherwise go toward traditional capital formation.

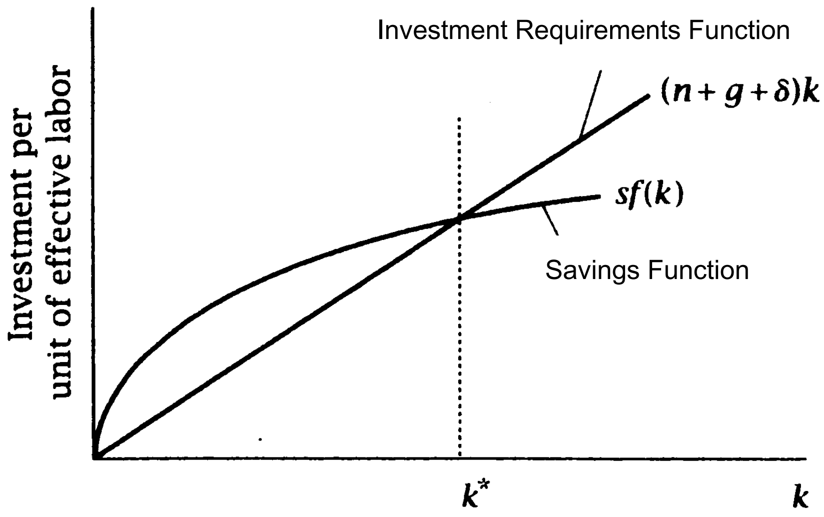
The component parts of Equation (2.7) are the same as that in Equation (2.2) consisting of a capital formation, 'Savings function', and an 'Investment requirements function'. The 'Investment requirement function' in Equation (2.7) now recognises g as a cost to capital formation. Romer, D. (2001, pp. 12-5) includes depreciation as a constant δ proportion of the total capital at any time. Equation (2.7) recognises depreciation in the 'Investment requirement function' as a cost to capital formation.

$$dk/dt = sf(k(t)) - (n + g + \delta)k(t) \qquad (2.7)$$

Where $k(t)$ = Capital/Labour
n = Population growth rate
g = knowledge growth rate
δ = depreciation rate
$(n + g + \delta)k(t)$ = Investment Requirements Function
s = The fraction of GDP saved
$f(k(t))$ = GDP per capita function TFP augmented
$sf(k(t))$ = Savings function
dk/dt = The rate of capital formation per capita

Figure 2.2 represents Equation (2.7) graphically. The mechanism to reach equilibrium k* in Figure 2.2 is the same as that described in Figure 2.1. However the augmented Solow model can reach a higher equilibrium output than that in the original Solow model by investing in activities to increase the knowledge growth rate. This results from two offsetting effects. These effects are illustrated by assuming that an initial k* in Figure 2.1 and a final k* in Figure 2.2 have the same value for ease of description. First, the 'Investment requirement function' in Figure 2.2 is greater than that in Figure 2.1 because the depreciation and the knowledge growth constants have been added, this shifts the equilibrium k to the left of k* in Figure 2.1. Second, the 'Savings function' in Figure 2.2 is greater than that in Figure 2.1 because the production function is now TFP augmented, this shifts k right back onto k*. The k* is the same in both figures but both the 'Savings function' and 'Investment requirements function' are higher in Figure 2.2 than that in Figure 2.1 implying a higher equilibrium output in the augmented model.

Figure 2.2 Augmented Solow Model



(Source: Romer, D. 2001, pp. 13-5)

(Romer uses k = K/L whereas Solow used r = K/L)

Even with the knowledge growth rate constant playing a part in determining the equilibrium the augmented Solow model gives no indication of how to improve TFP.

2.2.4 Endogenous Growth Models

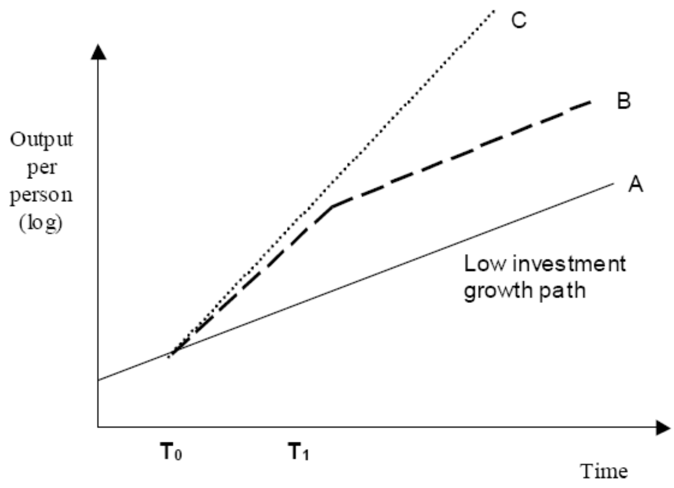
There are numerous EGM e.g. Romer's (1986) model, Lucas's (1988) model, and Barro and Sala-i-Martin (1995, pp. 38-41) describe a simple AK model. The EGM differ from the Solow model by treating TFP endogenously, and dropping the constant economies of scale assumption.

The Solow model has a constant economy of scale assumption implying diminishing marginal product to capital. A common EGM assumption is that there are increasing economies of scale to, at least, knowledge or human capital implying constant or increasing marginal product to human capital. For example Romer (1986, p. 1034) and

Mulligan and Sala-i-Martin (1993, p. 743) EGM use diminishing marginal product to capital and increasing economies of scale to knowledge.

Figure 2.3 shows the difference in economic growth from an investment in human capital in the Solow Model and EGM on trajectory B and C.

Figure 2.3 The impact of increased knowledge investment in the Solow and EGM



(Source: Dowrick 2002, p. 5)

Trajectory A is a baseline with no investment increase and constant economic growth. The Solow model in trajectory B with diminishing marginal product to capital has a temporary increase in economic growth then the economic growth returning to that in trajectory A i.e. both trajectories A and B become parallel. This is called a level effect as there has been no long-term increase in economic growth but an increase in output level. The EGM in trajectory C with constant marginal returns to human capita has a permanent increase in economic growth. This is know as a growth effect and is distinct from the level effect.

Jones (2002, p. 156) notes the implications of the above for government policy. In the Solow model subsidies on research or taxes on investment have level effects but no real long-run growth effect, whereas in some EGM they do have long run growth effect.

2.2.5 Comparing Solow and Endogenous Growth Models

2.2.5.1 Differences and Similarities

A major difference between Solow and the EGM is how human capital is treated. Population ageing implies increasing human capital per capita because population ageing increases the average age of the workforce, which increases knowledge through experience. In addition to population ageing, each generation has increased educational levels. Both these factors combine to increase human capital.

In the Solow Model human capital accumulation increases output until the steady state at k* is reached. In comparison for the AK model, a simple EGM, human capital accumulation increases output at all stages of k.

Mankiw, Romer and Weil (1992, p. 407) state that the Solow model predicts countries' standard of living would converge if they had the same population growth and savings rate. The evidence for this is weak. Mankiw, Romer and Weil (1992, pp. 407-8) notes that augmenting the Solow model with human capital improves the fit of their cross-county regression model from fifty percent to eighty percent. Also, the human capital augmented Solow model better predicts convergence among countries then the original Solow model. Spiezia (2002, p. 85) claims human capital formation becomes more important as the population ages, because fewer workers justify a higher per capita investment. This effect would induce higher economic growth given in an EGM.

2.2.5.2 Solow EGM Debate

Romer (1986, p. 1005) cites Alfred Marshall as the first author with the concept of increasing returns that are external to the firm but internal to the industry, and Allyn Young with the insight to apply the concept to growth theory. Romer (1986, p. 1005) notes that Arrow (1962) identifies knowledge, once publicly known, as a factor that fitted the concept of increasing returns. Solow (1987, p. 18) agrees with Arrow's (1962) observation but claims it did not fundamentally alter the basic proposition of neo-classical growth theory. Moreover Solow (1987, p. 19) comments that increasing returns to capital is not very plausible empirically and has no convincing theoretical foundation. Rogers (2003, pp. 128-9) agrees commenting that there is a need to model technological growth, and that EGM empirical research is often cross-sectional and has homogeneity problems producing fragile results. Romer (1986, p. 1008) acknowledges the following difficulties in empirically verifying EGM: comparisons between countries; filtering out the business cycle; extracting the factors that growth theory is trying to explain; and short time series. Romer (1986, p. 1008) also acknowledges the lack of dynamic equilibrium models.

Romer's (1986, p. 1034) model combines decreasing marginal returns to capital and increasing marginal returns to knowledge. Romer (1986, p. 1017) assumes a simple linear relation when introducing knowledge into his model, to which Solow (1987, p. 19) states "this is a situation where 'approximately' will not do". Romer (1986, p. 1034) criticises incomplete models that treat technological progress as exogenous or endogenous in a descriptive fashion as they could not address social welfare implications nor slowing growth rates nor convergence per capita output.

Dowrick (2002, p. 26) finds sufficient evidence from a survey of Australian empirically based studies into the effect of R&D and education on output to conclude that there is long-term economic growth benefits from human capital investment, not just a level effect, so supporting the EGM. There is still remaining uncertainty over how long is ‘long-term’.

Rodgers (2003, p. 129) comments that EGM offer many new insights but on their own were not suitable as a policy guide. Jones (2002, p. 166) agrees claiming EGM are not the best way to understand long-term economic growth but nevertheless have been tremendously useful in developing our understanding of economic growth.

2.2.6 Summary

Population ageing is identified with a decrease in the labour supply per capita. The identity in Equation (2.1) gives a clear link between decreasing labour supply per capita and a decrease in GDP per capita. Equation (2.1) suggests policies aimed at increasing the labour supply per capita and/or the labour productivity rate are potential solutions to a decrease in GDP per capita.

The Solow Model and EGM both show that increases in TFP or labour productivity are key to increases in economic growth but offer different conclusions on the ability of policy to increase them over the long-run. The Solow model and EGM point to factors ameliorating the population ageing induced decrease in economic growth namely the Solow effect, and the increase in human capital as the population ages.

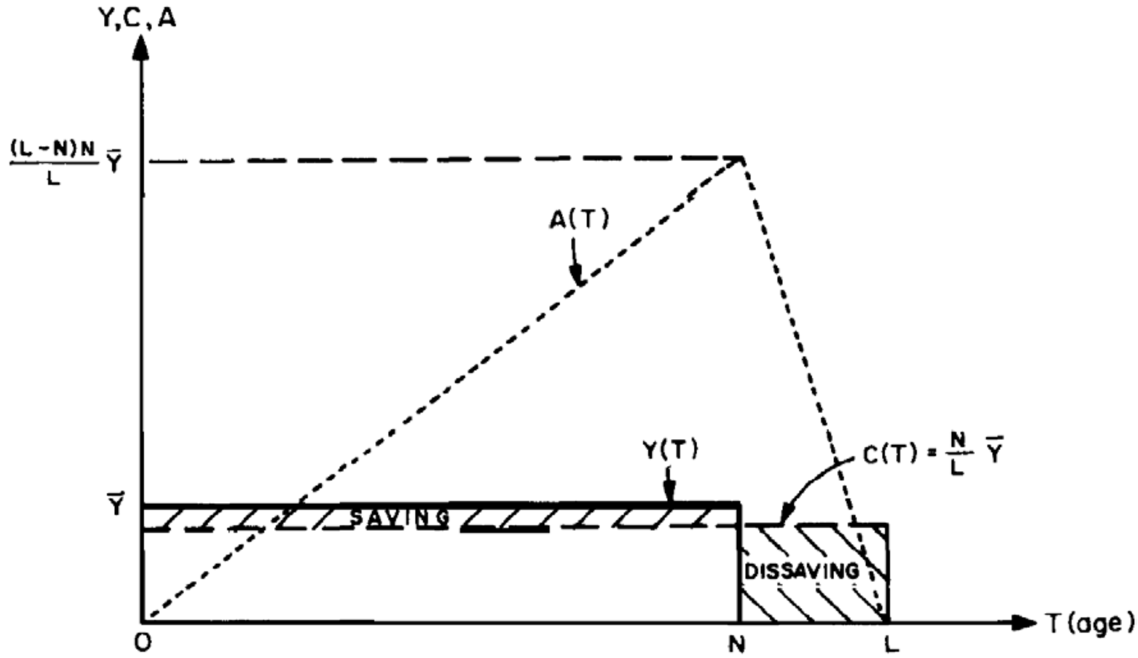
2.3 Savings and Population Ageing

Modigliani (1985, p. 150) notes that savings are seen as a source of the supply of capital essential in enhancing the productivity of labour which leads to economic growth over time. The annual savings flow is the source for deepening of capital stock. The following section discusses the effect of population ageing on savings using the Life Cycle Hypothesis (LCH) and Permanent Income Hypothesis (PIH).

2.3.1 Life Cycle Hypothesis of Saving

Figure 2.4 illustrates Modigliani's (1985) Life Cycle Hypothesis (LCH) of savings that shows individuals save during their working life (N), then dissave during retirement while trying to maintain a constant consumption (C) level throughout their natural life (L).

Figure 2.4 Income, Consumption, Savings and Wealth as a function of Age



(Source: Modigliani 1985, p. 155)

Equation (2.8) captures Figure 2.4.

$$C(T) = (N \times Y) / L \qquad (2.8)$$

Where Y = Annual income
C = Consumption
N = Years of Working Life
L = Years of Natural Life

Modigliani made the following simplifying assumptions.

- people receive income for N years then from retirement to death receive no income
- income from accumulated wealth is zero
- there are no liquidity constraints
- myopia does not exist
- bequests are not left
- there are no precautionary or buffer stock savings
- and the budget deficit does not affect savings

The LCH implications for population ageing are discussed. A feature of population ageing is a larger proportion of the population is aged so according to LCH there will be a reduction savings. Another feature of population ageing is the increase in life expectancy which according to the LCH and Spiezia (2002, p. 82) will increase savings as working individuals are required to save for longer retirements. Spiezia (2002, p. 82) notes that realistically relaxing the LCH assumption 'No income during retirement' will reduce savings as retired individuals can supplement their saving with part-time work. Another feature of population ageing Spiezia (2002, p. 81) notes is a lower TFR and consequently a decrease in youth dependency, which is likely to increase the savings rate. Spiezia (2002, p. 82) concludes that the LCH makes no definitive theoretical prediction of the population ageing effect on savings. The results are ambiguous.

2.3.2 Permanent Income Hypothesis

Modigliani (1985, p. 153) notes that Milton Friedman's (1957, pp. 20-37) Permanent Income Hypothesis (PIH) and the LCH have a common conclusion but differ in simplifying assumptions. In the PIH the notion of life's resources is replaced by 'Permanent income' and any discrepancy between current and permanent income is labelled 'Transitory income'. The PIH and LCH are sometimes used interchangeably and referred to as the LC-PIH.

Spiezia (2002, pp. 82-3) tabulates the results from sixteen studies showing the effect on the savings rate of a 1 percent rise in the ADR. The projected change in savings ranges from near 0 percent in three studies to a maximum of 1.16 percent in one study. Spiezia (2002, p. 84) claims that the wide range was indicative of the uncertainty surrounding the relationship between population ageing and savings, concluding that the population ageing and savings link is limited. The Productivity Commission (2004a, p. xxxi) also concludes that the effects of population ageing are mixed in direction but overall there will be some dissaving.

The empirical results and theory appear consistent in their ambiguity over the population ageing savings link. It appears there are other factors more important than population ageing in determining savings. The theory shows many compensating effects making direction difficult to determine.

There may be a small decrease in savings from population ageing. The Solow and EGM predict different economic growth outcomes for a small decrease in savings. The Solow model predicts the same equilibrium growth rate regardless of the amount saved. The small decrease in savings would have a level effect, reducing output, but the economic growth rate would be maintained. This assumes TFP is exogenous. Further, the Solow effect would offset the small decrease in savings. The EGM differs considerably predicting a small decrease in savings could lead to lower human capital formation resulting in a reduced economic growth rate. Offsetting this lower human capital formation induced by lower savings, is the increase in human capita as the population ages. The EGM's economic growth prediction is ambiguous. The Solow model by treating changes in TFP exogenously limits its usefulness in determining the effect of reduced savings and population ageing on economic growth.

2.4 International Linkages and Population Ageing

The population ageing effect on economic growth and savings so far has been reviewed with models that assume a closed economy. However, Australia has a small open economy linked to other countries via trade and capital flows. Australia main trading partners are also in the later stages of population ageing, which has implications for Australia.

OECD (1996, pp. 11, 25) notes that the OECD countries with advanced population ageing are expected to dissave, Disney (1996, p. 99) and Lenehan (1996, p. 162) agree. The dissaving and population ageing effects are projected to be most pronounced in Australia's leading trading partner Japan. Kenc & Sayan (2001, p. 698) note that the demographic shock in the OECD countries may be transferred to the developing countries via higher world interest rates as these traditional suppliers of capital start to dissave.

Fougère and Mérette (1998, pp. 11, 7) argue that OECD countries may develop worsening current accounts and experience increases in capital inflows. Similarly, Cutler et al. (1990, p. 53) conclude that the US will experience increases in capital inflows with demographic ageing.

Canton, Ewijk & Tang (2003) suggest that population ageing may induce a shift in trading patterns and international capital flows, such as, a shift from inter-OECD trade to OECD countries trading with developing countries and an increase in capital flows from the developing countries to OECD countries. This is attributed to dissaving and a larger aged dependency ratio (ADR) in OECD countries. However Canton, Ewijk and Tang (2003) and Farrell, Ghai and Shavers (2005) observe that there are other more significant factors affecting capital flows and trade.

In summary, the international linkages are important for an open economy such as Australia but the population ageing effect on these linkages appears small compared to other factors. The outcomes of population ageing on international linkages are not conclusive.

2.5 GDP and Economic Growth Projections

This section reviews economic growth projections for the United States (US), Japan, the European Union (EU) and Australia. Economic growth is the increase in real GDP per annum or increase in real GDP per annum per capita. Table 2.1 compares the effect of population ageing on GDP growth, TFP, capital stock, and employment (labour supply) in the US, Japan, and EU15. The results in Table 2.1 agree with the theoretical predictions in the previous section that the population ageing effect may decrease the labour supply and capital stock but produce an uncertain TFP outcome.

Table 2.1 Components of Growth in GDP per Capita for the US, EU15, and Japan 2000-2050

	EU15		US		Japan	
	Annual Average % Change	Change Relative to Baseline	Annual Average % Change	Change Relative to Baseline	Annual Average % Change	Chang Relative Baselir
Employment	–0.13	–0.30	0.03	–0.18	–0.16	–0.36
Capital Stock	0.75	–0.12	0.75	–0.05	0.72	–0.12
TFP	1.22	0.00	0.94	0.02	1.12	–0.01
Totals	1.97	–0.43	1.71	–0.20	1.67	0.49

(Source: McMorrow & Roeger 2001, p. 41)

Similarly, the Productivity Commission's (2005a, pp. 126-7) economic growth projection 2005 to 2045 stays positive implying real per capita income will continue to rise in spite of population ageing. Real per capita incomes are expected to nearly double from 2003 to 2045. Likewise, Guest and McDonald (2002; 2004, p. 4) project the standard of living (or real GDP per capita) to increase by 84 percent from 1999 to 2050. Guest and McDonald (2001, p. 117) infer a growth in living standards of 1.2 percent per annum during this period. The Productivity Commission's (2005a, pp. 126-7) predicts continued economic growth until 2012 then a decline to a minimum about 2023 and a slow increase in economic growth afterwards. The Treasury's (2002, pp. 5-6) economic growth prediction is consistent with the Productivity Commission (2005a).

In summary, GDP per capita growth may remain positive until 2050 with a dip about 2023. Population ageing may cause a small amount of dissaving and a decrease in the labour supply. But its effect on TFP is uncertain and small.

2.6 Tax Elasticity of the Labour Supply

Guest and McDonald (2000) note the disincentive/incentive effect of increases/decreases in taxation which decrease/increase the labour supply and consequently decrease/increase GDP. The disincentive and incentive effects are modelled with a 'Tax elasticity of the labour supply' (TELS) equation given in Equation (2.9).

$$TELS = -\left(\%\Delta \text{ tax rate} \,/\, \%\Delta \text{ labour supply}\right) \qquad (2.9)$$

Where the labour supply is in hours and the tax rate is given as a percentage of GDP. Guest and McDonald (2000) assume TELS of 0 and 0.2. Dixon and Rimmer (2000) use TELS values from 0.2 to 2.0 in their study on tax and wage policies to increase employment. The range of values used indicates uncertainty over the TELS value. There appears to be a gap in the literature over what constitutes an appropriate value for the TELS.

The value of TELS could have considerable effect on determining the effectiveness of any tax policy. The lack of information on an appropriate TELS forms a recommendation for further research. Some of the following policy proposals rely on an estimated value of TELS.

2.7 Policy Proposals to Reduce Fiscal Pressure

This section covers the policy options available to reduce fiscal pressure induced by population ageing. The options discussed include economic growth policies; tax policies; and 'Changes in government services and privatisation' policies. These options are not mutually exclusive and often involve complex interdependencies. The following discusses how the policy options relate to one another, economic theory, and the literature.

2.7.1 Economic Growth Policy

An economic growth policy acts via participation, productivity, and population policies: participation policy increasing the labour supply by increasing the LFPR; productivity policy increasing the labour productivity growth rate (LPGR); and population policies altering population parameters to decrease fiscal pressure. A growth policy increases the GDP per capita to increase the tax revenue per capita which reduces fiscal pressure given a constant tax rate. Equation 2.1 implies labour productivity increases and/or labour supply per capita increases can increase GDP per capita.

2.7.1.1 Participation Policy

Policies to increase the labour supply per capita include increasing the retirement age; increasing the LFPR; increasing the average hours worked per capita; and reducing the unemployment rate. The Solow model indicates a problem deriving from policies to increase the labour supply, because population ageing is expected to slightly reduce savings, and there is an increased investment requirement for increases in the labour supply, otherwise a decrease in GDP is expected.

The OECD (2003:1) and Gruen and Garbutt (2002, p. 5) argue for an increased LFPR. Gruen and Garbutt (2002, p. iii) claims improving LFPR may be sufficient to cover the demographically induced portion of the fiscal pressure. The Treasury (2004, p. 1) claims that the best way to achieve higher economic growth is via increases in the LFPR and labour productivity.

2.7.1.2 Productivity Policy

Policies to increase the labour productivity growth rate (LPGR) according to the EGM mainly involve investment in human capita, such as, R&D and education. Section (2.2.2) mentions other sources of LPGR increases. These sources are amenable to development by policy to varying degrees. The Solow model indicates increases in investment/saving produce level effects but do not produce permanent increases in economic growth. Economic theory is inconsistent – the Solow model indicates problems with policies to increase the LPGR, the EGM does not.

2.7.1.3 Population Policy

Population policies are directed at the following population parameters: mortality, net overseas migration (NOM), or total fertility rate (TFR) to reduce population ageing. This could reduce fiscal pressure. Increasing the TFR increases the labour supply but there is a 15 to 20 year delay before individuals become economically productive. Until that time they increase the fiscal pressure by requiring extra government services. Policies to increase the TFR such as increasing the family tax benefit (FTB) and baby bonuses can reduce the female LFPR. This may decrease the labour supply and increase fiscal pressure. Increasing NOM by introducing younger workers could moderate population ageing and increase the labour supply per capita. Increasing the mortality rate or decreasing life expectancy is not a valid policy option. The increase in life expectancy increases fiscal pressure but it does suggest a healthier older population so increasing the retirement age becomes an option.

2.7.2 Tax Policy

The three tax policies discussed include a pay as you go policy (PAYGP) – progressively increasing the tax rate to cover any increase in fiscal pressure; a bond-issue policy – issuing government bonds to cover any increase in fiscal pressure; and a tax-cut policy – claiming tax-cuts are a necessary precursor to increasing economic growth.

The states and Commonwealth have differing sources of tax revenue and responsibility for social outlay expenditure. This may create differences in fiscal pressure between the governments.

2.7.2.1 Pay As You Go Policy

The PAYGP involves progressively increasing the tax rate to cover increases in fiscal pressure. Guest and McDonald (2000) and Day and Dowrick (2004) support the PAYGP. The Treasurer (2004, pp. 25-8) rejects the PAYGP and the Treasury (2002, p. 15) rejects the PAYGP by committing to a tax rate at the 1996-97 level.

Guest (2004b) argues that current economic growth would raise the standard of living to a point where it became less difficult to pay higher taxes to fund future government social outlays. The Treasurer (2004, p. 25) claims that Australia cannot increase the tax rate as this would place Australia at a long-term international competitive disadvantage. The Treasurer (2004, p. 25) states that increasing the tax rate would slow GDP per capita growth relative to other countries. The TELS indicates a PAYGP would decrease the labour supply and GDP.

Day and Dowrick (2004, pp. 4, 18-9) argue that the case for policy action is overstated and fails to adequately consider the following countervailing factors. The decline in fertility is associated with increases in the female LFPR and educational achievement. The increase in educational achievement is likely to sustain strong productivity growth in the future. This is consistent with the EGM but inconsistent with the Solow model. The productivity growth means that the standards of living in forty years time may be much higher than present despite increased dependency ratios. The future standard of living is due to the investment of the current generation in both physical and human capital so an increase in taxes does not appear inequitable.

The Productivity Commission (2005a, p. 325) calculates that with a 1.75 percent LPGR and complete inflation indexation of tax scales after 2004-05, more than half of their projected 7 percentage point fiscal pressure in 2044-45 could be automatically financed.

The PAYGP assumes that people will be willing to pay a larger percentage in tax, because their after-tax standard of living is still growing.

2.7.2.2 Bond-issue Policy

The bond-issue policy involves issuing government bonds to cover increases in fiscal pressure. The Treasurer (2004, pp. 25-8) considers that the bond-issue policy is not an option worthy of serious consideration. The Barro-Ricardian equivalence theorem (Barro 1989) suggests that the PAYGP and bond-issue policy are equivalents but this theorem remains controversial. The bond-issue policy relies on economic growth in the same way as the PAYGP. In that, economic growth will make any future repayment a smaller proportion of after-tax GDP per capita. This policy option also has TELS and international capital flow implications.

2.7.2.3 Tax-cut Policy

Henry (2004, p. 8), Secretary to the Treasurer, advocates cutting tax as a necessary part of an economic growth strategy intended to increase the LFPR and the labour productivity rate. This policy assumes a high TELS. The tax-cut policy is usually associated with the cuts in government service and increases in privatisation. It is the policy mix advocated by those who claim that population ageing is a crisis requiring urgent action. The Treasurer, US government, and the OECD (2003:1) are such advocates. However unless the tax-cut policy delivers sufficiently large economic growth then the Treasurer's (2004, pp. 25-8) no-cuts in government services policy appears sustainable only while the economy is in the demographic gift phase but not so afterwards.

2.7.3 Changes in Government Services and Privatisation Policies

The Treasurer (2004, pp. 25-8) states that cuts in government services could never be seriously contemplated. However the government is fostering private health insurance and private superannuation, which in turn reduces the need for government pensions and health services. This is creating a shift from government service provision to private service provision. Possible reasons for the shift are the market operates more efficiently giving better service provision; and to reduce fiscal pressure. Turner (2005), Guest (2004b), Cutler et al. (1990, p. 53) show flaws in the reasoning.

Turner (2005) notes using a PAYGP funded pension or private savings funded superannuation both have the same problem, namely population ageing. The problem is that a smaller working-age population has to provide for a larger retired population. The PAYGP taxes a smaller working-age population to provide pensions to a larger retired population who then purchase from the smaller working-age population. The private savings superannuation system requires a large population of retirees to sell assets to a small number of working-age so pushing down the value of the assets and diminishing the value of their saving to purchase from the smaller working-age population.

Swapping from a PAYGP funded system to a privately funded superannuation system merely changes the resource transfer mechanism but does not solve the population ageing problem. Swapping the transfer mechanism may reduce fiscal pressure but it raises equity and efficiency issues. This is discussed further in Chapter 6.

Tax-smoothing is a process of prepaying for any prospective government liabilities removing the need to raise taxes at later stage. The superannuation strategy is consistent with this approach. Guest (2004b) notes that a welfare loss would occur from equalising future and current expenditure by having people fund their own retirement. This requires paying for the current retirees and saving for their own retirement – in effect paying twice. Similarly, Cutler et al. (1990, p. 53) claims that tax-smoothing has little validity as there is only a small efficiency loss in following a PAYGP with variable tax rates.

The Commonwealth government is fostering a private health insurance system with subsidies and tax-breaks. From 1 April 2005 the health insurance rebates are as follows: 30 percent if everyone on the membership is under 65 years; 35 percent if the oldest member is 65 to 69; and 40 percent if the oldest member is over 70 years. The rebate compensates the private health insurers for legislations preventing them from rejecting people with pre-existing conditions. The rebate indicates the size of the private health insurance industry’s market failure due to adverse selection. The privatisation may reduce fiscal pressure but an increase in the aged dependency ratio (ADR) would increase the rebate and fiscal pressure. The privatisation of health insurance has equity and efficiency issues.

The growth in health expenditure may provide much of the increase in fiscal pressure. The Treasury (2002) and the Productivity Commission (2005a) observe that the growth in real non-demographic health expenditure compounds population ageing induced fiscal pressure. This is particularly acute in the Pharmaceutical Benefit Scheme (PBS). Its expenditure rises sharply with age and exhibits a large growth in real non-demographic expenditure. Consequently health and the PBS in particular may become subject to large changes in government service provision.

2.8 Research Questions

This section develops the research questions to evaluate the policy options in the previous section. Time-constraints mean that the evaluation of all the policy proposals is not possible. The research questions focus on those policies proposed by the Treasury (2002), the Treasurer (2004) and Guest and McDonald (2000), namely economic growth policies, and tax policies.

2.8.1 Participation Policy – Retirement Age

Is increasing the retirement age an effective way to reduce fiscal pressure?

The question investigates a policy of increasing the retirement age to reduce fiscal pressure. This policy is one already exercised in some countries, where they have increased or are increasing their retirement age to 67. Increasing the retirement age simultaneously increases the labour supply, decreases ‘Age and service pension’ (ASP) expenditure, but increases expenditure on unemployment allowances and disability support pensions (DSP).

2.8.2 Participation Policy – Labour Force Participation Rate (15-64)

Is increasing the LFPR an effective way to reduce fiscal pressure?

This question is relevant as the OECD (2004a, p. 294, annex C, table B) notes Australia has a lower LFPR than many comparable OECD countries. Increases in the LFPR act to increase the labour supply thus increase tax revenue and reduce fiscal pressure. Increasing the LFPR is part of the Treasury's policy proposal to meet fiscal pressure. This policy could also reduce government social outlays by decreasing benefit payments.

2.8.3 Productivity Policy – Labour Productivity Growth Rate

Is increasing the LPGR an effective way to reduce fiscal pressure?

This question evaluates whether increases in LPGR are effective in reducing fiscal pressure. The Treasury argues that increasing labour productivity is part of the solution to reducing fiscal pressure. Guest and McDonald (2000) do not expect increasing the LPGR to alter fiscal pressure. This is implicit in their model's design which does not explicitly use a LPGR. Their simplifying assumption is that both government revenue and expenditure are linked to labour productivity so prices rise in unison. This study does not make Guest and MacDonald simplifying assumption. The question evaluates both Guest and McDonald's simplifying assumption and Treasury's labour productivity claim.

2.8.4 Tax Policy

Is changing the tax rate an effective way to adjust the fiscal pressure?

The motivation for increasing the tax rate is simply to directly reduce the fiscal pressure. The motivation for decreasing the tax rate is to increase the LFPR and labour productivity to indirectly reduce the fiscal pressure. The sensitivity of the LFPR to tax changes as a percentage of GDP is modelled by varying the TELS.

2.8.5 Tax Policy and Tax Elasticity of the Labour Supply

Does TELS determine the effectiveness of using tax rate changes to alter the fiscal pressure?

This question is relevant because the Government and Guest and McDonald have incompatible views. The government expects the labour supply is very sensitive to changes in the tax rate. They expect that decreasing the tax rate will increase the labour supply by a significant amount. Guest and McDonald (2000) expect the labour supply to decrease in a small way as they use a TELS of 0 and 0.2 for a PAYGP tax increase in their study.

2.8.6 Tax-cut Policy

Can using a policy of tax-cuts to increase the LPGR and the LFPR solve the population ageing induced fiscal pressure?

This question evaluates the tax-cut policy for its effect on fiscal pressure. The question assumes that tax-cuts are effective in increasing the LPGR and labour supply. This assumes that the labour supply is very sensitive to tax rate changes implying a TELS of a high value.

2.8.7 Pay As You Go Policy and Tax Elasticity of the Labour Supply

What effect does a high TELS have on after-tax GDP per capita under a PAYGP?

Guest and McDonald (2000) show that after-tax GDP per capita continues to grow with TELS values of 0 and 0.2 under a PAYGP. This question investigates the growth in after-tax GDP per capita using a higher TELS value of 2 under a PAYGP. A higher TELS value reduces GDP per capita so is less favourable to a PAYGP.

2.8.8 Pay As You Go Policy and Labour Productivity Growth Rate

What effect does changing the LPGR have on after-tax GDP per capita under a PAYGP?

This question evaluates the effect of changing the LPGR on the growth in after-tax GDP per capita before and after applying the PAYGP. The intention is to investigate possible issues arising such as. Do decreases in the LPGR produce negative growth in after-tax GDP per capita when using a PAYGP? How effective are LPGR increases in ameliorating the PAYGP tax increases?

2.8.9 Population Policy

Can changing the mortality, net overseas migration (NOM), and total fertility rates (TFR) eliminate population ageing induced fiscal pressure?

This question investigates the possibility of using the population parameters – mortality, NOM, and TFR to alter the population ageing induced fiscal pressure. These parameters are the drivers for population growth and more specifically the drivers for the population's age structure. By altering these parameters there is a possibility that population ageing could be decreased. If effective then they become potential policy tools to solve fiscal pressure.

2.8.10 Real Non-Demographic Health Expenditure Growth

Do real non-demographic health expenditure projection methods and parameters have a large effect on fiscal pressure projection?

The question investigates both a sensitivity analysis on the 'Health premium above real growth in GDP per capita' (health premium) and two alternative projection methods. The alternatives include special treatment for Pharmaceutical Benefit Scheme (PBS) expenditure, and an alternative treatment for the 'Real growth in GDP per capita' part of health premium projections.

This question reviews the effect of alternative projection methods for health because there is no common method to project health costs. The Productivity Commission (2005a), Treasury (2002), and Guest and McDonald (2000) handle the projection of growth in real non-demographic health expenditure differently.

Guest and McDonald (2000) assume that the real non-demographic health expenditure growth is 1.75 percent, the baseline labour productivity growth rate, implying non-demographic health expenditure grows along with the rest of the economy.

Treasury (2002, p. 81, table C2 & C3) applies the following real non-demographic growth rates to different areas of health: Pharmaceutical Benefit Scheme (PBS) uses 5.64 percent; Medicare uses age specific growth rates ranging from –0.12 to 3.78; Hospital uses 1.64 percent; and 'Other' is assumed to grow at a constant proportion of GDP.

The Productivity Commission (2005a, pp. 167-8) uses a 0.6 percent 'Health premium above real growth in GDP per capita' (health premium) and notes the health premium range is between 0.3 to 0.9 percent. This treatment is used for Medicare, hospital, and

'Other' areas of health. The PBS projection is given special treatment starting in 2004 with a growth rate of 4.9 percent 'Above real growth in GDP per capita in 2044-45' which is then asymptotically decreases in 2045 to 0.6 percent 'Above real growth in GDP per capita in 2044-45'. This is discussed further in Appendix (A.7.1).

This question has three parts: varying health premiums, alternative PBS projections, and alternative real growth in GDP per capita projections.

2.8.10.1 Health Premium

The sensitivity analysis on the health premium investigates its effect on fiscal pressure projections noting the wide range for the health premium value.

2.8.10.2 Pharmaceutical Benefit Scheme

The Productivity Commission's method for projecting PBS expenditure is applied to investigate its effect on fiscal pressure projections.

2.8.10.3 Real Growth in GDP per Capita

The alternative methods for treating 'Real growth in GDP per capita' are compared. The alternative methods investigated are treating 'Real growth in GDP per capita' as a constant and treating 'Real growth in GDP per capita' as projected 'Real growth in GDP per capita' to find their effect on the fiscal pressure projections.

2.8.11 Levels of Government

Are the State and Commonwealth levels of government equally affected by population ageing induced fiscal pressure?

This question investigates the difference in fiscal pressure between the Commonwealth and state governments. A large difference in fiscal pressure indicates a need to analyse the states and Commonwealth separately as opposed to just analysing 'All levels of government'. Also a large difference indicates the relative urgency for policy to address population ageing at the Commonwealth and state levels.

2.9 Conclusion

The identity in Equation (2.1) suggests population ageing acts to decrease economic growth per capita. The Solow model and EGM describe effects that could ameliorate this decrease: the Solow effect and population ageing increasing human capital respectively. The LC-PIH is ambiguous about the population ageing effect on savings. However there may be a little dissaving. The effect of a little dissaving on the economy according to the Solow model has a level effect but leaves long-term economic growth per capita unaltered, conversely the EGM predicts a permanent decrease in the growth rate.

The identity in Equation (2.1) indicates increasing economic growth per capita requires an increase in the labour supply per capita and/or labour productivity rate. The Solow and EGM provide contradictory insights into whether policy can increase economic growth per capita by increasing TFP or labour productivity. Economic theory proves ambiguous or inconsistent both in describing the population ageing effect on economic growth and in suggesting suitable policy proposals. Consequently the methodology chosen to evaluate the research questions is a simulation model using Equation (2.1).

The answers to the research questions will provide insights for policy decisions.

3 Population Ageing in Australia

3.1 Introduction

Chapter 2 examines how population ageing may decrease economic growth and the proposed policy solutions. Nearly all the policies proposed to reduce fiscal pressure involve economic growth either directly through measures to increase it or indirectly by relying on it. This chapter gives an Australian perspective on the effects of population ageing on economic growth, government revenue and government social outlays.

This chapter covers the population ageing effect under the following headings: population projections; government revenue and economic growth; government social outlays; the labour supply; and labour productivity.

3.2 Population Projections

This section examines the parameters driving population ageing: mortality, net overseas migration (NOM), and total fertility rate (TFR). The ABS (2004f, table 9) Estimated Residential Population (ERP) and the ABS (2003b, table 9b) Population Projection (Series B) are used as the standard or baseline population projection. Series B assumes a TFR of 1.6 babies per woman, NOM of 100,000 persons per year, and life expectancies at birth of 84.2 years for males and 87.7 years for females.

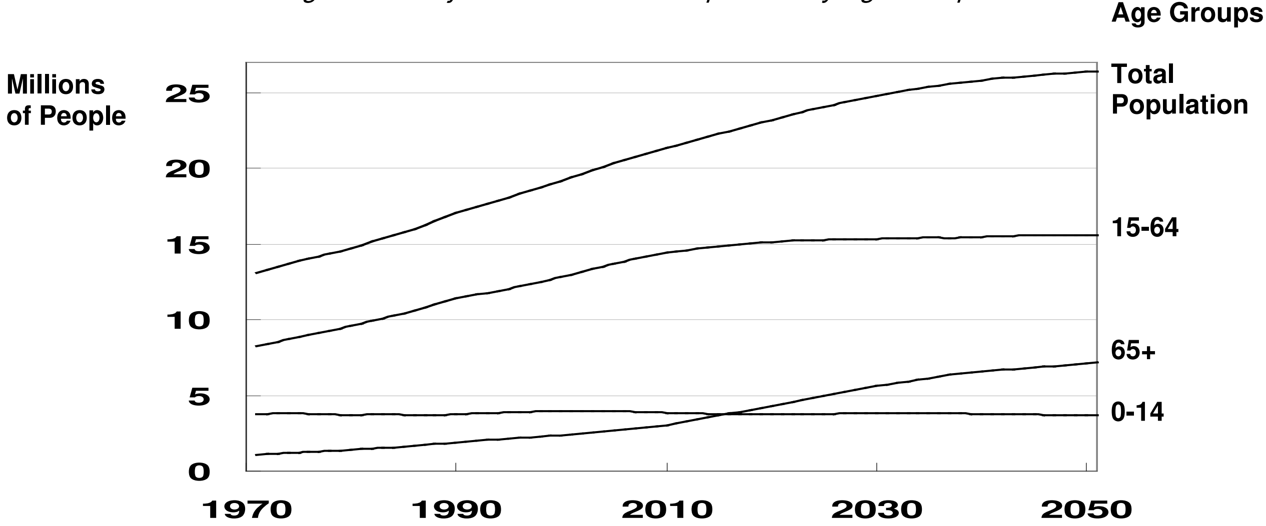
The ABS (2003b, tables 9a, 9b, and 9c) Population Projections (Series A, B, and C) provide high, medium, and low projections. The reason for using Series B in the baseline is that Series B is the most likely projection.

This section provides background for remainder of this study and discusses the following three aspects: the ERP and Series B population projections for differing age groups and the implication for fiscal pressure; the ERP and Series B dependency ratio projections and the implications for fiscal pressure; and the mortality, NOM, and TFR assumptions for Series B.

3.2.1 Population Projection by Age Group

Figure 3.1 shows the baseline population projection for the three age groups 0-14, 15-64, and over 65 which uses the ERP up to 2004 and Series B from 2005 onwards. The three age projections roughly correspond to a child of school age, a person of working-age, and an aged person of retirement age. The fiscal pressure implications for the three age groups are as follows. The child of school age is an educational cost to the government. The working-aged are a source of tax revenue. The aged are health, and 'Social security and welfare' (SS&W) costs to the government. The following simple analysis assumes a zero labour productivity growth rate (LPGR) and a constant tax rate. Figure 3.1 shows a slight decrease in the number of school-aged children so expect a decrease in educational costs to government. Figure 3.1 shows a rise in the number of working-age from 13 million in 2002 until 15 million in 2021, a plateau then slow decline so expect tax revenue to increase until 2021, plateau then decrease slowly. Figure 3.1 shows a rapid increase in the aged from 2 million in 2002 to 8 million in 2041 so health and aged care costs could be expected to increase rapidly. The population changes illustrated in Figure 3.1 underlies the projected increase in fiscal pressure. The remainder of the chapter refines the picture.

Figure 3.1 Projection of Baseline Population by Age Group



(Sources: ABS 2003b, table 9b; 2004f, table 9)

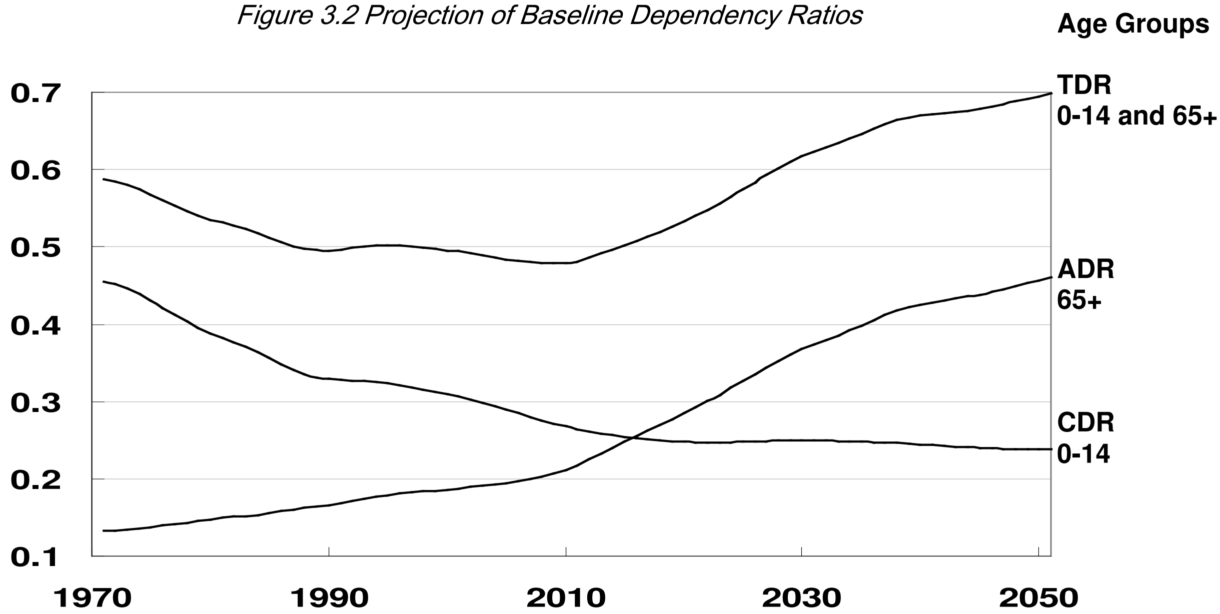
3.2.2 Dependency Ratios

The dependency ratios in Figure 3.2 give a clearer perspective on the population's changing age structure by removing the population growth seen in Figure 3.1. The dependency ratios include aged dependency ratio (ADR), child dependency ratio (CDR), and total dependency ratio (TDR). The ADR is the ratio of aged to working-age, the CDR is the ratio of child to working-age, and TDR is the ratio of aged and child to working-age.

Figure 3.2 illustrates the population ageing effect on the baseline CDR, ADR, and TDR. There is a steady increase in the ADR which almost quadruples from 1972 to 2042. Compensating for this there is a steady reduction in the CDR. Jackson (2001, p. 35) notes that government social outlays on the aged are two to four times that on youth, so equating dependency ratios do not translate into equalising government social outlays.

Figure 3.2 shows the TDR reaches a minimum about the year 2011. Jackson and Felmingham (2004) note economic growth may increase till 2011 when the dependency ratio is lowest or the working-age proportion is highest. This demographic gift effect is discussed in Chapter 2. However after 2011 the proportion of working-age people will decrease so reducing economic growth.

Figure 3.2 Projection of Baseline Dependency Ratios



(Sources: ABS 2003b, table 9b; 2004f, table 9)

In summary, the population ageing effect is an increase in the ADR, with the relative effect of decreasing government revenue and increasing government social outlays, so increasing the fiscal pressure, on the proviso that the government maintains the same social outlay per person and tax rate. Section (3.4) examines why social outlays on the aged are two to four times that for children.

3.2.3 Mortality, Net Overseas Migration, and Total Fertility Rates

Guest and McDonald (2000, p. 16) and the Treasury (2002, p. 21) observe that the age structure of immigrants reduces Australia's population ageing thereby increasing the labour supply and improving economic growth projections. Guest and McDonald (2002, p. 17) use two immigration scenario, 70,000 and zero immigrants a year, calculating social outlays in 2051 at 29.5 percent and 32.3 percent of GDP respectively. Guest and McDonald (2002) conclude that there are more important factors than the small percentage changes in government social outlay to decide in favour of immigration. The Productivity Commission (2004a, p. xxii) and Banks (2004, p. 11) agree that even a large immigrant influx would not alter the population ageing effect significantly. The Treasury (2002, pp. 61, 4) simulates an increase in the NOM rate from 90,000 people per to 135,000 people per year finding a 0.67 percentage decrease in fiscal pressure noting the effect reduces as the immigrants begin to age.

A lower TFR will reduce population growth and economic growth because the lower TFR means that after 20 years there will be fewer working-aged to support the retired so reducing the GDP per capita. Guest and McDonald (2000, p. 20) note that Australia has a higher TFR than many other OECD countries so making the population ageing effect relatively milder in Australia.

The lower mortality rate is placing pressure on the pension funds as people live longer drawing pensions for longer. The low mortality rate is not amenable to change by government, but it does indicate people are living longer and increasingly healthier in retirement. Consequently, an increase in the retirement age is a policy proposal being investigated in a research question.

3.3 Government Revenue and Economic Growth

Population ageing may decrease government revenue per capita because as the ADR increases the tax base proportionately decreases. Restoring tax revenue involves either an increase in GDP per capita for a fixed tax rate and/or an increase the tax rate.

Equation (2.1) indicates that to increase GDP per capita requires an increase the labour supply per capita (L/N) and/or an increase in labour productivity (Y/L). These issues are considered in sections (3.4) and (3.5)

$$Y/N = Y/L \times L/N \qquad (2.1)$$

Guest (2004b, p. 7) notes that the average tax rate has increased by 4% over the last 32 years. Over this time GDP per capita has increased by about 70%, easily accommodating the tax increase. On this basis Guest (2004b) suggests a pay as you go policy (PAYGP) that is increases in tax to meet the increase in fiscal pressure.

There appears a historical relationship between the growth in total government tax revenue and the growth in GDP. The ABS (2004a, pp. 4, 7) shows from 1998-99 to 2002-03 that total government tax revenue has remains a constant percentage of GDP. Similarly, Treasury (2002, pp. 54-5) shows from 1972 to 2002 that PAYE tax and total Commonwealth tax has fluctuated around a constant percentage of GDP. Treasury (2002, pp. 6,55) uses a Commonwealth government revenue of 22.4 percent of GDP in their projection. The Treasury's (2002) flat tax rate scenario is used while discussing government social outlays and fiscal pressure in the next section.

3.4 Social Outlays

Government social outlays consist of education, health, and 'Social security and welfare' (SS&W). Calculations on the ABS (2005c, p. 6) Government Financial Statistics (GFS) 2003-2004 for 'All levels of government' show that the share of total government expenditure is SS&W (29%); health (18%); education (15%); and all other government expenditure (38%). The government social outlays are sensitive to population ageing and comprise 62% of government expenditure. This section discusses the impact of population ageing effect on each social outlay.

3.4.1 Health

The AIHW (1998) notes in Australia that the cost of health care increases with age. Schulz (2004, p. 1) notes that this relationship holds in fifteen other European countries. The AIHW (2004a, p. 378) finds in 2000-2001 that those aged over 65 represented 12.5% of the population and accounted for 38.0% of total allocatable health expenditure. The AIHW (2004a, p. 383) claims that the population aged over 65 is projected to nearly double over the next 20 years. This indicates there may be a very large increase in health expenditure.

Bjornerud & Martins (2005, pp. 5,6,12), the Productivity Commission (2004a, D7), and Gruen and Garbutt (2004, pp. 23-4) isolate demographic from non-demographic factors in past health expenditure growth. They note non-demographic factors may be more significant than the population ageing effect in future health expenditure growth. Non-demographic health expenditure growth is addressed in detail in Appendix (A.7.1) and forms the basis for a research question about alternative health expenditure projection methods.

3.4.2 Age Care

Hogan (2004, p. 5) notes that aged care includes ‘Residential aged care’ funded by health and ‘Care in the community’ funded by SS&W. Table 3.1 projects a rise in aged care expenditure indicating that the population ageing effect may double aged care expenditure as a percentage of GDP.

Table 3.1 Total cost of supplying aged care services

	2002-03	2012-13	2022-23	2032-33	2042-43
Cost in $ billion (current prices)	7.8	14.7	29.9	59.4	106.8
Cost as % of GDP	1.1	1.2	1.6	2.0	2.3

(Source: Hogan 2004, p. 2)

3.4.3 Education

Education expenditure categories are schools, universities, vocational, and ‘Other’. Population ageing is expected to reduce demand for education across all categories because the low TFR means fewer 5-24 year olds. Treasury (2002, p. 47) projects education spending to decrease slightly in all categories. This is consistent with the ABS (2002a) Population Projections. Treasury (2002, p. 47) notes in 1972 that thirty percent of the population was 5-24 years old, compared to twenty percent in 2002. However the potential savings from population ageing are reduced because the following factors have increased: student participation rates; the costs per student; and students’ average age. These factors may level out in the future. In summary, education expenditure is expected to decrease slightly with population ageing.

3.4.4 Social Security and Welfare

‘Social security and welfare’ (SS&W) payments are made up of ‘Age and service pensions’ (ASP), disability support pensions (DSP), parenting payments single (PPS), unemployment allowances, and family tax benefits (FTB). The following subsections discuss them.

3.4.4.1 Age and Service Pensions

The ASP are benefits paid to those over retirement age, which in 2005 is 65 for males and being progressively increased to 65 for females by 2014. The Treasury (2002, p. 45) predicts ASP to increase from 3 percent of GDP in 2001-2 to 4.5 percent of GDP in 2041-2. Two factors are involved in this increase. First, the AIHW (2003, p. 324) notes that at the end of 2002, 83 percent of the over 65 were in receipt of the ASP, and only 6 percent were in the labour force. Second, the ABS (2002a, p. 39) Population Projections show that the number of people over 65 nearly quadrupled over the same period. These two factors would suggest a much larger increase than that predicted by the Treasury (2002, p. 45).

However there are ameliorating factors. The AIHW (2003, p. 324) provides two reasons for the smaller than expected increase, first, the high levels of dependency on pension payments is expected to decrease as the effects of increased superannuation coverage flow through, and second, an increase in the labour force participation rate (LFPR) for the over 65. Also Creedy (1999, p. 241) notes that the average age of immigrants is lower than the Australian population so partially compensating for the expected increase in ASP as a percentage of GDP.

The Treasury (2002, p. 45) and Creedy (1999, p. 241) note that their projected increase in ASP in Australia is relatively small compared to other OECD countries, which they attributable in part to private superannuation.

Mitchell and O'Quinn (1997, p. 6) cite the Treasury's Retirement Income Modelling Group as stating – although there is a strong consensus in Australia that individuals should be responsible for saving for their own retirement, a safety net will remain in place to ensure that no one will be worse off under the privatised system. In effect, every retiree is guaranteed an ASP equal to 25 percent of the average earnings of male workers.

The government ASP is now means-tested so even though almost all retirees will have some income from their superannuation savings, more than 33 percent of senior citizens in 2050 will receive a full age pension from the government. All told, a full 75 percent of the aged population in 2050 will have their private savings income supplemented by full or partial government benefit payments.

3.4.4.2 Other Social Security and Welfare payments

The combined ASP is much larger than all the other SS&W payments including disability support pensions (DSP), parenting payment singles (PPS), unemployment allowances, and family tax benefits (FTB).

The DSP is paid to the working-age with the disabled going onto an ASP once they reach retirement age. Consequently, the DSP is expected to reduce slightly as the proportion of working-age reduces.

Treasury (2002, p. 45) predicts a negligible change in PPS resulting from two opposing effects: first, the reduction in the number in the age group receiving the allowance because of a decrease in the TFR; and second, the growth in the proportion of single parents to all parents.

There are two reasons the unemployment allowance is predicted to decrease: first, the benefit is indexed to the CPI rather than the average total male weekly earning (ATMWE), the CPI index grows at a slower rate and reduces the unemployment allowance as a percentage of GDP; and second, the increase in the TDR decreases the supply of labour which reduces the unemployment rate and expenditure on the unemployment allowance.

There are two reasons the FTB is predicted to decrease: first, components of the benefit are indexed to CPI rather than ATMWE; and second, the low TFR is expected to reduce the number receiving this benefit.

3.4.5 Social Outlay Summary

Population ageing may increase government SS&W and health expenditure considerably and reduce education expenditure moderately. The government social outlays expenditure growth may be largest for Health and second, largest for the ASP. This completes the coverage of government expenditure on social outlays.

3.5 Labour Supply

The labour supply is the quantity of labour available, for example, as measured by the number of working hours supplied. The labour supply is relevant because Equation (2.1) shows its importance in determining GDP. The three factors that affect the labour supply per capita are the labour force participation rate (LFPR), the unemployment rate, and average hours worked. All are affected by population ageing. Appendix (A.4) defines the labour supply in more detail.

3.5.1 Labour Force Participation Rate

Banks (2004) and the Productivity Commission (2004a, p. xxvi) note that the LFPR decreases with age meaning an ageing population will have a reduced labour supply. The OECD (1996, pp. 31-2) and McMorrow and Roeger (2001, p. 35) assume in their simulation models that the LFPR is constant. This simplification may cause an overestimate in their GDP projections. The following subsections discuss trends in the LFPR and their relationship to population ageing. These trends need consideration in order to produce accurate projections.

3.5.1.1 Cohort and Gender Effects

The ABS (1999, p. 3) predicts an overall decrease in the LFPR from 1998 to 2016. However a noticeable past trend is the increase in the female LFPR and small decrease in the male LFPR resulting in a long-term projected convergence for most age groups. The Treasury (2002, pp. 72-3) analysis of the trends in the LFPR by age and gender leads to a similar projection. The Productivity Commission (2005b, pp. T3.1-13) allows for a cohort effect to enable more accurate LFPR projections. The Productivity Commission (2005a, p. xx) show that the cohort effect is particularly pronounced among females, where each successive female cohort considerably increases its LFPR. In contrast the Productivity Commission (2005b, p. T3.5) notes that each successive male cohort shows a slight decrease in its LFPR. Potential policy tools for increasing the LFPR include identifying and enhancing the causes for the increases in the female LFPR, and identifying and reversing the causes for the decrease in the male LFPR.

3.5.1.2 Education Level Effect

The Treasury (2004, p. 5) cites the ABS 1981 and 2001 census results of LFPR by age and education noting there is a trend for those with a higher education level to have a higher LFPR and stay in the workforce for longer. The Productivity Commission

(2004a, pp. 3, xxx) agrees. Increasing the education level is a potential policy tool to increase the LFPR.

3.5.2 Unemployment Rate

The Productivity Commission (2004a, p. xxvii) predicts that population ageing is likely to reduce unemployment. Three reasons contribute to this. First, the young who have the highest unemployment rates form a decreasing proportion of the population. Second, the aged who have the lowest unemployment rate form an increasing proportion of the population. Third, the aged have the alternative of retirement. The Consequently, population ageing is likely to reduce the measured unemployment rates. Combined with a generally falling trend in the unemployment rates implies that, for any given LFPR the effective labour supply will be higher than otherwise. In contrast, the OECD (1996, pp. 31-2) and McMorrow and Roeger (2001, p. 35) assume a constant unemployment rate in their projections. This simplifying assumption may cause an underestimation of GDP, but seems acceptable given the small effect that population ageing may have on the unemployment rate.

3.5.3 Average Hours Worked

The ABS (2004b) notes a steady rise in the proportion of part-time employment from 24 percent in 1993 to 28.5 percent in 2003. The Productivity Commission (2004a, p. xxviii) projects this trend to continue until it reaches 33 percent in 2044 without population ageing and 34 percent with population ageing. Factors contributing to this are older workers have a higher propensity to work part-time and more males shifting from full-time to part-time work.

The Commission (2004a, p. xxviii) notes that the average hours worked are generally projected to increase modestly for part-time workers of most ages and continue to be stable for full-time workers generally. However, the average weekly hours per employee are projected to fall because the incidence of part-time work will continue to increase for most age groups, particularly among males and older workers, who have a higher propensity to work part-time.

3.5.4 Labour Supply Summary

The Productivity Commission (2004a, p. xxviii) projects sluggish growth in the labour supply as population ageing has a doubly depressive effect by reducing both the LFPR and average hours worked. These greatly outweigh the positive influences of lower unemployment. The Productivity Commission (2004a, p. xxix) expects an overall decrease in the labour supply per capita (L/N). Equation (2.1) implies maintaining output per capita (Y/N) requires measures to increase the labour supply per capita (L/N) and/or increase the labour productivity rate (Y/L), which is discussed in the next section.

$$Y/N = Y/L \times L/N \qquad (2.1)$$

3.6 Labour Productivity

In this study the labour productivity rate is measured by GDP per hour worked (Y/L). The labour productivity growth rate (LPGR) is measured by the annual percentage increase in the labour productivity rate. Two factors that affect labour productivity are capital deepening and multifactor productivity (MFP). Population ageing indirectly affects both capital deepening and MFP although the outcome is uncertain. The following subsections review both of the factors.

3.6.1 Ageing and Productivity at an Individual Level

The Productivity Commission (2004a, pp. xxx, xxxi) notes that the population ageing effect on labour productivity is mixed. Empirical estimates suggest worker's productivity increases until middle age then decreases. However this could in part be due to a cohort effect as the aged of today are less educated than the middle aged of today so less productive. Further health improvements coupled with a trend away from more hazardous occupations reducing injury and disability may improve productivity in older workers. In addition, the population ageing induced shift from employing young inexperienced workers to more aged experienced workers may improve productivity. The net result is expected to be negligible in magnitude. Similarly, McMorrow & Roeger (2001, pp. 26, 41) predict in the US, Japan, and EU15 over the period 2000-2050 that the effect of population ageing on TFP is negligible.

How ageing affects entrepreneurship is important to the LPGR as entrepreneurship involves using one or more of the sources of labour productivity growth outlined in section (2.2.2). Peters, Cressy & Storey (1999) in the UK produce three findings. First, individuals starting their business around the age of 50 have higher survival rates in business than younger workers. Second, these are perhaps up to three times as high as individuals in their teens and early twenties. Third, businesses established by older workers exhibit slower rates of growth – in terms of employment and sales – than businesses established by prime age individuals. De Bruin and Firkin (2001, p. 116) in NZ note that there is an increase in the propensity for older people to be in self-employment. In summary, the overall effect of an increase in the proportion of aged entrepreneurs on the LPGR is ambiguous.

3.6.2 Ageing and Productivity at an Industry Level

Table 3.2 shows that the health industry's LPGR is 1.2 percent and below that of the 'All market sector industries' at 3.0 percent. The population ageing effect is expected to increase the health industry as a proportion of GDP so increase the weighting of health in Table 3.2 which may reduce the overall LPGR.

Table 3.2 Labour Productivity[a] Average Annual Growth Rate 1993-94 to 1999-2000

Industry[b]	%
Agriculture, forestry and fishing	2.7
Mining	7.3
Manufacturing	2.8
Electricity, gas and water supply	6.7
Construction	1.0
Wholesale trade	6.0
Retail trade	1.9
Accommodation, cafes and restaurants	1.2
Transport and storage	2.4
Communication services	6.0
Finance and insurance	3.9
Health and community services	1.2
Cultural and recreational services	–0.5
All market sector industries	3.0

(a) Gross product per hour worked. (b) Estimates are not available for Property and business services, Government administration and defence, education, and Personal and other services.

(Source: ABS 2002b)

However caution is required when extrapolating the LPGR shown in Table 3.2 to later periods, for three reasons. First, 1993-94 to 1999-2000 was a period of recovery after the 1991-92 recession, an increase in LPGR is expected in this phase of the business cycle. Second, some of the high LPGR may be due to one-off events such as privatisation. For example in 1993 Telecom, as it was then, had about 90,000 employees. In 2000 it was down to about 55-60,000. Third, low LPGR in health may be because the level of productivity is already high.

3.6.3 Capital Deepening and Savings in Australia

Chapter 2 covers the population ageing effect on savings for individuals and international capital flows as sources of capital deepening and investment to promote economic growth. Chapter 2 notes the differing outcomes for savings in the Solow model and EGM. This section reviews savings and investment trends in Australia, in particular the interaction between the savings components in Equation (3.2) and Equation (3.3).

National Savings = public sector savings + private savings (3.2)

Private savings = business savings + personal savings (3.3)

3.6.3.1 Australian Savings Rate: a Comparison

Roseveare et al. (1996, p. 26) note in the years 1995 and 2000 that Australia had the lowest national and private savings as a percentage of GDP of the 18 OECD countries surveyed other than for Denmark in 2000 for private savings.

Roseveare et al. (1996, p. 26) projects private and national savings in Australia may decrease in 2030 (see Table 3.3). The small decrease in private saving is consistent with the findings in Chapter 2. The decrease in public sector savings is consistent with the increases in government social outlay in section (3.3).

Table 3.3 Demographic Impact on Future Savings

Savings as a %GDP	1995	2000	2030
Private Savings	2.6	3.1	–1.0
National Savings	1.0	3.2	–2.2

(Source: Roseveare et al. 1996)

Roseveare et al. (1996, p. 26) notes that Australia's national savings ranking increases from the lowest in 1995 and 2000 to ninth of the eighteen ranking in 2030. This increase in ranking is attributable to Australia undergoing population ageing to a smaller degree than the many other OECD countries (Roseveare et al. 1996, pp. 27-9), and Australia having lower projected pension payment as a percent of GDP than many other OECD countries (Roseveare et al. 1996, pp. 31-2). However Roseveare et al. (1996, p. 5) claims Australia's exposure to increases in public health expenditure may affect national savings.

3.6.3.2 Australian Savings Composition

The ABS (2004e) notes that sectors within a nation can have different saving behaviour, and net national saving can be dissected to show the trends in saving by the following sectors – households, general government and corporations. The ABS (2004e) observes over the longer term (from the 1960s onward) that the household sector has been the main contributor to national saving. However, since the early 1970s, the net saving of the household sector as a percentage of GDP has fallen. The downward trend in household savings appears to contradict the predictions of the LC-PIH, namely the demographic gift is projected to occur around 2012 implying household saving are expected to increase until 2012, then to decrease afterwards. The observation indicates other trends are more significant.

The ABS (2004e) notes that the general government sector went from being a net saver during the 1960s to a net dissaver between the 1970s and early 1990s, but during the 1990s, government dissaving was progressively reduced and between 1997-98 and 2002-03 the government sector was again a net saver. This is consistent with population ageing in the demographic gift phase. However, the large swings show so far that other cyclical factors are of greater magnitude than population ageing.

The ABS (2004e) observes that the corporate sector has seen considerable fluctuations in saving since the 1960s. However for much of the 1990s the corporate sector has been a net saver.

Guest and McDonald (2001, pp. 117-8) note that there is no consensus on what is a suitable savings rate for Australia.

3.6.3.3 Capital Formation

Capital formation is continuing, despite the poor savings record. The Productivity Commission (2004a, p. xxxii) notes that capital deepening has been remarkably stable over the last 40 years despite the significant changes in global investment and demographic conditions. The source for capital may increasingly come from overseas capital flows supplemented with an increasing proportion of savings carried out by the business sector.

3.6.4 Labour Productivity Summary

There is little persuasive evidence to support the premise that population ageing will affect innovation, entrepreneurship or technical progress. Capital formation remains stable despite its change in source. Overall, there is insufficient evidence to suggest that population ageing will either reduce or enhance labour productivity. However, Table 3.2 shows considerable difference between industries' LPGR. The 'Health and community services' industry with a low LPGR is expected to grow in size with population ageing and may decrease the 'All market sector industries' LPGR.

The Productivity Commission (2004a, p. xxxii) note capital formation is happening at a steady rate despite Australia's very low savings rate. Fougère & Mérette (1998) project that capital investment made in excess of decreasing domestic savings will be made from increasing overseas capital inflows.

3.7 Conclusion

Population ageing is projected to increase the ADR while slightly decreasing the CDR. Additionally, it is noted that the cost of social outlays for the aged is much higher than that for children. This has consequences for government social outlays by increasing the SS&W and health expenditure and by reducing education expenditure by a small amount. Further the tax revenue per capita may decrease as the ADR increases. Both actions will increase fiscal pressure.

There is uncertainty about the population ageing effect on labour productivity but any effect may be small. There may be a reduction in the labour supply because the LFPR may decline. This may result in a slowing in economic growth reducing growth in tax revenue based on a flat tax rate.

However offsetting this slowing in economic growth are decreases in the unemployment rate, increases in the female LFPR, and increases in part-time work by the aged. Day and Dowrick (2004) note population change has often been treated as exogenous, whereas it is perhaps best seen as involving complex interdependencies. The population ageing effect on government social outlays may have been oversold as a problem.

4. Methodology

4.1 Introduction

Chapter 2 finds that economic theory is ambiguous or inconsistent in predicting the population ageing effect on economic growth or savings. Consequently, this study uses a simulation model to analyse the research questions. The purpose of a simulation model is to represent reality in a simplified form, so enabling the testing of various scenarios without trialling them in the real world. The advantages of this approach include the ability to obtain quantifiable results and to carry out 'What-if' or sensitivity analysis.

Sensitivity analysis involves changing parameters from the model's baseline values and measuring the effect on dependent variables. The sensitivity analysis methods in this model are the 'Change in time to achieve a negative cumulative net operating balance (NOB) balance' to measure change in fiscal pressure; and 'After-tax GDP per capita' projection to measure the change in growth in living standards under a pay as you go policy (PAYGP). These sensitivity analysis methods are used to investigate the research questions listed in Chapter 2. The calculations for the simulation model are detailed in Appendix A. This study's baseline is compared with those of other studies' to be certain of its suitability for sensitivity analysis. This simulation model uses the 'Tax elasticity of the labour supply' (TELS) method to model how changes in the tax rate affect the labour supply.

The sections in this chapter cover the following issues: the creation of the baseline as a percentage GDP for comparison with other baselines; the sensitivity analysis methods; the development of the research questions from Chapter 2 for investigation; and simplifying assumptions.

4.2 Baseline Projection and Comparison

The baseline projection forecasts future events given no intervention. It is important to the sensitivity analysis because it provides a starting point from which the effectiveness of various interventions can be measured. The baseline is compared to other studies to ensure its suitability for sensitivity analysis. The baseline's accuracy is dependent on the accuracy of its parameter values and the methodology used. Additionally the more sensitive the baseline is to a parameter the more accurately the parameter needs to be determined.

Appendix A details the simulation model's baseline methodology. This section gives an overview of the baseline methodology and parameter values. In the literature, baseline projections of government social outlays are usually expressed as a percentage of GDP. This allows easy identification of the relative growth in social outlays. This study's baseline is initially projected as a percentage of GDP for comparison with the baselines from the Productivity Commission (2005a), the Treasury (2002), and Guest and McDonald (2000).

The simulation model uses the methodology and baseline parameter values common to the Productivity Commission (2005a) and Treasury (2002). Departures from their projection methodology are detailed in Appendix A. The baseline core data sets include the ABS (2005c) Government Financial Statistics (GFS); ABS (2004f, table 9) Estimated Residential Population (ERP); and the ABS (2003a, table 9a) Population Projection (Series B). The GFS and ERP provide much of the initial calibration.

There are a number of terms utilised to describe the increase in government expenditure over revenue caused by population ageing: fiscal pressure, funding gap, net operating balance (NOB), net leading/borrowing, and budget deficit. These terms refer to slightly different measurement or can be ambiguous but are often expressed as a percentage of GDP. This study uses the NOB from the GFS to calibrate the model and as a measure of fiscal pressure or funding gap. The NOB is shown in Equation (4.1). The funding gap as a percentage of GDP is shown in Equation (4.2).

$$\text{NOB} = \text{GFS Revenue} - \text{GFS Expenditure} \qquad (4.1)$$

$$\text{NOB as a percentage of GDP} = \text{NOB} / \text{GDP} * 100 \qquad (4.2)$$

The approach adopted by the other three studies is to assume that all components of government expenditure and revenue other than social outlays and tax revenues stay a constant percentage of GDP, so making the funding gap a measure of fiscal pressure rather than budget deficit. These other three studies apply population ageing to different portions of government expenditure and/or revenue and use slightly different fiscal pressure or budget deficit type concepts. This study uses the NOB to allow for easy calibration with the GFS and to enable comparison with the various fiscal pressure or budget deficit measures with adjustment.

The sensitivity analysis and research questions use the baseline parameter values from Appendix A. They are presented here in a condensed form for easy reference. The baseline projection uses the following values and projections. The population projection is Series B. The labour productivity growth rate (LPGR) is 1.75 percent. The retirement age for males is 65 and for females 62.5 in 2004, increasing to 65 by 2014. The Commonwealth tax rate is 25.7 percent of GDP. The state tax rate is 5.8 percent of GDP in 2004 then 5.5 percent of GDP from 2005 onwards. The 'Tax elasticity of the labour supply' (TELS) is zero. The 'Health premium above real growth in GDP per capita' (health premium) is 0.6 percent. The projection of the unemployment rate, LFPR, and hours worked are based upon the ABS (2005e, table LM8) and the Productivity Commission (2005b, sec. 3).

4.3 Sensitivity Analysis Methods

Heylighen (2005) writes that sensitivity analysis is a procedure used to determine how sensitive a model's outcomes are to changes in its parameters. If a small change in a parameter results in relatively large change in the outcomes. Then the outcomes are said to be sensitive to that parameter.

The previous section plans to use the NOB as percentage of GDP method to present the baseline projection to facilitate comparison. The research questions and sensitivity analysis are better served by using two alternative methods or presentations of the baseline: 'Change in time to achieve a negative cumulative NOB'; and 'After-tax GDP per capita'. 'Tax elasticity of the labour supply' (TELS) supplements the sensitivity analysis methods to allow modelling of the labour supply's sensitivity to the tax rate. TELS was not an issue in the baseline projection, where the change in the tax rate is effectively zero.

This section discusses the following sensitivity analysis methods: 'Change in time to achieve a negative cumulative NOB'; 'After-tax GDP per capita'; and TELS.

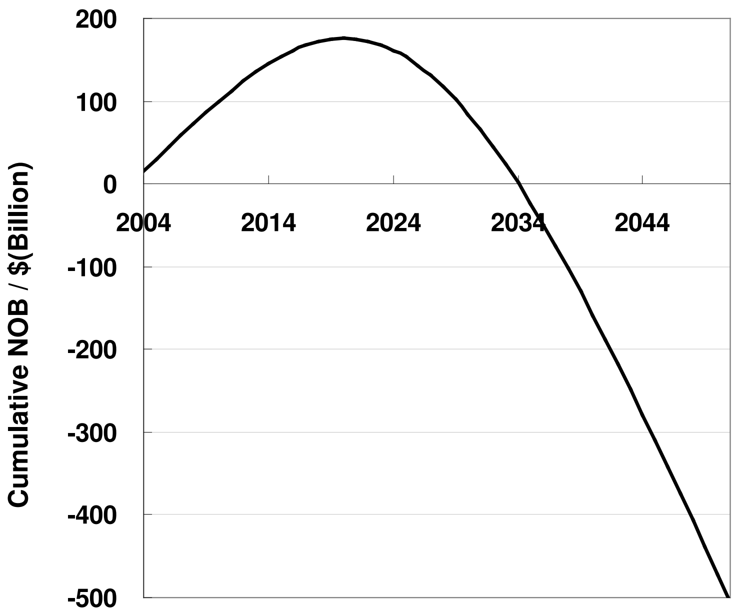
4.3.1 Change in Time to Achieve a Negative Cumulative NOB

The 'Change in time to achieve a negative cumulative NOB' sensitivity analysis method measures changes in fiscal pressure. The method is applied to all the research questions that change parameters to investigate their effect on fiscal pressure. There are four reasons that make 'Change in time to achieve a negative cumulative NOB' preferable to 'NOB as percent GDP'. First, the method allows for the time value of money. Second, the 'NOB as a percentage of GDP' treats government finances as an annual flow, in contrast to the 'Cumulative NOB', which treats government finances as stock, thereby reflecting past government financial flows at any moment in time. Third, the 'Time to achieve a negative cumulative NOB' converts the 'Cumulative NOB' in monetary terms – often a mind-numbingly large figure – onto a time scale (a date or a year) giving a more intuitive measure of fiscal pressure. Fourth, the 'Change in time to achieve a negative cumulative NOB' allows changes in fiscal pressure to be seen as changes in years. This allows easy comparison between sensitivity analysis results and easy measure of policy effectiveness.

Figure 4.1 illustrates the baseline cumulative NOB for 'All levels of government'. The model's sensitivity to changes in a parameter is measured by the change in time to achieve a negative cumulative NOB from the baseline date 2043. Measuring the changes from the baseline date is important as it indicates changes in fiscal pressure and the potential effectiveness of policy that is intent on changing a parameter. If the time to achieve a negative cumulative NOB increases/decreases to a year after/before 2043, fiscal pressure decreases/increases and the policy is effective/counterproductive. Alternatively if the time to achieve a negative cumulative NOB stays the same, i.e. the year remains 2043, fiscal pressure remains unchanged and the policy is ineffective.

The cumulative NOB for any year is calculated by adding the net present values (NPV) of NOB from 2004 to the projected year. The base year is 2004 and the discount rate used in the calculation is three percent. A three percent discount rate was chosen to represent the 'Real interest rate' for government that is, the difference between the target cash rate and underlying inflation. The Reserve Bank of Australia (2005) target cash rate is 5.5 percent and the consumer price index (CPI) is 2.5 percent, giving a 'Real interest rate' of 3.0 percent as at 3 August 2005. The monetary values in the model are all expressed in terms of 2004 dollars, so avoiding the requirement to account for inflation in the NPV calculations. Appendix C covers sensitivity analysis on the discount rate and finds no appreciable effect on the conclusions this study makes.

Figure 4.1 Baseline Cumulative NPV of NOB for 'All Levels of Government'

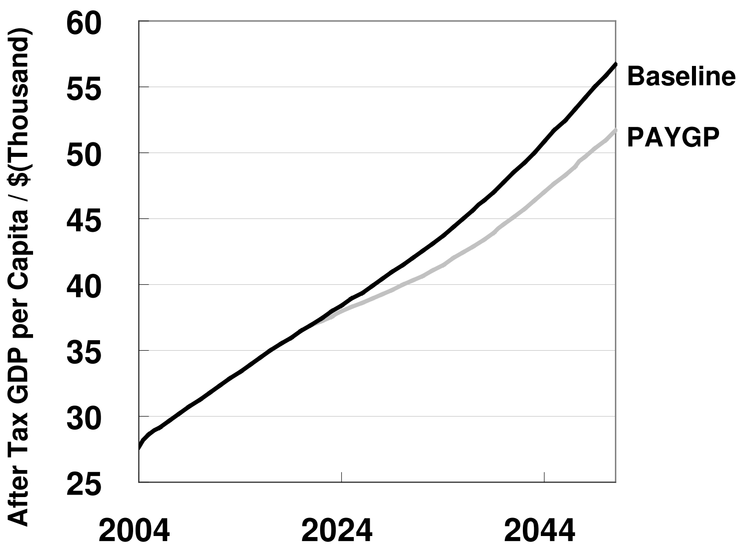


4.3.2 After-tax GDP per Capita

The ‘After-tax GDP per capita’ sensitivity analysis method is used to investigate the pay as you go policy (PAYGP) research questions. The PAYGP proposal is that any negative NOB is covered with a tax increase in the same year, resulting in a zero NOB, or balanced budget. The ‘After-tax GDP per capita’ method is required in addition to the ‘NOB as a percentage of GDP’ and ‘Change in time to achieve a negative cumulative NOB’ methods because it allows easy comparison of after-tax GDP per capita before and after applying a PAYGP. The continued growth in after-tax GDP per capita after applying a PAYGP is part of the justification for using a PAYGP. This method extends Guest and MacDonald’s (2000) work by providing a graph representing the growth in after-tax GDP per capita for the baseline and under a PAYGP simultaneously.

Figure 4.2 illustrates growth in after-tax GDP per capita and provides an alternative presentation of the same baseline projection shown in Figure 4.1. There are two lines in Figure 4.2. The black line represents the growth in after-tax GDP per capita for the baseline. The light grey line represents the growth in after-tax GDP per capita under a PAYGP. The slope of the line indicates the rate of growth in after-tax GDP per capita. Note the PAYGP decreases the steepness of the line, indicating a decrease in the growth of after-tax GDP per capita. The steepness acts as a guide to how the PAYGP affects the growth in the standard of living.

Figure 4.2 Projection of after-tax GDP per capita under a PAYGP for TELS = 0



4.3.3 Tax Elasticity of the Labour Supply

Guest and McDonald (2000) note a disincentive effect that of increases in the tax rate reducing the labour supply which reduces GDP. This disincentive effect and the incentive effect of a decrease in the tax rate increasing GDP are modelled with a 'Tax elasticity of the labour supply' (TELS) method shown in Equation (2.9).

$$\text{TELS} = -(\%\Delta \text{ tax rate} / \%\Delta \text{ labour supply}) \qquad (2.9)$$

The calculation of the labour supply in hours is given in Appendix (A.2.3.4). The tax rate is give as a percentage of GDP. Guest and McDonald (2000) assume TELS values of 0 and 0.2. In comparison Dixon and Rimmer (2000) use TELS values from 0.2 to 2.0 in their study on tax and wage policies to increase employment. This range of values indicates uncertainty over the true TELS value. Consequently this study uses the TELS values 0, 0.2, 1 and 2.

Equation (2.9) allows the calculation of a new labour supply given a change in tax rate and TELS. GDP and NOB are recalculated using Equation (2.1). The simplifying assumption is made that the prevailing labour productivity (GDP per hour) is maintained regardless of the source of the extra hours. Based on the reasoning that if the extra hours come from those receiving unemployment allowance, disability support payment (DSP), parent payment single (PPS), age or service pension (ASP), or family tax benefits (FTB), then there is a savings on government social outlay expenditure and an increase in government revenue. If the extra hours come from those not receiving benefits, then there is just an increase in government revenue. This assumes those on various benefits would earn considerably less on average than those already in the workforce and consequently have earnings in the low marginal tax rates so producing little in tax revenue. However the savings from the decrease in the number of beneficiaries, or those shifting to partial payments, would offset the poor tax revenue, making the net effect on the funding gap similar for both groups.

4.4 Research Questions

This section develops methodology to investigate the research questions from Chapter 2 by associating each with a sensitivity analysis method from the previous section; by identifying any simplifying assumptions; and by establishing parameter ranges.

4.4.1 Participation Policy – Retirement Age

Is increasing the retirement age an effective way to reduce fiscal pressure?

The sensitivity analysis method to measure the change in fiscal pressure is ‘Change in time to achieve negative cumulative NOB’. The retirement age is varied from 65 years, the baseline retirement age, to 70 years by one year increments. This is a suitable maximum because Duval (2004, p. 29) notes from 1969 to 2003 that the OECD countries with the highest standard retirement age were Norway and Ireland at 70 years. A simplifying assumption made is that, when the retirement age increases from 65 to 70, the 60-64 age group's disability rate, unemployment rate, LFPR, and average hours worked apply to those no longer retired. This acknowledges that increasing the retirement age simultaneously increases the labour supply, decreases ASP expenditure, but increases unemployment allowances and DSP expenditure. The sensitivity analysis measures the decrease in fiscal pressure by finding the increase in years to a negative cumulative NOB per year increase in the retirement age.

4.4.2 Participation Policy – Labour Force Participation Rate (15-64)

Is increasing the LFPR an effective way to reduce fiscal pressure?

The sensitivity analysis method to measure the change in fiscal pressure is 'Change in time to achieve negative cumulative NOB'. The baseline LFPR (15-64) projection from 2004 to 2051 is developed by summing the weighted projections of the LFPR of the age groups 15-19, 20-24, 25-29, …, …, …, 55-59, and 60-64. Hence the baseline LFPR (15-64) projection ranges from 74.4 to 75.7 percent varying over time. The sensitivity analysis increases the baseline LFPR (15-64) to 76 percent, then by one percent increments after that up to 81 percent. This is a suitable maximum because the OECD (2004a, p. 294, annex C, table B) notes in 2003 that the OECD country with the highest LFPR (15-64) was Switzerland at 81.2 percent.

The calculation uses the simplifying assumption that a one percent rise in the LFPR gives a one percent rise in the labour supply. This assumption allows the scaling of the labour supply by the desired LFPR and the current LFPR. The increase in labour supply is used to calculate the increase in GDP, which provides the increase in tax revenue when the increase in GDP is multiplied by the tax rate. The NPV of the increase in tax revenue with a 3 percent discount rate is combined with the baseline cumulative NOB to form the new cumulative NOB projection for the increased LFPR.

The sensitivity analysis measures the decrease in fiscal pressure by finding the increase in years to a negative cumulative NOB per percentage point increase in the LFPR.

4.4.3 Productivity Policy – Labour Productivity Growth Rate

Is increasing the LPGR an effective way to reduce fiscal pressure?

The sensitivity analysis method to measure the change in fiscal pressure is 'Change in time to achieve negative cumulative NOB'. The sensitivity analysis uses the following LPGRs, low (1.45%), baseline (1.75%), and high (2.05%). The reasons for selecting this range are as follows. The Productivity Commission (2005a, p. 102) cites the ABS (National Accounts, Cat. No. 5204.0 and 5206.0) LPGRs, 1966-67 to 2003-2004, for the market and non-market sectors ranging between 1.45% and 2.05%, providing symmetry around a long-term average of 1.75%. The Treasury (2002) and the Productivity Commission (2005a) use a baseline LPGR of 1.75 percent. Guest (2004b, p. 6) notes 1.5 percent is conservative value and the Treasury (2002, p. 25) notes that 2 percent is a value higher than the 30 year trend. The sensitivity analysis measures the decrease/increase in fiscal pressure by finding the increase/decrease in years to a negative cumulative NOB per 0.3 percent increase/decrease in the LPGR.

4.4.4 Tax Policy

Is changing the tax rate an effective way to adjust the fiscal pressure?

The sensitivity analysis method to measure the change in fiscal pressure is 'Change in time to achieve negative cumulative NOB'. The tax rate sensitivity analysis range selected is a decrease/increase of 1 and 2 percent of GDP based on the following figures. The Treasury (2002, p. 55) reduces their Commonwealth tax rate to 20.8 percent of GDP in their projection from 2005 to 2042 whereas the ABS (2005a) finds that the rate is 22.4 percent. This indicates a potential tax-cut of 1.6 percent. Tax rate increases are addressed in the PAYGP research questions in this study. The simplifying assumptions made are that a change in the tax rate does not change the LPGR nor the labour supply, i.e. a TELS value of zero. The sensitivity analysis measures the decrease/increase in fiscal pressure by finding the increase/decrease in years to a negative cumulative NOB per percentage point increase/decrease in the tax rate.

4.4.5 Tax Policy and Tax Elasticity of the Labour Supply

Does TELS determine the effectiveness of using tax rate changes to alter the fiscal pressure?

The sensitivity analysis method to measure the change in fiscal pressure is 'Change in time to achieve negative cumulative NOB'. The TELS method is described in section (4.3.3). The sensitivity of the labour supply to the tax rate is modelled by varying the value of TELS. Subsequently the change in GDP and tax revenue is calculated from the change in the labour supply. The range for the tax rate increase/decrease is 1 percent of GDP. The values for TELS are 0, 0.2, 1 and 2. The reason for choosing these TELS values is that Dixon and Rimmer (2000) use TELS values of 0.2 and 2.0 in their study and Guest and McDonald (2000) use TELS values of 0 and 0.2 in their study. The TELS value of 1 is selected as an intermediate value between 0 and 2. The sensitivity analysis measures the decrease/increase in fiscal pressure by finding the increase/decrease in years to a negative cumulative NOB for the TELS values 0, 0.2, 1, and 2 with a 1 percent increase/decrease in the tax rate.

4.4.6 Tax-cut Policy

Can using a policy of tax-cuts to increase the LPGR and the LFPR solve the population ageing induced fiscal pressure?

The sensitivity analysis method to measure the change in fiscal pressure is 'Change in time to achieve negative cumulative NOB'. The sensitivity of the LPGR to the tax changes is exogenous to the model but the simulation assumes a small tax rate cut will give a large LPGR increase. The tax-cut policy is evaluated for its effect on the time to achieve a negative cumulative NOB under favourable conditions, assuming that a small 0.5 percent tax-cut increases the LPGR from the baseline 1.75 percent to the range maximum of 2.05 percent, and a maximum TELS value of two. The TELS method is described in section (4.3.3), which covers the sensitivity of the labour supply to tax rate changes. The sensitivity analysis measures the decrease/increase in fiscal pressure by finding the increase/decrease in years to a negative cumulative NOB for the 0.5 percent tax-cut, a TELS value of 2, and LPGR of 2.05 percent.

4.4.7 Pay As You Go Policy and Tax Elasticity of the Labour Supply

What effect does a high TELS have on after-tax GDP per capita under a PAYGP?

The 'After-tax GDP per capita' sensitivity analysis method is used to measure the effect of an increase TELS value under a PAYGP. This study's minimum and maximum TELS values of 0 and 2 are used in the sensitivity analysis. The change in slope of the 'After-tax GDP per capita' line indicates the sensitivity to the change in TELS value under a PAYGP. A smaller gradient implies a slower growth in the standard of living.

The larger the decrease in gradient, the more sensitive the standard of living is to TELS, and the less appealing a PAYGP becomes.

4.4.8 Pay As You Go Policy and Labour Productivity Growth Rate

What effect does changing the LPGR have on after-tax GDP per capita under a PAYGP?

The 'After-tax GDP per capita' sensitivity analysis method is used to measure the effect of LPGR changes under a PAYGP. The sensitivity analysis uses the following LPGRs, low (1.45%), baseline (1.75%), and high (2.05%). The change in the gradient of the 'After-tax GDP per capita' line indicates the sensitivity to the LPGR under a PAYGP. The larger the change in the gradient, the more sensitive the standard of living is to the LPGR under a PAYGP. The more sensitive after-tax GDP per capita is to the LPGR, the more useful the LPGR becomes as a policy tool under a PAYGP.

4.4.9 Population Policy

Can changing the mortality, net overseas migration (NOM), and total fertility rates (TFR) eliminate population ageing induced fiscal pressure?

The sensitivity analysis method to measure the change in fiscal pressure is 'Change in time to achieve negative cumulative NOB'. Ideally the sensitivity analysis would change the population parameters; mortality, NOM, and TFR, individually but does not because of data and time constraints. Instead the sensitivity analysis uses the three ABS (2003a, tables 9a, 9b, and 9c) Population Projections (Series A, B and C) to give low, baseline, and high projections. Table 4.1 details the population parameters for Series A, B, and C. Table 4.2 indicates the change in population parameters from the baseline.

Table 4.1 Population Projection Parameters

	TFR	NOM	Life expectancy at birth (years)		2051	2101
	Babies per woman	Persons	Males	Females	million	million
Series A – High	1.8	125,000	92.2	95.0	31.4	37.7
Series B – Baseline	1.6	100,000	84.2	87.7	26.4	26.4
Series C – Low	1.4	70,000	84.2	87.7	23.0	18.9

(Source: ABS 2002a, p. 1)

Table 4.2 Population Projection Parameter Changes from Baseline

	TFR	NOM	Life expectancy at birth (years)		2051	2101
	Babies per woman	Persons	Males	Females	million	million
Series A – High	0.2	25000	8	7.3	5	11.3
Series C – Low	-0.2	-30000	0	0	-3.4	-7.5

4.4.10 Real Non-Demographic Health Expenditure Growth

Do real non-demographic health expenditure projection methods and parameters have a large effect on fiscal pressure projection?

The sensitivity analysis method to measure the change in fiscal pressure is 'Change in time to achieve negative cumulative NOB'. This study's baseline uses a 2.15 percent non-demographic growth rate for all areas of health. This is a 0.6 percent health premium above the projected 2044-45 GDP per capita growth of 1.55 percent. Appendix (A.7.1) gives a more detailed account. This question is broken into three parts: varying health premium, PBS, and alternative real growth in GDP per capita projections.

4.4.10.1 Varying Health Premium

The baseline health premium of 0.6 percent altered to the range maximum of 0.9 percent and minium of 0.3 percent to measure its effect on the time to achieve a negative cumulative NOB. The sensitivity analysis measures the uncertainty in health expenditure projection by finding the increase/decrease in years to a negative cumulative NOB for the 0.3 percent health premium decrease/increase.

4.4.10.2 Pharmaceutical Benefit Scheme

The Productivity Commission's (2005a) PBS projection method is compared to this study's baseline method. The Productivity Commission (2005a) PBS projection that uses a special PBS health premium. It starts in 2004 with a growth rate of 4.9 percent 'Above real growth in GDP per capita in 2044-45' which is then asymptotically decreases in 2045 to 0.6 percent 'Above real growth in GDP per capita in 2044-45'. The algorithm for calculating the PBS health premium is given in Equation (A.4). The sensitivity analysis measures the uncertainty in health expenditure projection by finding the increase/decrease in years to a negative cumulative NOB for using the PBS health premium decrease/increase.

4.4.10.3 Real Growth in GDP per Capita

The baseline's health expenditure projection uses a constant 1.55 percent for 'Real growth in GDP per capita' part of 'Health premium above real growth in GDP per capita'. That constant projection is compared with the baseline's variable 'Real growth in GDP per capita' projection. This effectively compares a smooth growth rate with a variable growth rate. The sensitivity analysis measures the uncertainty in health expenditure projection by finding the increase/decrease in years to a negative cumulative NOB for the change in projection method.

4.4.11 Levels of Government

Are the State and Commonwealth levels of government equally affected by population ageing?

The sensitivity analysis method to measure the change in fiscal pressure is 'Change in time to achieve negative cumulative NOB'. Fiscal pressure is analysed for the Commonwealth and state governments by projecting the cumulative NOB for each. If the time to achieve a negative cumulative NOB is the same (different) for the Commonwealth and state governments as for the 'All levels of government' then each level of government's fiscal pressure is equally (unequally) affected by population ageing.

4.5 Simplifying Assumptions

Making any simulation model requires a certain number of simplifying assumptions, otherwise the model becomes too complex to use. However the simplifying assumptions mean the model departs from reality. Consequently any interpretation of the model's results is conditional on the simplifying assumptions. The following covers some of the assumptions which require consideration when interpreting the results.

1. This model makes many linear approximations to complex nonlinear situations with feedback loops making any sensitivity analysis only valid over a range where the linear form approximates the nonlinear situation.
2. The model does not factor in the cost of increasing the labour supply/LFPR. Increasing the LFPR could involve providing childcare facilities for those receiving FTB or PPS, special facilities or equipment for the disabled and aged, and extra training for the unemployed.
3. The assumption is made that all the assumptions in the model will hold till 2051. Any change in the assumptions could make the projection inaccurate.

4. The model assumes no linkage between labour productivity and the number in the population. Although, the literature indicates there maybe a possible link between the two variables.
5. This model provides a simplified service and age pension (SAP) projection. This compares with the Treasury (1992) Retirement Income Model used in both the Productivity Commission (2005a) and Treasury (2002) projections.
6. Most of the data used in the model has random errors whilst the model assumes that the data is exact.

Assumptions Relevant to Education

7. The model combines primary and secondary education expenditure assuming average cost per student is the same.
8. This model assumes the ratio of private to state school students and the government funding ratio of private to state school stay constant. These assumptions allow the use of an average government-expenditure per school student in the model, regardless of whether the student is in state or private school.
9. It is assumed that full-time to part-time school student ratio stays constant. The number of part-time school student has remained approximately 1% since 2002 when part-time records began.

Assumption Relevant to Parenting Payment Single

10. The thesis model uses the ABS (2004i, Series II) single parent projections until 2026. It then assumes that the ratio of single parents by sex and age group to the population stay constant until 2051.
11. It is assumed that the ratio of PPS recipients to single parents is constant over the projection.

4.6 Conclusion

A simulation model is used to investigate the research questions from Chapter 2 because Chapter 2 finds economic theory to be inconsistent or ambiguous in analysing population ageing. Appendix A contains the calculations for the model's baseline. This study's baseline construction follows the Treasury's (2002) and Productivity's Commission (2005a) method. This method differs from Guest and McDonald's (2000) method in the following ways: by including real non-demographic health expenditure growth; by using a LPGR explicitly; and by using a narrower range of government social outlays. This study includes a TELS similar to Guest and McDonald (2000).

This study's methodology provides three versions of the baseline to perform different functions. First, the 'NOB as a percentage of GDP' presentation is used to provide a forecast of events if no intervention is made. It also allows the baseline to be compared with other studies to ensure its suitability for use in the sensitivity analysis. Second, the 'Change in time to achieve a negative cumulative NOB' sensitivity analysis method used to measure change in fiscal pressure. Third, the 'After-tax GDP per capita' sensitivity analysis method used to measure growth in after-tax GDP per capita before and after a PAYGP.

This chapter has matched the research questions from Chapter 2 with suitable sensitivity analysis methods, baseline parameter values, and parameter ranges, to calculate the results shown in Chapter 5.

5. Results

5.1 Introduction

This chapter reports the results of running the simulation model as described in Chapter 4. The results comprise of three parts: a baseline projection; a baseline comparison with other studies; and a sensitivity analysis evaluation of the research questions. Initially the baseline's projection is given as a percentage of GDP. This is used to compare it with other studies to ensure its suitability for sensitivity analysis. The sensitivity analysis uses two presentations of the baseline to analysis the research questions: the 'Change in time to achieve a negative cumulative Net Operating Balance (NOB)'; and 'After-tax GDP per capita'. These sensitivity analysis methods are covered in section (4.3).

The first section discusses the baseline projection measured as a percentage of GDP. This provides a detailed account of the components contributing to fiscal pressure. The baseline projection is what is likely to happen without intervention. The second section makes a comparison between the baseline from this study and the baselines from other studies to ensure this study's baseline is robust and suitable for sensitivity analysis. In the third section, the 'Change in time to achieve a negative cumulative NOB' and 'After-tax GDP per capita' sensitivity analysis methods are used to measure the change in fiscal pressure and the change in growth of after-tax GDP per capita to answer the research questions from Chapter 4.

5.2 Baseline Projection

This section discusses the baseline projection in detail, firstly, to determine expected government expenditure and revenue in the case of no intervention, and secondly, to show that this model is comparable to the models used in other studies.

The values for the baseline projection are justified in the previous chapter. They are spread throughout the previous chapter and thus are given in a condensed form below.

- Population projection is the ABS (2003b, table 9b) Population Projection (Series B) whose parameters are given in the next subsection.
- The labour productivity growth rate (LPGR) is 1.75 percent
- Retirement age for males is 65 years
- Retirement age for females is 62.5 in 2004 increasing to 65 years by 2014
- Commonwealth tax rate is 25.7 percent of GDP. This includes GST.
- State tax rate is 5.8 percent of GDP in 2004 then 5.5 percent from 2005 onwards
- The 'Tax elasticity of the labour supply' (TELS) is zero
- 'Health premium above real growth in GDP per capita' (health premium) is 0.6 %
- The labour force projections for unemployment, participation, hours worked are based upon ABS (2005e, table LM8) by sex and age and Productivity Commission (2005b, sec. 3).
- ABS (2004d) Government Financial Statistics (GFS)
- ABS (2004f, table 9) Estimated Residential Population (ERP)

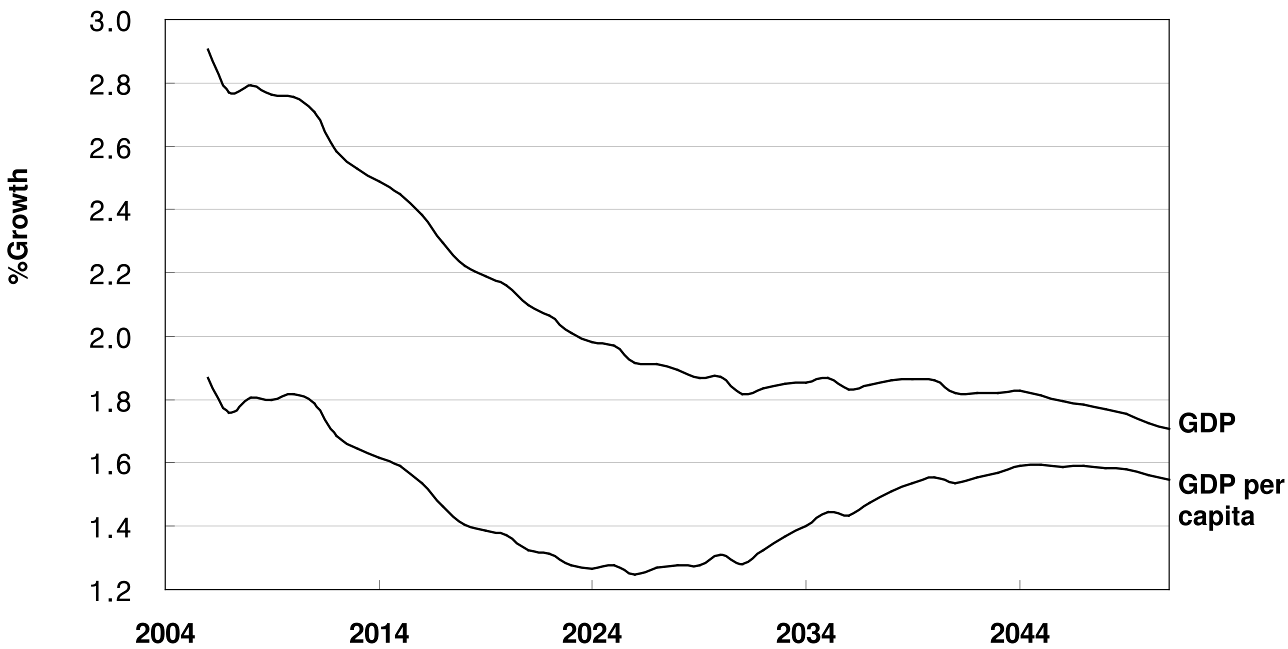
The GFS and ERP provide much of the baseline's initial calibration.

This subsection provides the baseline projections for the following areas: economic growth and tax revenue; government social outlays; GDP per capita and tax; and net operating balance (NOB).

5.2.1 Economic Growth and Tax Revenue

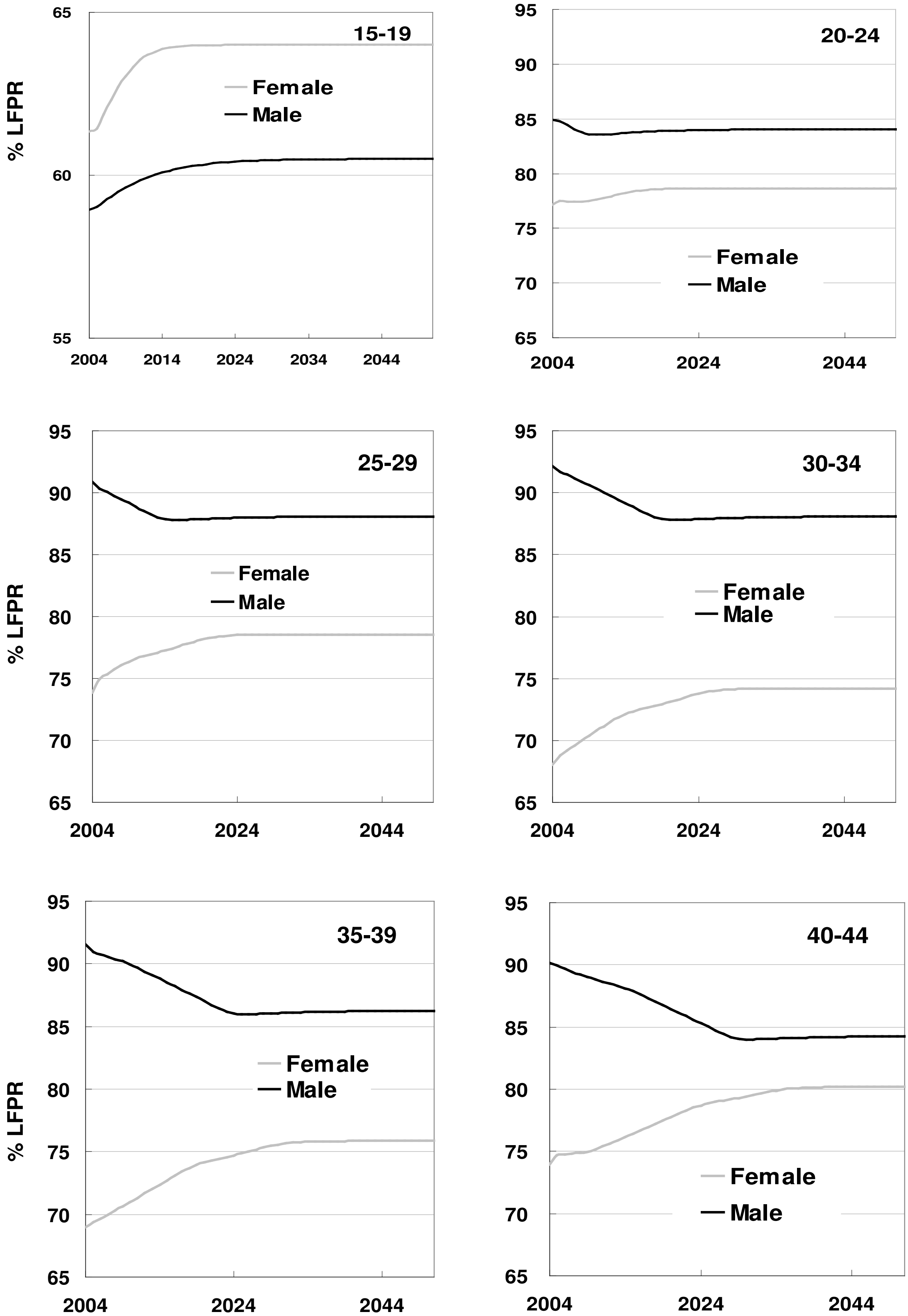
Tax revenue is fixed at 31.2 percent of GDP in the model so growth in GDP or GDP per capita also reflects the growth in tax revenue and tax revenue per capita. Figure 5.1 shows the GDP growth rate decreasing until 2031, changing little until 2044, and then decreasing. Further, the GDP per capita growth rate is decreasing until 2025, slowly increasing until 2044, and then decreasing slightly.

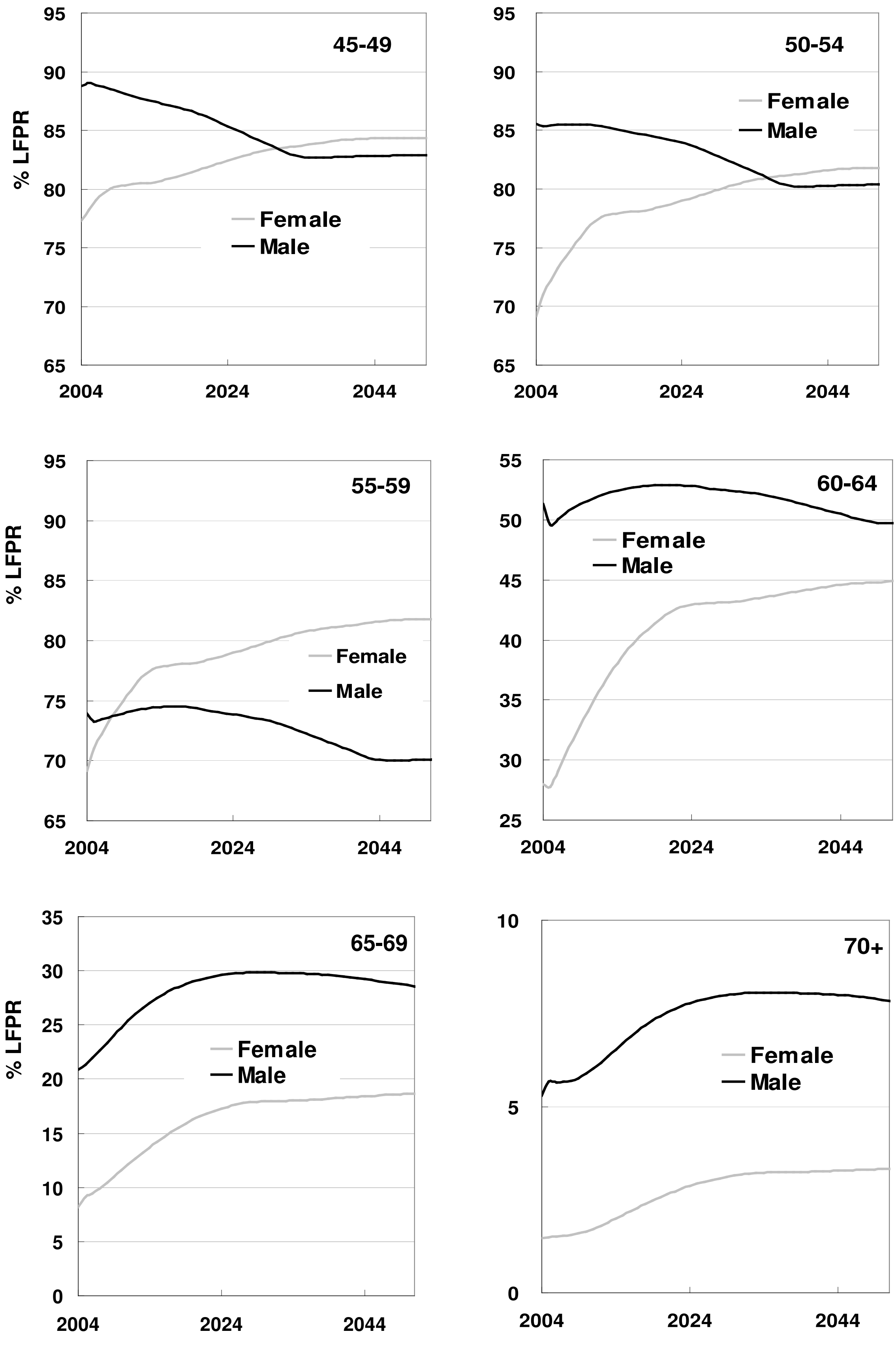
Figure 5.1 Projection of percentage growth in GDP and GDP per capita



The growth rates shown in Figure 5.1 are largely determined by the labour force participation rate (LFPR) and population ageing. Figure 5.2 illustrates the projected changes in the LFPR. The most notable LFPR trends are increases for females in all age groups and for males (15-19), and a general decrease in the other male age groups.

Figure 5.2 Projected Labour Force Participation Rates by age and sex



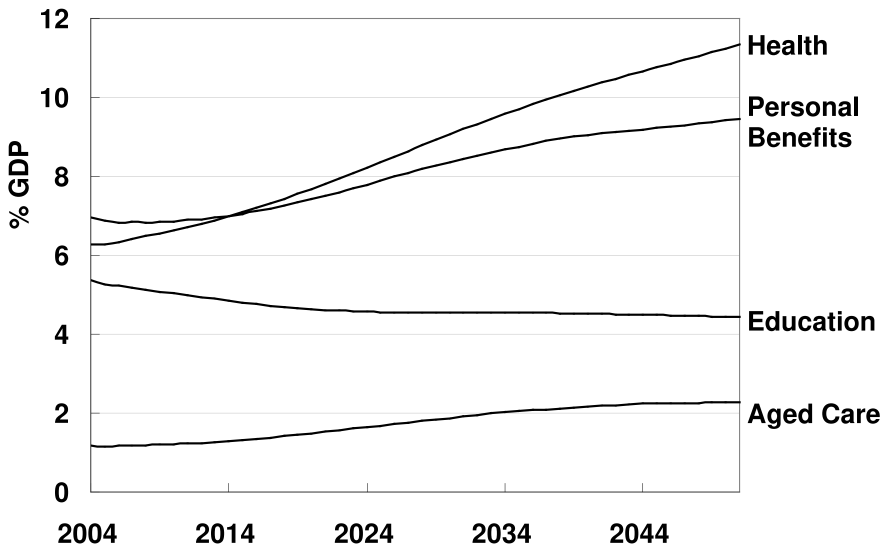


(Source: ABS 2005e; Productivity Commission 2005b, technical paper 3)

5.2.2 Government Social Outlays

Figure 5.3 shows the main age sensitive components of government social outlays – health, personal benefits, education and aged care. All the government social outlays are increasing with the exception of education which is decreasing. This is consistent with the changing dependency ratios in Figure 3.2, namely a decreasing child dependency ratio (CDR) requiring reduced education and personal benefit expenditure, and an increasing aged dependency ratio (ADR) requiring more aged care, personal benefits, and health expenditure. The aged are those over 65 and a child is 0-14. There is a net increase in personal benefits as the benefits for the aged increase more than the personal benefits for children decreases.

Figure 5.3 Projection of Government Social Outlays as a percentage of GDP



5.2.2.1 Health

Figure 5.4 compares the four areas of health expenditure: Hospital, Medicare, Pharmaceutical Benefit Scheme (PBS), and 'Other'. Hospital expenditure has the largest proportional increase, doubling from 2004 to 2051, because the hospital has a large growth in average cost per capita with the age. The PBS and 'Other' curve crossover in 2014 indicating the rate of growth in PBS average cost per capita with age is steeper than for ‘Other’ expenditure. The baseline projection uses the same 0.6 percent health premium for all health areas. Alternative health premiums are investigated in the research question in section (5.4.10).

Figure 5.4 Projection of Health Expenditure by areas as a percentage of GDP

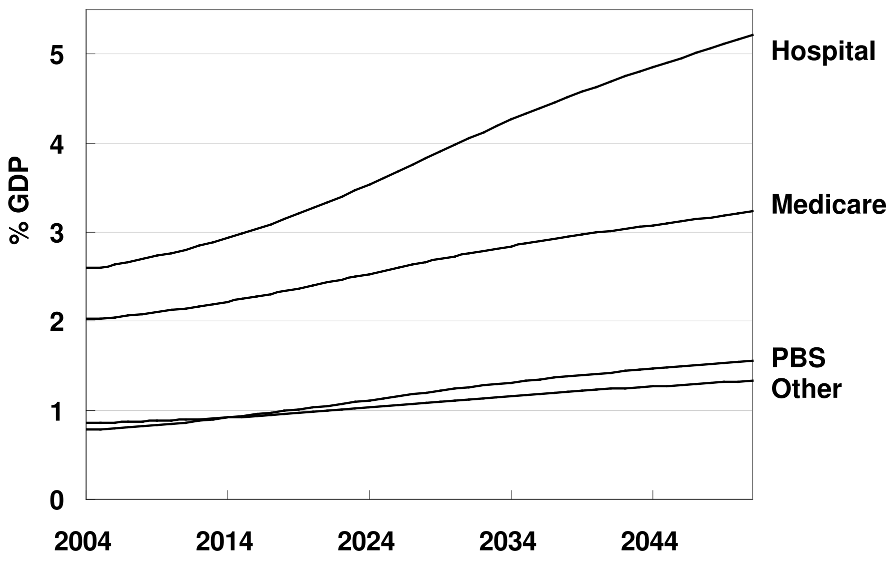
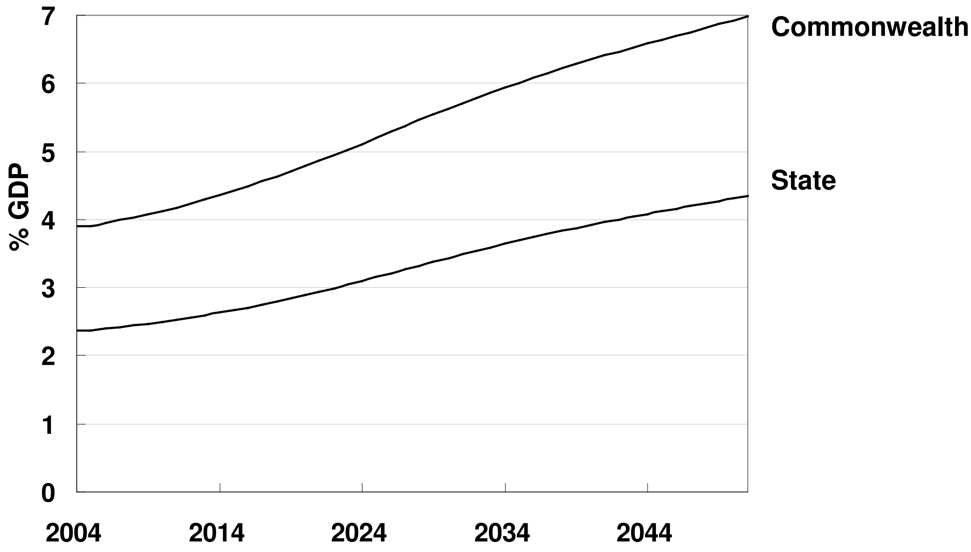


Figure 5.5 shows that Commonwealth and state expenditure on health is projected to increase as a percentage of GDP. The states fund more of hospital expenditure than the Commonwealth. The Commonwealth funds the PBS so projection methods that use a higher PBS growth rate would proportionally increase the Commonwealth expenditure. Alternative PBS projections are explored in the section (5.4.10).

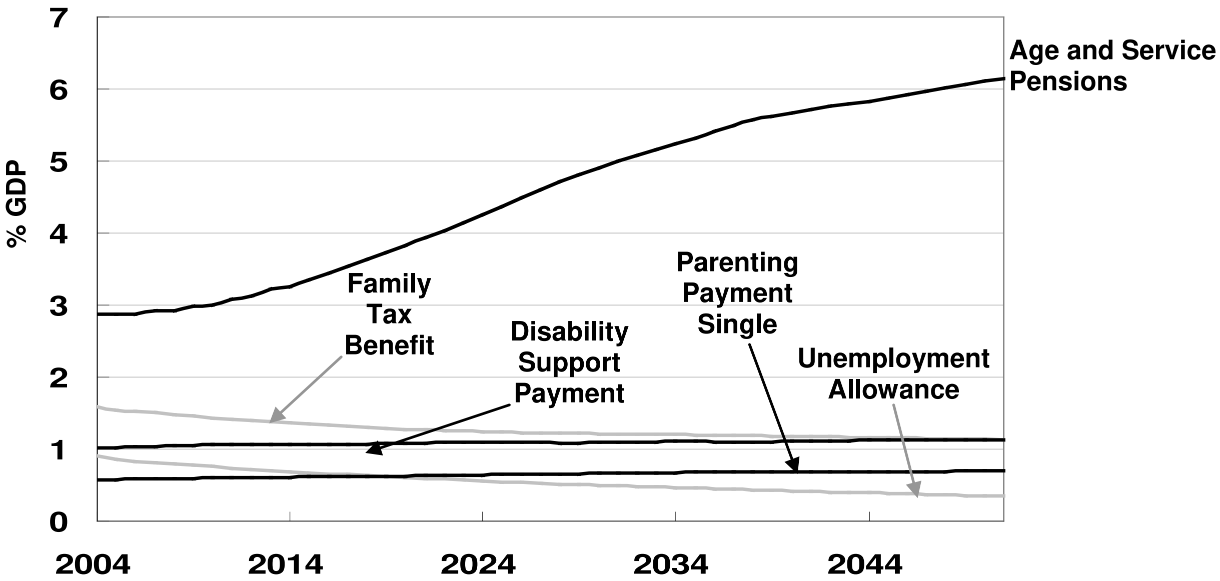
Figure 5.5 Projection of Health Expenditure by government level as a percentage of GDP



5.2.2.2 Personal Benefits

The personal benefits in the model are 'Age and service pensions' (ASP), family tax benefit (FTB), parenting payment single (PPS), disability support payment (DSP), and unemployment allowance. Figure 5.6 illustrates that ASP are larger than the other benefits in 2004 and projected to more than double by 2051. The FTB and unemployment allowance are projected to decrease and the PPS and DSP to slightly increase. The unemployment allowance has decreased by more than half. This is because the benefit is indexed to CPI and there is a projected decrease in unemployment. The FTB decreases because there is a decrease in the CDR. The DSP increases slightly because the disability rate increases with age and the proportion of working-age (15-64) belonging to older age groups is projected to increase. Those on DSP at age 65 switch benefits to the ASP. The PPS has balancing trends, a decrease in the CDR, an increase in rate of parental separation, and some of the PPS is indexed to the CPI. The ASP are the largest personal benefit and form the focus for the research question in section (5.4.1).

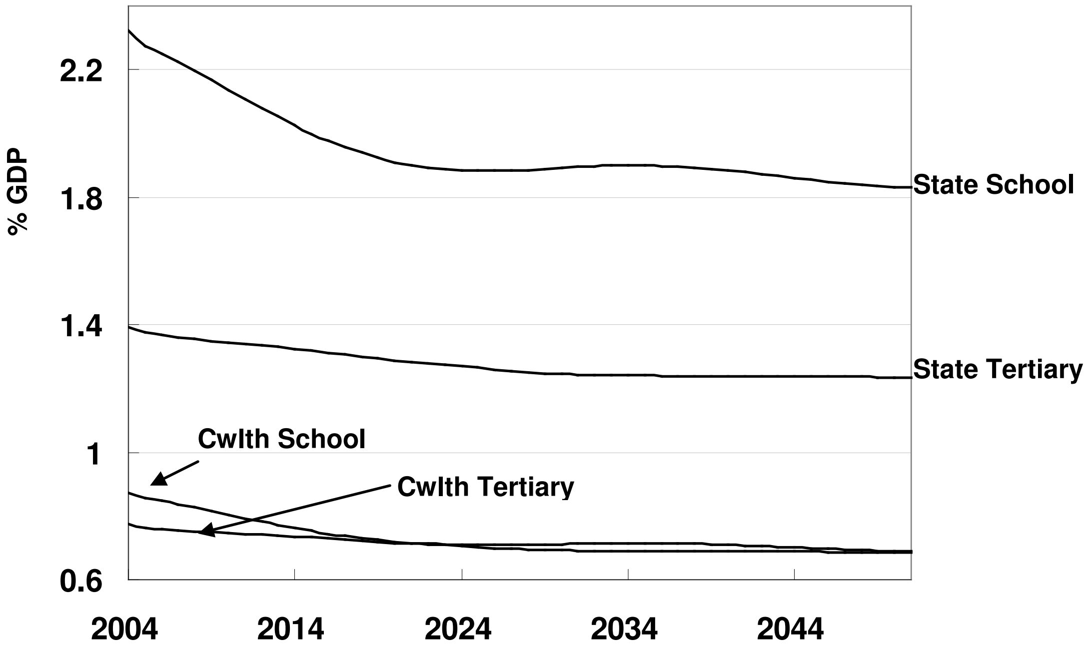
Figure 5.6 Projection of Personal Benefits Expenditure as a percentage of GDP



5.2.2.3 Education

Figure 5.7 illustrates education expenditure by level of government and level of eduction as a percentage of GDP. The model's levels of education are 'School' and 'Tertiary'. 'School' includes secondary, primary, and preschool. 'Tertiary' includes the GFS educational categories: university, and vocational education and training (VET). The GFS educational category 'Other' is split between 'School' and 'Tertiary' levels on a per student basis. There is a decrease in expenditure for both levels of government and both levels of education. The decrease in school level expenditure is more substantial. This is consistent with the decrease in CDR. Older students' increased participation in tertiary education has moderated the decrease in tertiary education expenditure. The states have a larger involvement in education expenditure than the Commonwealth so the states have the largest total decrease in education expenditure as percentage of GDP.

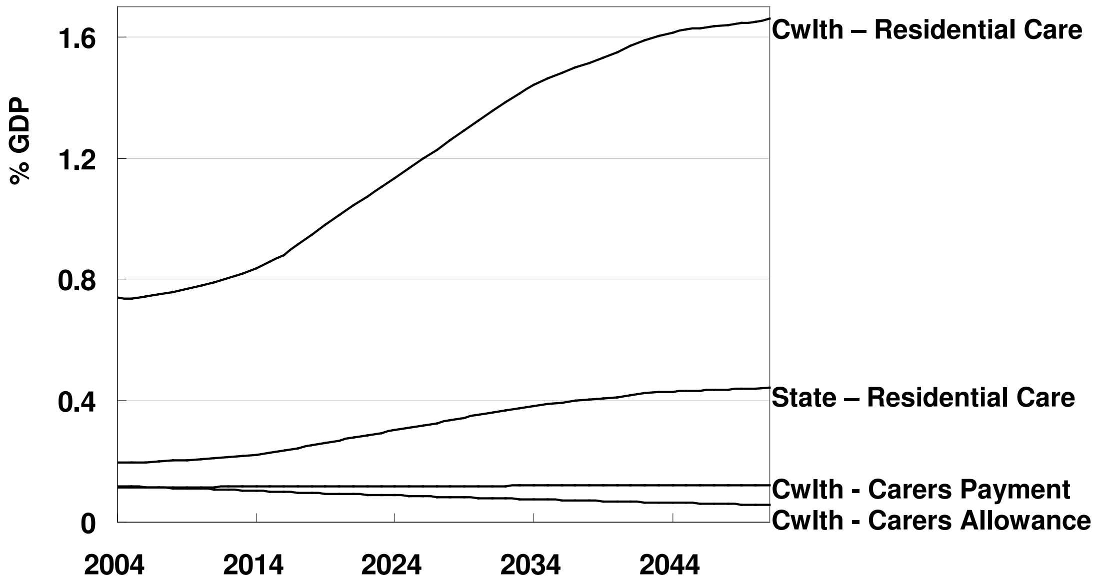
Figure 5.7 Projection of Education Expenditure as a percentage of GDP



5.2.2.4 Aged Care

Figure 5.8 illustrates aged care expenditure as a percentage of GDP. Age care includes Commonwealth and state residential care and Commonwealth carers' payment and carers' allowance for community care. The carers' allowance is CPI indexed which accounts for most of the decrease in the allowance from 2004 to 2051. The carers' payment increases 0.01 percent of GDP. The absence of a large increase is due to an expected short supply of carers. The Commonwealth and state are affected by residential care expenditure projected to more than double from 2004 to 2051. Residential care is the most important aged care expenditure. This model's projected increase in aged care agrees with the Hogan (2004, p. 2) Report.

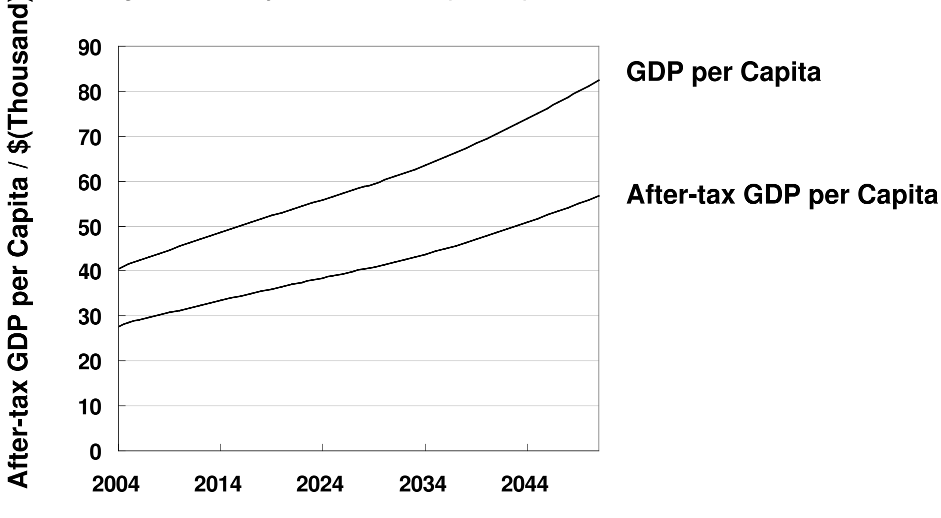
Figure 5.8 Projection of Aged Care Expenditure as a percentage of GDP



5.2.3 After-tax GDP per Capita

Figure 5.9 illustrates the GDP per capita from 2004 to 2051, which is projected to double over this time. The tax rate for 'All levels of government' is 31.2 percent of GDP in the baseline projection. The 'After-tax GDP per capita' sensitivity analysis method uses similar figures to illustrate the effect of changing parameters on after-tax GDP per capita from the baseline position.

Figure 5.9 Projection of GDP per capita



5.2.5 Net Operating Balance

The ABS (2004d, p. 52) states that the net operating balance (NOB) is calculated as revenue minus expenses and is equivalent to the change in net worth arising from transactions. The NOB has a more consistently precise definition than the general terms funding gap, fiscal pressure or budget deficit thus the cumulative NOB is used in the remainder of this study to define fiscal pressure.

Figure 5.10 projects the baseline NOB as a percentage of GDP for Commonwealth, state and 'All levels of government'. The 'All levels of government' curve is the sum of the state and Commonwealth curves. The lack of smoothness in the states' curve between the 2004 and 2005 is caused by the states' tax rate dropping from 5.8 to 5.5 percent of GDP. The assumption is based on the Treasurer's (2005) claim that the state governments promised to reduce state taxes as agreed to when implementing the GST.

Figure 5.10 Projection of NOB for various levels of government as a percentage of GDP

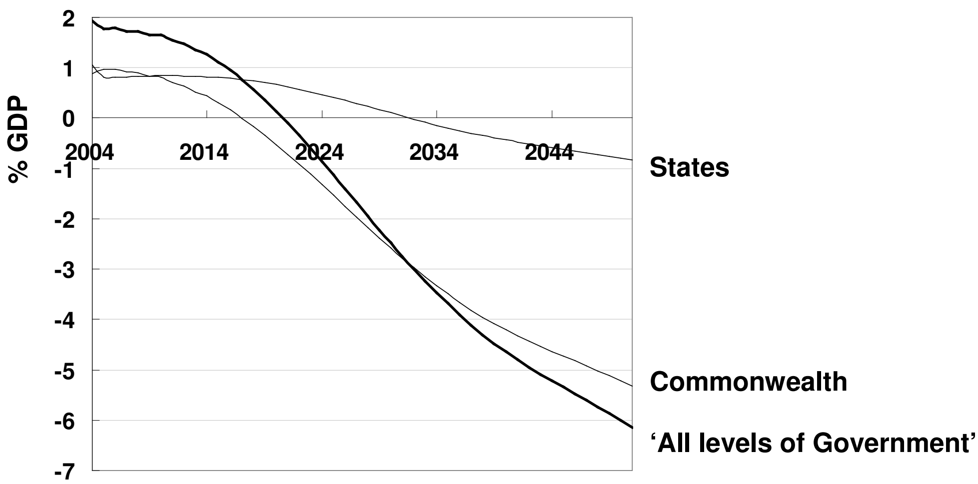


Figure 5.10 shows that the state governments maintain a positive NOB until 2031, the Commonwealth until 2017, and 'All levels of government' until 2020. This indicates

population ageing is more a concern for the Commonwealth than the state government. The issue becomes the focus of a research question in section (5.4.11).

5.3 Baseline Comparison

This study's baseline is compared with the baselines from the Treasury (2002), Productivity Commission (2005a), and Guest and MacDonald (2000) in Appendix B. This section offers a summary of the findings. This study's baseline compares well with the other models at the Commonwealth and 'All levels of government'. This means that this simulation model can be considered to be at least as good as the other models.

This study's baseline projects a decrease in NOB for the Commonwealth of 5.5 percent from 2003-04 to 2044-45. The Productivity Commission's (2005a, p. 308) fiscal pressure projection is 5.7 percent over the same period.

This study's projects a negative NOB of 4.4 percent in 2041-42. The Treasury's (2002, p. 57) projects the gap between revenue and expenditure to grow to 5.0 percent in the same year.

This study's baseline projects a decrease in NOB for all states of 1.5 percent from 2003-04 to 2044-45. The Productivity Commission's (2005a, p. 308) fiscal pressure projection is 0.8 percent over the same period.

This study's baseline projects a decrease in NOB for 'All levels of government' of 6.9 percent from 2003-04 to 2044-45. The Productivity Commission's (2005a, p. 308) fiscal pressure prediction is 6.5 percent over the same period.

The ‘All levels of government’ projection from 2006 for this study shows a decrease in the NOB of 6.6 percent in 2041 and of 7.9 percent in 2051. The ‘All levels of government’ projection from 2006 for Guest and McDonald’s (2000, p. 54) show an increase in fiscal pressure of 6.6 percent in 2041 and of 7.3 percent in 2051.

This study’s projection is higher than Guest and McDonald’s projection and lower than the Productivity Commission’s and the Treasury’s. This is caused in part by the differing treatment of non-demographic growth in health expenditure. The research question in section (5.4.10) examines alternative non-demographic growth projections.

This study’s baseline ‘All levels of government’ NOB projection is comparable to the fiscal pressure projections of the Productivity Commission (2005a), the Treasury (2002), and Guest and McDonald (2000). This means the baseline is suitable for conducting sensitivity analysis on the research questions.

5.4 Research Questions

The two sensitivity analysis methods from section (4.3) are used to evaluate the research questions from Chapter 4: ‘Change in time to achieve a negative cumulative NOB’, a measure of change in fiscal pressure; and ‘After-tax GDP per capita’, a measure of change in growth in standard of living under a PAYGP. The following subsections discuss the results of the sensitivity analysis.

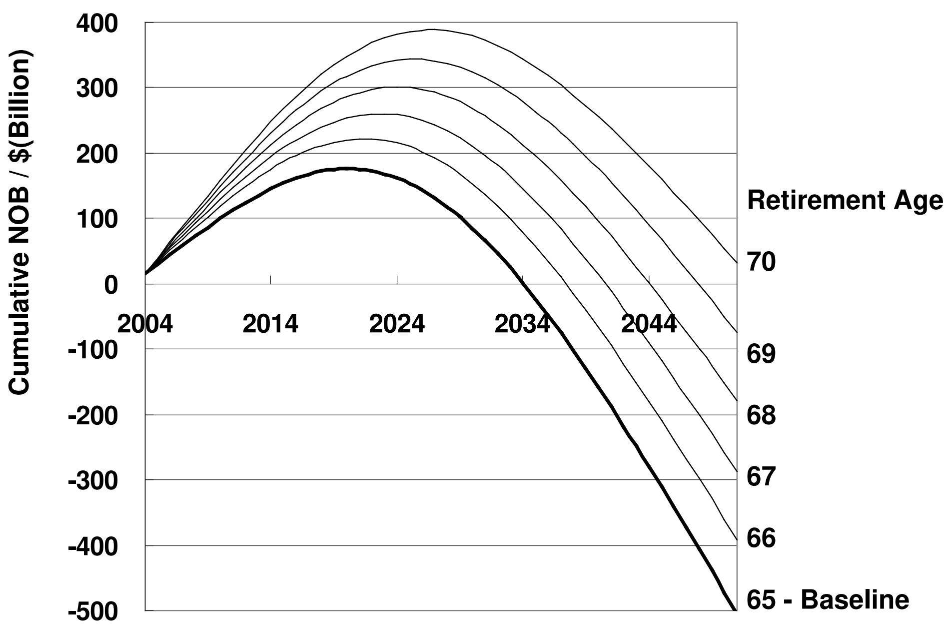
5.4.1 Participation Policy – Retirement Age

Is increasing the retirement age an effective way to reduce fiscal pressure?

Figure 5.11 shows the effect of increasing the retirement age on the cumulative NOB. Increasing the retirement age from the baseline of 65 years to 69 years increases the time to achieve a negative cumulative NOB by thirteen years. Increasing the retirement age simultaneously increases the labour supply, and decreases ASP expenditure, but also increases the unemployment allowance and DSP expenditure. The result is a net reduction in government social outlays and an increase in GDP so increasing the NOB. When increasing the retirement age, the 60-64 age group's average hours worked, disability rate, unemployment rate, and LFPR, apply to those no longer retired.

The results support the conclusion that **increasing the retirement age is an effective way to reduce fiscal pressure.**

Figure 5.11 The effect of Increasing Retirement Age on the Cumulative NOB



5.4.2 Participation Policy – Labour Force Participation Rate (15-64)

Is increasing the LFPR (15-64) an effective way to reduce fiscal pressure?

This section uses sensitivity analysis to test the feasibility of the government's policy to increase the LFPR (15-64) to overcome the fiscal pressure. Figure 5.12 shows this study's LFPR (15-64) projection. It is calculated by using a weighted average of the individual LFPR by sex and age in Figure 5.2. Section (4.4.2) and Appendix (A.4) outline the baseline LFPR (15-64) calculation.

Figure 5.12 Projection of the Baseline LFPR Group Aged 15-64

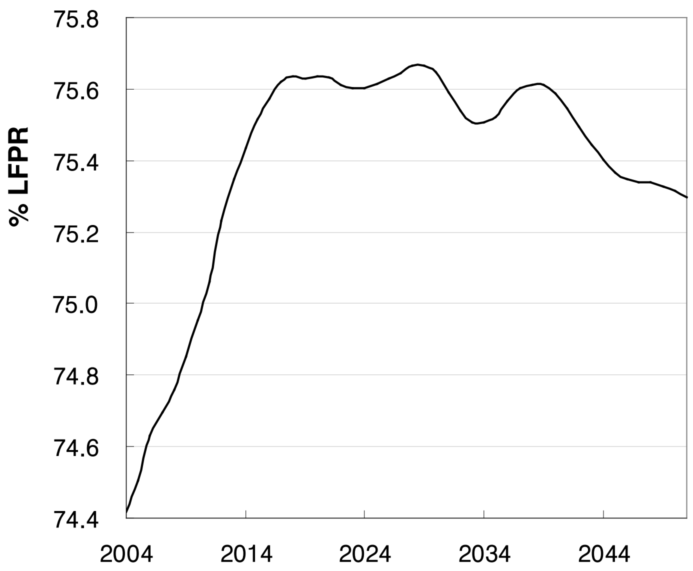


Figure 5.13 shows the effect of increasing the LFPR on the cumulative NOB. Section (4.4.2) identifies the reasons for the LFPR sensitivity analysis range.

Figure 5.13 The Effect of Increasing the LFPR (15-64) on the Cumulative NOB

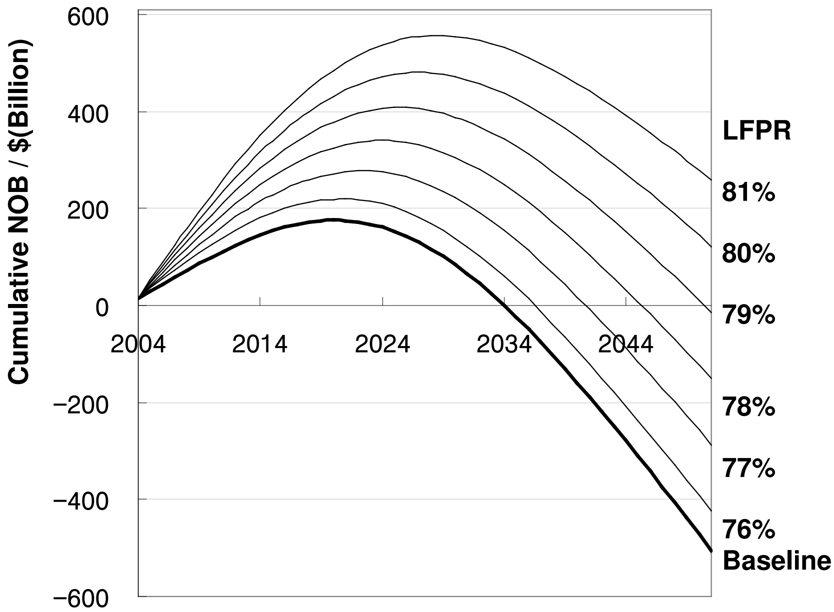


Table 5.1 shows each increase in the LFPR (15-64) with the corresponding increase in the number of years to a negative cumulative NOB from the baseline year in 2034.

Table 5.1 LFPR (15-64) and the increase in years to a negative cumulative NOB

LFPR (15-64)	76%	77%	78%	79%	80%	81%
Years	2	6	11	16	>17	>17

The results show that increasing the LFPR (15-64) has a substantial effect in increasing the time to achieve a negative cumulative NOB. A lower population growth reduces the effect of increasing the LFPR (15-64) on the time to achieve a negative cumulative NOB and visa versa.

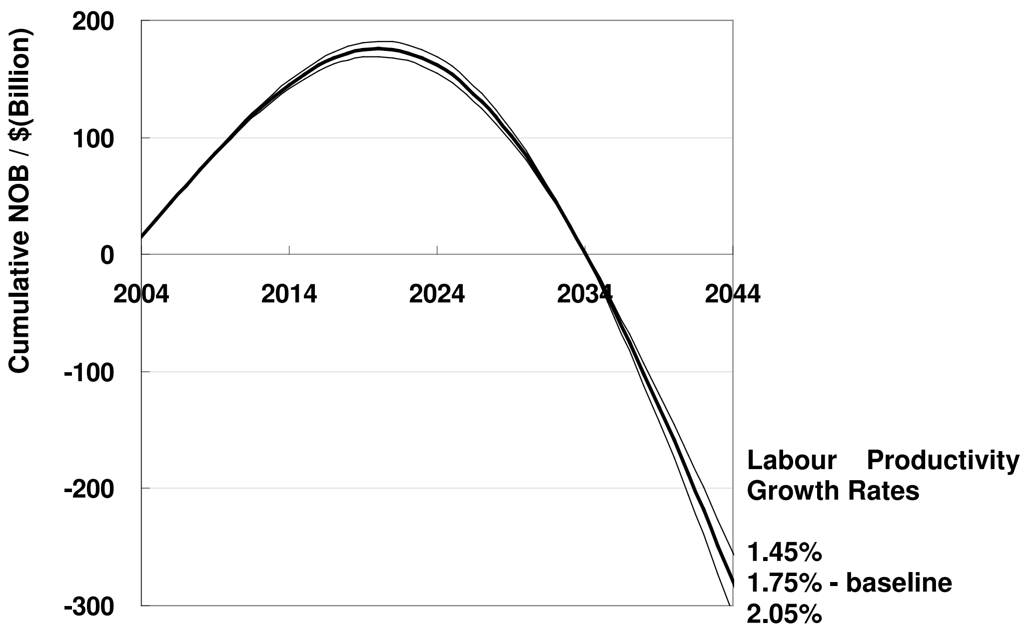
How the LFPR can be increased is discussed in detail in the next chapter.

5.4.3 Productivity Policy – Labour Productivity Growth Rate

Is increasing the LPGR an effective way to reduce fiscal pressure?

Chapter 4 establishes a baseline LPGR of 1.75 percent with maximum and minimum rates of 2.05 percent and 1.45 percent respectively. Figure 5.14 shows how changing the baseline LPGR to the minimum and maximum rate affects the cumulative NOB. **The results show that increases in the LPGR are ineffective at reducing fiscal pressure.** An increase (decrease) in the LPGR amplifies (attenuates) the cumulative NOB by increasing (decreasing) the magnitude of positive or negative NOB. The reason for the ineffectiveness is that both government revenue and expenditure are linked to increases in labour productivity. This finding supports Guest and MacDonald's (2000) assumption that all government social outlays costs rise at the LPGR thus removing the need to explicitly model the LPGR.

Figure 5.14 Cumulative NOB at various Labour Productivity Growth Rates

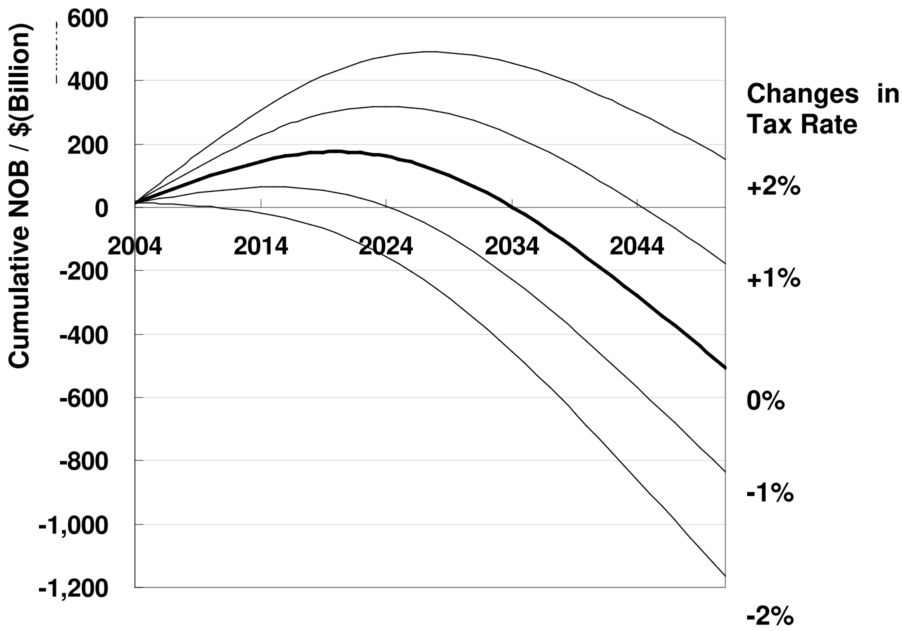


5.4.4 Tax Policy

Is changing the tax rate an effective way to adjust the fiscal pressure?

Figure 5.15 shows the effect of changing the baseline tax rate on the cumulative NOB with a TELS value of zero and no change in the LPGR.

Figure 5.15 Cumulative NOB at various Tax Rates with TELS=0



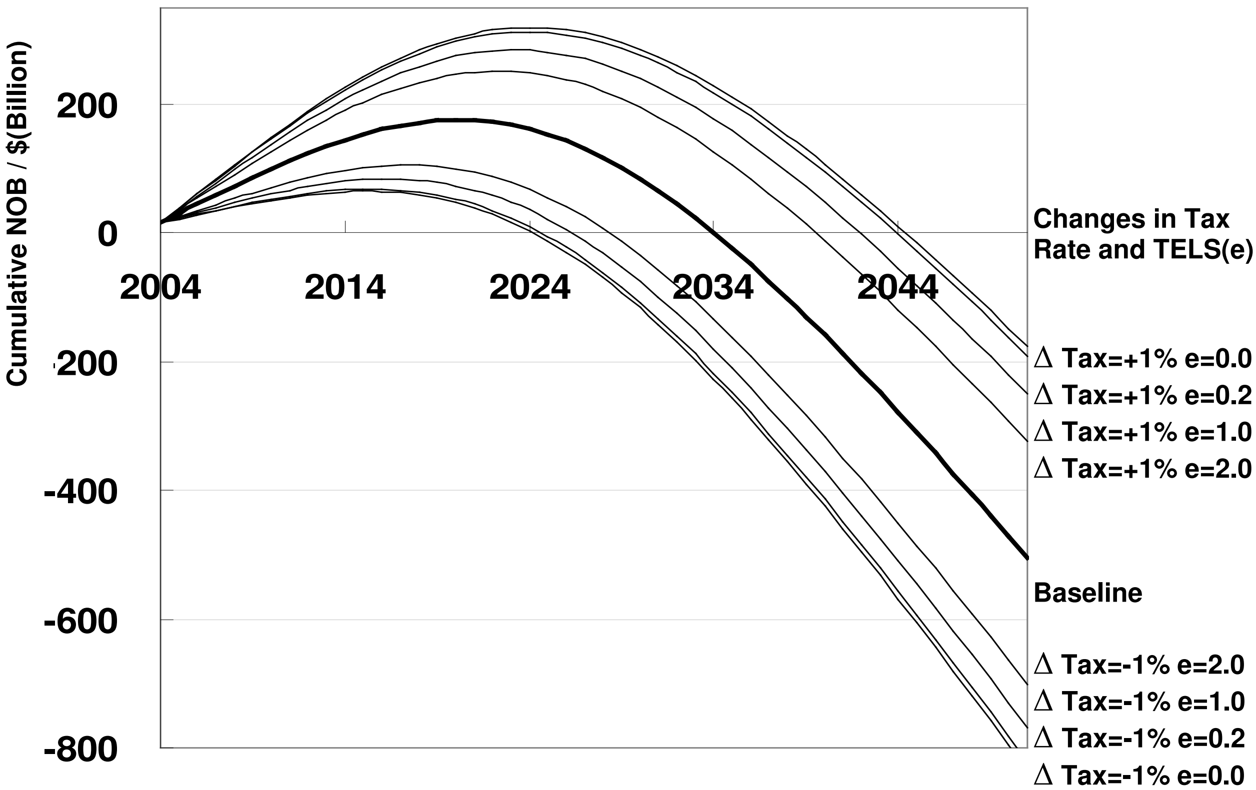
Increasing/decreasing the tax rate from the baseline value by one or two percent increases/decreases the time to achieve a negative cumulative NOB, for tax decreases of two and one percent the decreases are 24 and 10 years, and for tax increases of one and two percent the increases are 10 and greater than 17 years. The model shows that **altering the tax rate is a very effective way to adjust fiscal pressure at a TELS value of zero and cutting taxes could turn the fiscal pressure from population ageing into a crisis**.

5.4.5 Tax Policy and Tax Elasticity of the Labour Supply

Does TELS determine the effectiveness of tax rate changes to alter fiscal pressure?

Figure 5.16 shows the effect of varying the value of the TELS on a tax rate of plus and minus one percent. A TELS of high value substantially reduces the effect of a change in tax rates on the time to achieve a negative cumulative NOB. For instance the effect of a high TELS value of two on a one percent increase (decrease) in the tax rate is to increase (decrease) the time to achieve a negative cumulative NOB by 5 (6) years. This compares to the case where the value of TELS is zero – the increase and decrease in the time to negative cumulative NOB is 10 years. Even with the high TELS value, a tax decrease is still a net loss in revenue and a tax increase a net gains in revenue. The results show that **a TELS of high value diminishes the effect of tax rate changes in altering fiscal pressure.**

Figure 5.16 Cumulative NOB at various Tax Rates and TELS values

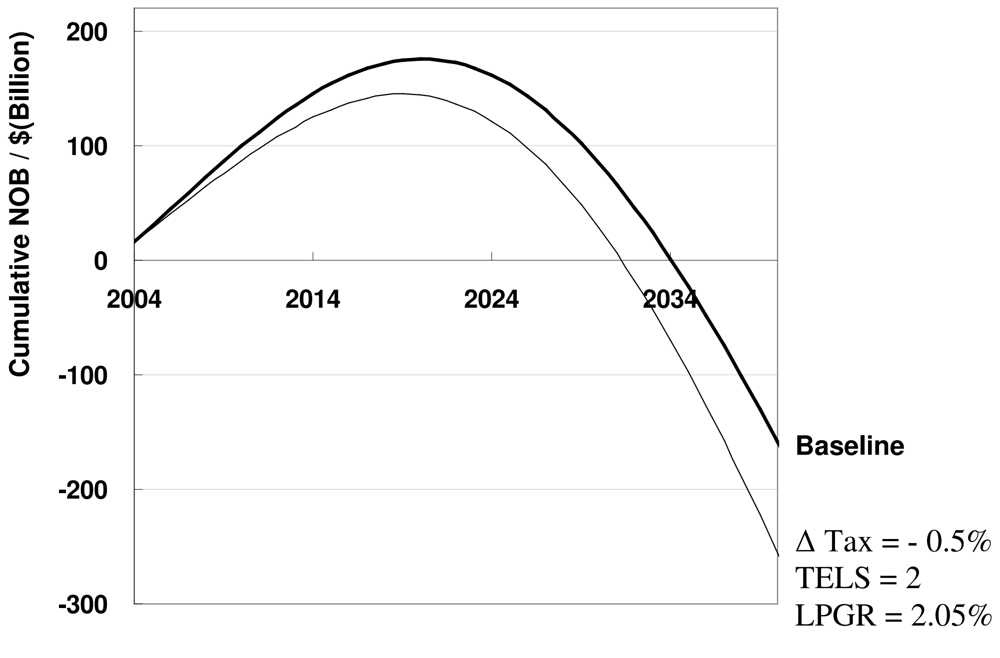


5.4.6 Tax-cut Policy

Can using a policy of tax-cuts to increase the LPGR and the LFPR solve the population ageing induced fiscal pressure?

The tax-cut policy is evaluated for its effect on the time to negative cumulative NOB under favourable conditions, namely a TELS value of two and assuming a 0.5 percent tax-cut will increases the LPGR from the baseline 1.75 percent to the range maximum of 2.05 percent. Figure 5.17 illustrates that the time to achieve a negative cumulative NOB is decreased by three years indicating an increase in fiscal pressure. **The model indicates that using a policy of tax-cuts to increase the LPGR and the LFPR to solve the population ageing induced fiscal pressure is counterproductive.**

Figure 5.17 Cumulative NOB with LPGR = 2.05%, TELS = 2, and ΔTax = –0.5%

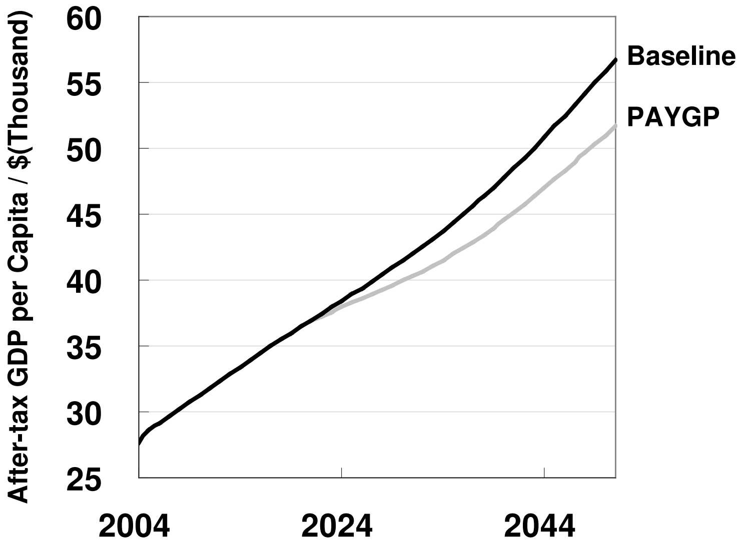


5.4.7 Pay As You Go Policy and Tax Elasticity of the Labour Supply

What effect does a high TELS value have on after-tax GDP per capita under a PAYGP?

Figure 4.2 shows that after-tax GDP per capita continues to grow under a PAYGP for a TELS value of zero. The black line is the baseline after-tax GDP per capita. The baseline tax rate is 31.2 percent of GDP. The light grey line is the PAYGP after-tax GDP per capita.

Figure 5.18 PAYGP after-tax GDP per Capita for TELS = 0



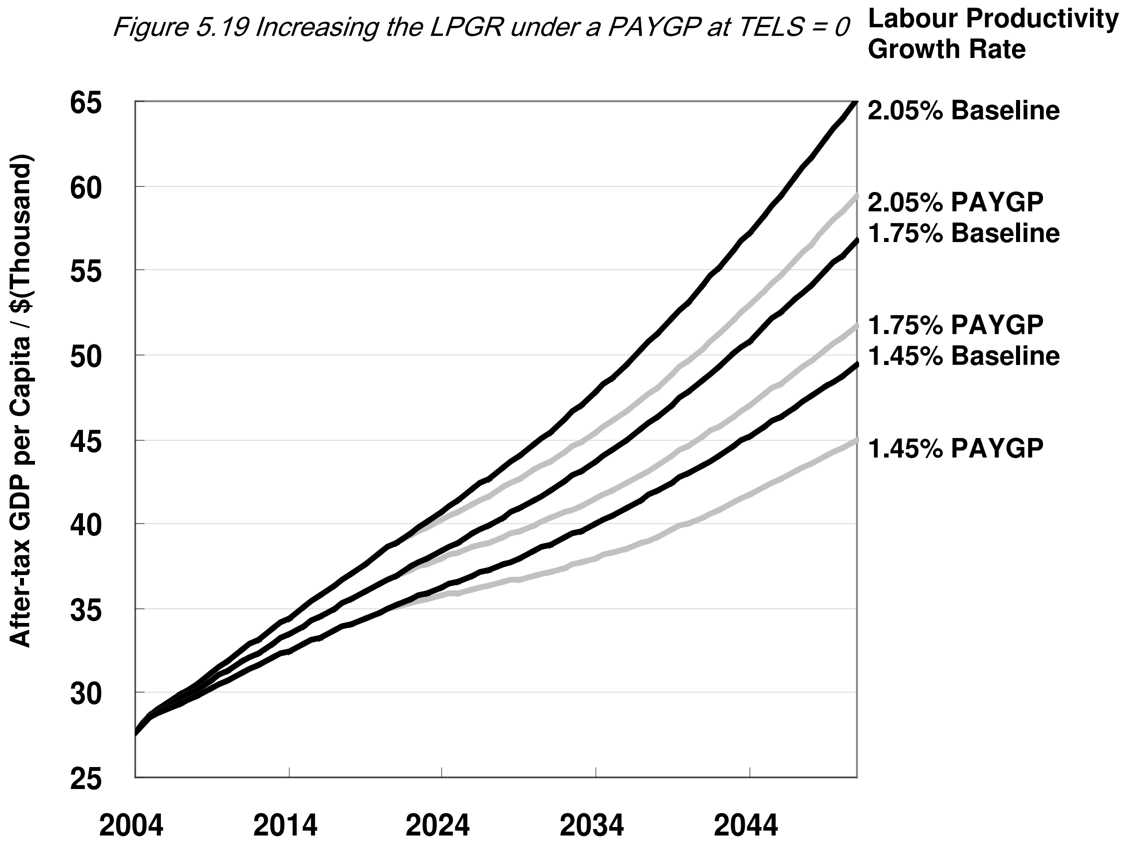
Calculations show that after-tax GDP per capita continues to grow even for a high TELS value of two. The NOB in 2051 is –6.15 percent of GDP. Increasing taxes to cover the NOB at a TELS value of two would decrease GDP by 12.30 percent. This reduces GDP per capita from $82,452 to $72,310 making $45,302 the after-tax GDP per capita for a TELS value of two under a PAYGP. In comparison the after-tax GDP per capita in 2051 for a TELS value of zero is $51,656 under a PAYGP. The results illustrate that **after-tax GDP per capita continues to grow even with a high TELS value under a PAYGP**.

5.4.8 Pay As You Go Policy and Labour Productivity Growth Rate

What effect does changing the LPGR have on after-tax GDP per capita under a PAYGP?

Figure 5.19 shows that increasing the LPGR increases the growth in after-tax GDP per capita under a PAYGP. The black lines are the baseline after-tax GDP per capita. The light grey lines are the PAYGP after-tax GDP per capita.

Figure 5.19 Increasing the LPGR under a PAYGP at TELS = 0



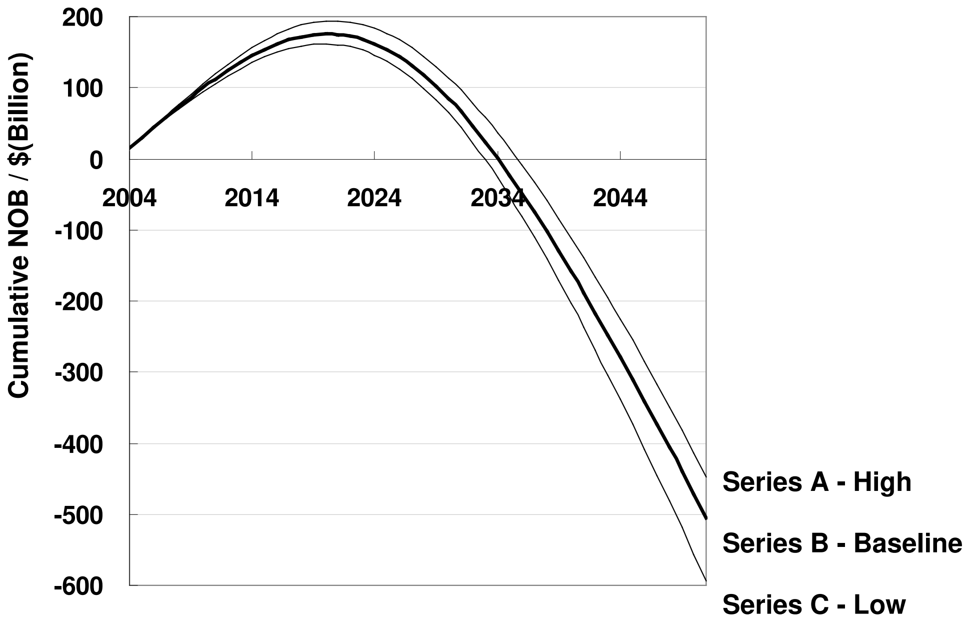
The results indicate increasing the LPGR increases the growth in after-tax GDP per capita under a PAYGP. For example, even with a small increase in the LPGR from 1.45 percent to 1.75 percent, growth in after-tax GDP per capita under a PAYGP is higher at a 1.75 percent LPGR than without a PAYGP at 1.45 percent.

5.4.9 Population Policy

Can changing the mortality, net overseas migration (NOM), and total fertility rates (TFR) eliminate population ageing induced fiscal pressure?

Figure 5.20 illustrate the effect of changing population parameters – mortality, NOM, and TFR on cumulative NOB. Increasing the population growth from the baseline Series B to Series A increases the time to achieve a negative cumulative NOB by one year. Decreasing the population growth from the baseline Series B to Series C decreases the time to achieve a negative cumulative NOB by two years. **The results show that changing population growth can only slightly influence fiscal pressure by changing the time to achieve a negative cumulative NOB by a relatively brief period, not stopping it from occurring.**

Figure 5.20 Mortality, NOM, and TFR and the Cumulative NOB



5.4.10 Real Non-demographic Health Expenditure Growth

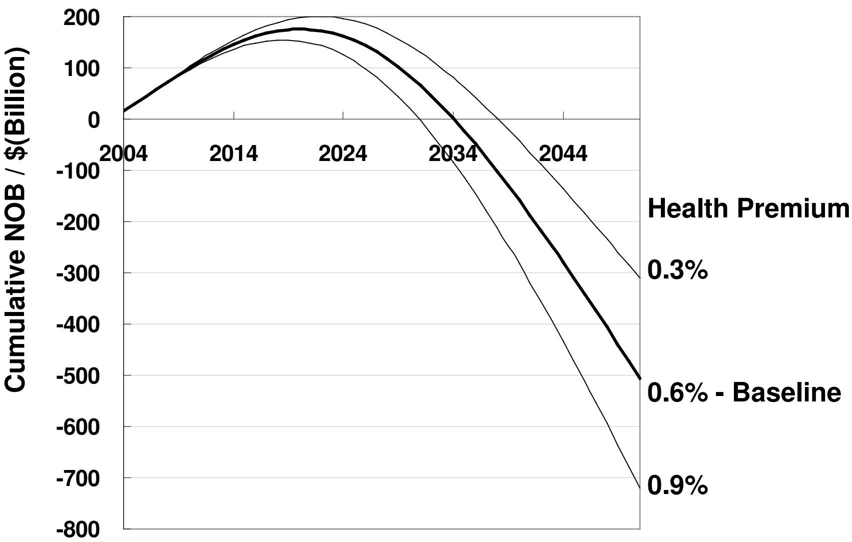
Do real non-demographic health expenditure projection methods and parameters have a large effect on fiscal pressure projection?

This question is broken into three parts, varying health premiums, PBS, and alternative real growth in GDP per capita projections.

5.4.10.1 Varying Health Premium

Figure 5.21 shows the baseline health premium of 0.6 percent altered to the range maximum of 0.9 percent and minimum of 0.3 percent to measure its effect on the time to achieve a negative cumulative NOB. **Altering the baseline health premium to the range maximum or minimum has a substantial effect on the projected time to achieve a negative cumulative NOB. This indicates the large uncertainty in health expenditure projection.**

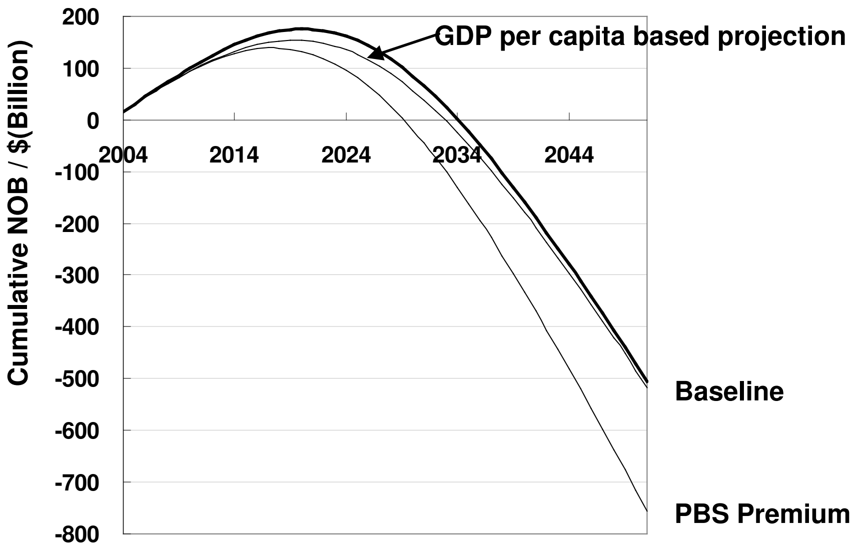
Figure 5.21 The Effect of Changing Health Premium on the Cumulative NOB



5.4.10.2 Pharmaceutical Benefit Scheme

Figure 5.22 compares the Productivity Commission's (2005a) method for projecting PBS expenditure to the baseline. The Productivity Commission's PBS projection involves treating PBS expenditure separately from all other health expenditure. Equation (A.4) describes their PBS health premium calculation starting in 2004 with a premium of 4.9 percent 'Above real growth in GDP per capita in 2044-45' which is then asymptotically decreases in 2045 to 0.6 percent 'Above real growth in GDP per capita in 2044-45'. The health premium for the non-PBS areas of health is 0.6 percent. **The alternative PBS expenditure projection has a substantial effect on the projected time to achieve a negative cumulative NOB.** This indicates alternative methodologies have a substantial effect on fiscal pressure projection.

Figure 5.22 Changing PBS and GDP per capita projection methods



5.4.10.3 Real Growth in GDP per Capita

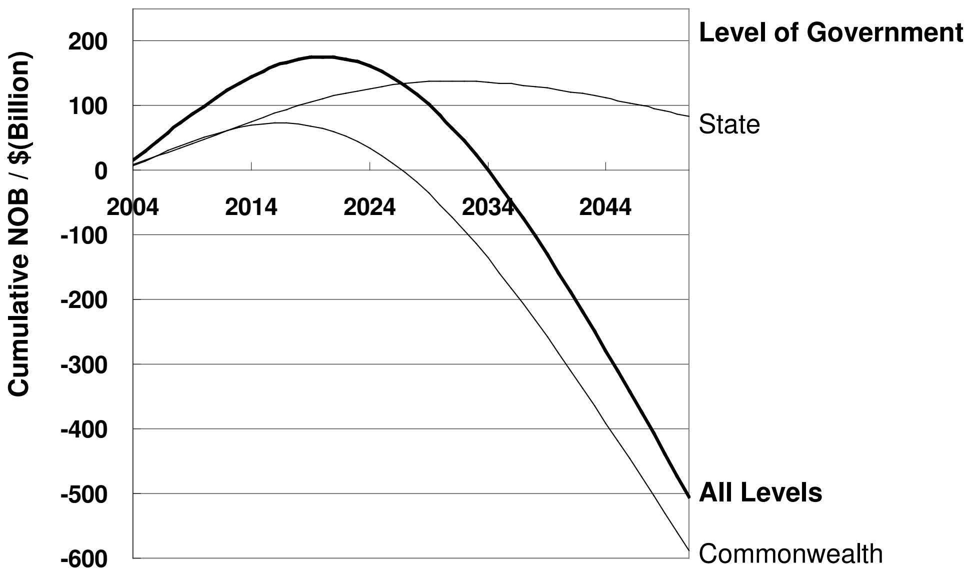
Figure 5.22 illustrates the effect of replacing the baseline's health expenditure projection using a constant 1.55 percent to represent the 'Real growth in GDP per capita' with the baseline's 'Real growth in GDP per capita' projection. **The use of the 'Real growth GDP per capita' projection only has a small effect on the time to achieve a negative cumulative NOB**. Using a constant growth rate method or 'Health premium above real growth in GDP per capita' method has little effect on the results.

5.4.11 Levels of Government

Are the State and Commonwealth levels of government equally affected by population ageing?

Figure 5.23 illustrates the effect of population ageing on the cumulative NOB for various levels of government. The time to achieve a negative cumulative NOB for the Commonwealth and states differs widely from that for 'All levels of government'. The state government time to achieve a negative cumulative NOB is greater than to 2051, and outside the range of the projection. **The results show the Commonwealth may experience considerably higher fiscal pressure than the states.**

Figure 5.23 Cumulative NOB for Various Levels of Government



The implications are discussed in the next chapter.

5.5 Conclusion

The baseline in this study is comparable with the baselines from Productivity Commission (2005a), Treasury (2002), and Guest and McDonald (2000) on an aggregate level. This model is robust and comparable thus suitable to conduct sensitivity analysis on the research questions.

One of the sensitivity analysis methods used to investigate the research questions is 'Change in time to achieve a negative cumulative NOB', which is a measures of the change in fiscal pressure. The following policy relevant forecasts were obtained. Increases in the retirement age or the LFPR for the age group 15-64 were substantial in reducing fiscal pressure. Increases in the LPGR were ineffective in altering fiscal pressure. The tax-cut policy to increase the LPGR and the LFPR to reduce fiscal pressure is counterproductive. A TELS value of zero made tax changes effective in changing fiscal pressure and higher TELS values reduce this effectiveness. Population policies are, at best only, slightly effective in altering fiscal pressure. Fiscal pressure increases are more imminent and larger for the Commonwealth than for the state governments.

The other sensitivity analysis method used to investigate the PAYGP research questions is 'After-tax GDP per capita'. This measures the rate of growth in after-tax GDP per capita. This method finds the following. The after-tax GDP per capita under a PAYGP continues to grow with a high TELS value or a low LPGR. The growth in after-tax GDP per capita under a PAYGP is greater than a non-PAYGP with a slightly lower LPGR. The implications of these findings are discussed in the next chapter.

6. Discussion

6.1 Introduction

This chapter discusses the implications of the following results from Chapter 5. The participation policies are very effective in reducing fiscal pressure. The productivity policy is ineffective in reducing fiscal pressure. The population policies, are at best, only slightly effective in reducing fiscal pressure. The tax-cut policy is counterproductive in reducing fiscal pressure. The pay as you go policy (PAYGP) is effective at reducing fiscal pressure while maintaining growth in after-tax GDP per capita. This is true even with a low labour productivity growth rate (LPGR) and with a high value for the 'Tax elasticity of the labour supply' (TELS). It was also found that growth in after-tax GDP per capita under a PAYGP increases more than without a PAYGP with a slightly lower LPGR.

The PAYGP involves progressively increasing taxes to cover fiscal pressure to result in balanced budget over the business cycle. The tax-cut policy involves decreasing the tax rate to increase the LPGR and the labour force participation rate (LFPR) so that total tax revenue increases to cover any negative NOB. A change in intergenerational equity is a key difference between the two policies. The PAYGP proposal transfers wealth from younger to older people. The tax-cut policy often associated with cuts in government service and privatisation, discussed in section (2.7.3), transfers wealth in the opposite direction.

6.2 Research Questions

The following subsections discuss the implications of the simulation analysis for the eleven research questions: participation policy increasing the retirement age; participation policy increasing the LFPR (15-64); productivity policy changing the LPGR; tax policy changing the tax rate; tax policy and TELS changing the tax rate and the value of the TELS; tax-cut policy involving a tax rate cut to increase the LPGR and the LFPR to reduce fiscal pressure; tax policy involving PAYGP and different values of the TELS; tax-policy involving PAYGP and the LPGR; population policies changing the mortality, net overseas migration (NOM), and total fertility rate (TFR); alternative real non-demographic health expenditure growth projections; and levels of government.

6.2.1 Participation Policy – Retirement Age

Is increasing the retirement age an effective way to decrease fiscal pressure?

Increasing the retirement age in this study significantly decreases fiscal pressure. This is consistent with Gruen & Garbutt's (2003, p. ii) projection which finds one sixth to one quarter of the increase in fiscal pressure could be covered with an increases in the LFPR in persons over 65. Gruen & Garbutt's (2003) and this study may overstate the savings from increasing the retirement age as there is a need to allow for an unknown implementation schedule.

The Productivity Commission (2005a, p. 48) notes at the beginning of the 20th Century that many workers had died shortly after retiring, enjoying only a brief retirement. Over the last century life expectancy has risen 20 years. It appears a viable option to increase the retirement age because people are living much longer and having healthier retirements. Duval (2004, p. 29) notes that the retirement age has varied across OECD countries over time. Norway and Ireland had a standard retirement age of 70 in 1969 reducing to 67 and 66 respectively by 2003. In comparison NZ, Italy, and Greece had a retirement age of 60 in 1979 increasing to 65 by 2003. The US standard retirement age for males and females will rise to 67 over the period 2000-2020. Iceland's retirement age is 67. There is ample precedence for increasing the retirement age. The OECD (2004a, p. 294, annex C, table B) notes that those OECD countries mandating higher retirement ages are associated with higher LFPR (15-64). This flow-on effect is discussed in section (6.2.2.2). The Productivity Commission (2005a, pp. 193, 334-5) notes that Australia is increasing the retirement age for females from 60 to 65, which is likely to be contributing to their LFPR increases. Duval (2004, p. 5) comments that in NZ when the retirement age was increased from 60 to 65, the LFPR (55-64) increased by 15 percent. Duval (2004, p. 29) concludes altering the retirement age has a major impact on the decision to retire, consequently affecting the LFPR. However, he notes that increases in the implicit tax rate explains why a third of people decide to retire early, this disincentive effect is discussed in section (6.2.2.1).

In summary, there appear successful precedents for increasing the retirement age in Australia. Increasing the retirement age appears a valuable part of any solution to meet the increasing fiscal pressure from an ageing population.

6.2.2 Participation Policy – Labour Force Participation Rate (15-64)

Is increasing the LFPR an effective way to decrease fiscal pressure?

This study finds increasing the LFPR (15-64) significantly decreases fiscal pressure. This is consistent with Gruen and Garbutt's (2003, p. ii) projection which finds that one third of the increase in fiscal pressure could be covered with an increases in the LFPR of males in the age group 45-64. Gruen and Garbutt (2002, p. iii) note that increasing the LFPR may be sufficient to cover the demographically induced portion of the funding gap. Increasing the LFPR appears a valuable part of any solution to meet the increasing fiscal pressure from an ageing population.

The OECD (2004a, p. 294, annex C, table B) provides LFPR for persons aged 15-64 years in 2003 showing many comparable countries have a higher LFPR than Australia (73.6%), such as, the UK (76.6%), Canada (78.1%), New Zealand (76.1%), and US (75.8%). Slightly less comparable are Switzerland (81.2%), Norway (79.4%), Sweden (78.9%), and Denmark (79.4%) with Iceland's LFPR in 2002 at (85.6%). The list serves two purposes: to identify possible LFPR (15-64) for Australia; and to provide a list of countries with potential LFPR enhancing structural differences that Australia could adopt.

The following sections cover ways to increase the LFPR without tax-cuts. The tax-cut policy research question specifically addresses tax-cuts and the LFPR in section (6.2.6).

6.2.2.1 Early Retirement and Retirees' LFPR

The Australian compulsory superannuation and means tested pensions increase the incentive to retire early (that is before 65) and decrease the incentive to work when retired. The Productivity Commission (2005a, pp. xxxix, 74, 333) notes differences in superannuation and pensions between NZ and Australia contributes to NZ's higher LFPR. NZ does not means test the government pension. NZ has no tax-breaks for superannuation savings. NZ relies on citizens saving voluntarily from their post-tax earnings to provide for their retirement. This differs considerably from Australia's means tested Commonwealth pension and complex compulsory superannuation with tax-breaks. The Australian system encourages double dipping, which is to retire early and spend the compulsorily saved superannuation then become entitled to the full Commonwealth pension. In comparison there is no incentive to retire in NZ as citizens can spend their retirement savings whenever they chose and the NZ pension is not means tested so encouraging work during retirement. Noteworthy is the fact that the NZ pension is coincidentally based just above the poverty line so providing a disincentive to retire early.

Introducing a non-means tested 'Age and service pensions' (ASP) to decrease the incentive to retire early and to increase the incentive to work while retired may increase the LFPR.

6.2.2.2 Increasing the Retirement Age Flow-on Effect

Increasing the retirement age has a flow-on effect by increasing the LFPR (15-64). The Productivity Commission (2005a, pp. 193, 334) notes a retirement age of sixty seven in Norway and Iceland with the US in transition from sixty five to sixty seven. All three countries have higher LFPR (15-64) than Australia. This suggests that an increase in the retirement age in Australia to sixty seven or even older may have a flow on effect and increase the LFPR (15-64). However the potential increase in LFPR (15-64) may be compromised by the means tested ASP and compulsory superannuation combination.

6.2.2.3 Paid Parental Leave, Childcare Subsidies, Child Benefits

Gruen & Garbutt (2003, pp. 34-6) note a link between high female LFPR in Canada, Denmark, Norway and Sweden and paid parental leave, reasoning that females on paid parental leave are more likely to return to the workforce. The Australian government is considering legislation for comprehensive paid parental leave (Parliament of Australia 2004). If implemented this may increase the LFPR for females in their child-bearing years with possible flow on effects for later years. The OECD (2004b, p. 8) notes that in order to maximise the LFPR, the optimal paid parental leave is 20 weeks. Leave periods longer than this decrease the LFPR as females choose not to return to work.

The largest child benefits in Australia are the Family Tax Benefit (FTB) and Parenting Payment Single (PPS). The OECD (2004b, p. 9) notes that child benefits decrease the female LFPR. This is due to these benefits decreasing as income increases so in effect creating a high marginal tax rate. This is a major disincentive for those females with low skills to enter the workforce. The Australian Government (2005) announces increases in the FTB and decreases in PPS. Increasing the FTB is inconsistent with increasing the LFPR.

Childcare subsidies include assistance for preschool, kindergarten, and after school care. The OECD (2004b, pp. 13,5) projects a 6 to 7 percent increase in the Australian LFPR of prime aged females by increasing childcare facilities to Denmark's level. The large projected increase highlights Australia's relatively low childcare support. The OECD (2004b, p. 8) comment that childcare subsidies are an effective way to help low income mother break free of welfare dependency also lightening the disincentive effect that child benefits create. The Productivity Commission (2005d, p. 336) notes that subsidised childcare facilities are associated with increasing educational access for females which also increases their LFPR.

6.2.2.4 Increasing the educational level

Gruen and Garbutt (2003, pp. 43-4) find that increases in educational level are associated with increases in the LFPR. Carey (2004, p. 24) notes that increasing lifelong learning and the education level is a long-term method to increase the LFPR. The

Productivity Commissions (2005a, p. 336) stresses the importance of increasing the LFPR of today's young cohorts to improve future LFPR.

6.2.3 Productivity Policy – Labour Productivity Growth Rate

Is changing the LPGR an effect way to decrease fiscal pressure?

The results show that increasing the LPGR is ineffective at reducing fiscal pressure. The reason is that both government revenue and expenditure are linked to labour productivity. Government revenue is a fixed percentage of GDP, and growth in GDP is linked to the LPGR. Both Guest and McDonald (2000) and the Productivity Commission (2005a, p. 336) note the link between labour productivity and government social outlay expenditure. Many government social outlays have high labour content such as health, education and aged care and many benefits are linked to the average total male weekly earnings (ATMWE). Labour costs and the ATMWE are linked to the LPGR.

CPI indexed benefits are not linked to LPGR. However the proportion of benefits linked to CPI is small compared to those linked to the ATMWE. For instance the ASP are ATMWE indexed, the largest benefit by expenditure, and projected to grow more than any other benefit. The CPI indexed benefits are small and expected to decrease or increase by a small amount making them an inconsequential part in a cumulative NOB.

Policies to break the link between government expenditure and labour productivity could make increases in labour productivity effective in reducing fiscal pressure. This includes linking benefits to the CPI, and holding wage increases below labour productivity increases. The CPI linking could be effective if applied to the ASP, the biggest benefit, but politically difficult given the growing voting power of the ASP recipients. The other benefits are politically easier but relatively inconsequential. Holding down wages in health and education could work but again politically difficult.

In summary, increases in the LPGR are not effective in reducing fiscal pressure.

6.2.4 Tax Policy

Is changing the tax rate an effective way to adjust the fiscal pressure?

This study shows that increasing the tax rate is a very effective way to decrease fiscal pressure when the 'Tax elasticity of the labour supply' (TELS) is zero. This agrees with Guest and McDonald's (2000) projection.

However this study shows that a decrease in the tax rate of two percent is a very effective way to increase fiscal pressure and turn population ageing into an imminent crisis. This is at odds with the Treasury's tax-cut policy to reduce fiscal pressure. The claim by Treasury is that the reduction in tax will increase the LFPR and the LPGR to decrease the fiscal pressure. However the previous section shows that an increase in the LPGR will not decrease fiscal pressure. In the next section, the TELS is assumed to increase from zero to two. This tests the tax-cut policy under more favourable conditions and tax rate increases under more adverse conditions.

It should be noted the current tax-cuts appear more an ongoing adjustment for fiscal drag rather than a cut in taxes as a percentage of GDP. In term of this study, fiscal drag adjustments are not tax-cuts but serve to maintain the baseline projection by keeping revenue at a fixed percentage of GDP.

6.2.5 Tax Policy and Tax Elasticity of the Labour Supply

Does TELS determine the effectiveness of using tax rate changes to alter the fiscal pressure?

This study introduces a tax increase with a TELS value of 0.2 for comparison with Guest and McDonald's (2000) projection. Both studies project a small reduction in the effectiveness of a tax increase to decrease fiscal pressure, and a small drop in GDP. Guest and McDonald use TELS values of 0 and 0.2. This study uses a larger TELS value of 2 which halves the effectiveness of a tax increase to decrease fiscal pressure at a TELS value of zero.

This study models a tax decrease with a TELS value of 2 to test the Treasury's claim that the reduction in tax will increase the LFPR to decrease the fiscal pressure under favourable conditions. The result is an increase in fiscal pressure which is at odds with the Treasury's claim. The model indicates that the factors affecting the LFPR discussed in section (6.2.2) may be more important in decreasing fiscal pressure than a tax-cut.

There appears to be a gap in the literature over what constitutes a viable TELS. Dixon & Rimmer (2000) use TELS values of 0.2 and 2.0 in their study, suggesting there is no accurate estimate. The value of TELS has considerable effect on the projected time to achieve a negative cumulative NOB. This indicates that TELS could be an important factor in determining the effectiveness of any tax policy in response to population ageing. There appears a lack of information on the TELS and on the true value of TELS for Australia. Rectifying this forms a recommendation for further research.

6.2.6 Tax-cut Policy

Can using a policy of tax-cuts to increase the LPGR and the LFPR solve the population ageing induced fiscal pressure?

The tax-cut policy claims that a decrease in taxes will increase the LFPR and the LPGR thereby reduce fiscal pressure. Section (6.2.3) finds that increases in the LPGR are ineffective at decreasing fiscal pressure. Section (6.2.5) finds using a tax-cut with a high TELS to increase LFPR is counterproductive in reducing fiscal pressure. This section examines the tax-cut policy by combining both a favourable LPGR and a favourable TELS value. Chapter 4 found a maximum LPGR of 2.05 percent and a maximum for the TELS value of 2. This study then assumes a very small 0.5 percent decrease in the tax rate will increase the LPGR to the maximum value and assumes the maximum value for the TELS. The results show that a tax-cut policy to reduce fiscal pressure is counterproductive even under the most favourable conditions.

The implications are that the tax-cut policy is only sustainable during the demographic gift phase of population ageing given the Treasurer's (2004, p. 26) conditional promise not to cut government spending. Long-term sustainable tax-cuts are usually associated with 'Cuts in government services and privatisation' policies discussed in section (2.7.3). The issue arises whether tax-cuts are the best use of the budget surpluses derived from the demographic gift. Alternatives uses include investment in infrastructure or human capital or being saved to meet future ASP and health requirements.

In summary, a tax-cut policy without 'Cuts in government services and privatisation' policies appears unsustainable beyond the demographic gift period.

6.2.7 Pay As You Go Policy and Tax Elasticity of the Labour Supply

What effect does a high TELS have on after-tax GDP per capita under a PAYGP?

The pay as you go policy (PAYGP) means increasing taxes to cover any negative NOB resulting in a balanced or zero NOB over the business cycle. **The results indicate after-tax GDP per capita continues to grow when using a PAYGP even with high TELS**. This is consistent with Guest and McDonald's findings at TELS values of zero and 0.2. Additionally, this study tested Guest and McDonald's claims at the higher TELS value of two. This study found that after-tax GDP per capita continues to grow under a PAYGP. However there was a 12 percent drop in after-tax GDP per capita when increasing TELS from a value of 0 to 2 in 2051. The projected after-tax GDP per capita is $51,656 at a TELS value of zero and drops to $45,302 at a TELS value of 2. The decrease in disposable income decreases the appeal of PAYGP as a solution to the increasing fiscal pressure. Increasing the LPGR is seen to be a solution in the next section.

6.2.8 Pay As You Go Policy and Labour Productivity Growth Rate

What effect does changing the LPGR have on after-tax GDP per capita under a PAYGP?

The results indicate increasing the LPGR increases the growth in after-tax GDP per capita under a PAYGP. The Productivity Commission (2005a, p. 336) agrees that the greater the labour productivity gains, the higher any real marginal tax rate can be made to cover the fiscal pressure. The increase in the after-tax GDP per capita increases citizens' absolute disposable income. In this way, increases in the LPGR become important to solving fiscal pressure. For example, even with a small increase in the LPGR from 1.45 percent to 1.75 percent, growth in after-tax GDP per capita under a PAYGP is higher at a 1.75 percent LPGR than without a PAYGP at 1.45 percent LPGR.

The Productivity Commission (2005d) reports that there are many ways to increase labour productivity without tax-cuts. The Productivity Commission (2005a, p. 336) notes that labour productivity gains in government service provision rather than the economy in general may prove useful in meeting the increases in demand from population ageing. A full investigation of all the possibilities is beyond the scope of this study.

In summary, a PAYGP appears feasible and is more easily accommodated with a higher LPGR ameliorating the tax increases.

6.2.9 Population Policy

Can changing the mortality, net overseas migration (NOM), and total fertility rates (TFR) eliminate population ageing induced fiscal pressure?

The results show that changing population growth can only influence fiscal pressure by increasing or decrease the time to achieve a negative cumulative NOB by a relatively brief period, not stopping it from occurring. The simulation analysis results are consistent with the findings of other studies.

Guest and McDonald (2000) find that altering the NOM rate has a small effect on fiscal pressure. The Productivity Commission (2005a, p. xvii) finds that NOM cannot realistically be altered to avoid population ageing or even substantially moderate the effect. The Treasury (2002, p. 64) finds that NOM increases have only temporary effects because the immigrants themselves eventually age.

The Productivity Commission (2005a, p. xvi) note that the real drivers of population ageing are mortality and TFR which indicates population ageing is inevitable. Mortality is difficult to alter and there are limits to which this can be changed in a democracy.

This leaves only the TFR to become a policy instrument. The Treasury (2002, p. 61) shows that changes in the TFR have uncertain effects on fiscal pressure. Also they note that the TFR takes a long time to change and to have an effect. The Commission (2005a, pp. 329-30) notes that the TFR is not very amenable to policy initiative.

Badly managed TFR policy could increase fiscal pressure as an increase in the TFR five to ten years before the number of baby-boomers in retirement peaks would increase the CDR and TDR. Policy measures, such as, baby bonuses or increases in the FTB to increase the TFR are possibly counterproductive policies measures because they increase fiscal pressure directly through tax-breaks and indirectly by encouraging the primary child-carer parent to leave the workforce.

In summary, population policies are not effective in reducing fiscal pressure. Their effect is very slight and potentially counterproductive.

6.2.10 Real Non-demographic Health Expenditure Growth

Do real non-demographic health expenditure projection methods and parameters have a large effect on fiscal pressure projection?

This study found both the health premium and alternative PBS projections do have a large effect on the projected time to achieve a negative cumulative NOB. They represent uncertainty in projection parameters and methodology rather than a policy proposal or tool. These uncertainties are important in determining the time to achieve a negative cumulative NOB or fiscal pressure. However they do not alter the conclusions about the policy proposals or tools under investigation in the other research question. This is because the conclusions are based upon a **change** in time to achieve a negative cumulative NOB, rather than an absolute value.

There is a need for further research into health expenditure projection. This is suggested for three reasons. First, there is uncertainty surrounding health expenditure projection methodology and parameter values. Second, health expenditure is the largest government social outlay. Third, this study's baseline projects health expenditure to double as a percentage of GDP from 2004 to 2051.

The implications are that the choice of PBS projection method could make population ageing appear more a crisis than it is in fact. Portraying population ageing as a crisis could lead to unnecessary and poorly crafted policy reforms passed in urgency. The Treasury's (2002) PBS projection is high compared to Productivity Commission's (2005a) projection which captures more recent trends. However, both the Productivity Commission (2005a) and the Treasury (2002) acknowledge the large uncertainty in health expenditure projections. The Treasurer (2004, pp. 23-4) reused the Treasury's (2002) PBS projection when he advocated policy action, omitting to mentioned the large uncertainty in health expenditure projection.

6.2.11 Levels of Government

Are the State and Commonwealth levels of government equally affected by population ageing?

The results show the Commonwealth may experience considerably higher fiscal pressure than the states. The result shows that population ageing is not an immediate concern collectively for the states unlike the Commonwealth. Consistent with this, the Treasury (2002, p. 36) observes that Commonwealth spending on health as a percentage of GDP has increased whereas state spending has decreased over the last decade. In addition, the Treasury (2002, p. 46) notes that the Commonwealth funding of private schools and university education is increasing whereas the states funding of public school education is decreasing. The Treasury (2002, p. 58) observes that the increasing health expenditure in the states is balanced by the decreasing education expenditure. Further, the Commonwealth covers the largest portion of 'Social security and welfare' (SS&W) payments. This sum is expected to rise with population ageing.

The large difference in fiscal pressure between the Commonwealth and states indicate the need to have separate projections. However this study and Guest and McDonald (2000) use an 'All levels of government' projection which simplifies matters by measuring the total fiscal pressure rather than the individual governments and the movements of pressure between governments.

The 'All levels of government' projection avoids the complexities of projecting financial flows between governments. The financial flows between governments makes the projection of individual governments unnecessary for this study. The flows consist of Special Purpose Payments (SPP) and horizontal fiscal equalisation (HFE). The Productivity Commission (2005a, p. 268) notes that any fiscal pressure difference between states is ameliorated by HFE, a method to distribute GST between the states.

Additionally, the Productivity Commission (2005a, p. 309) comments that difference in fiscal pressure between the state governments and the Commonwealth government is largely determined by SPP, a payment from the Commonwealth to the states for a specified purpose. The Productivity Commission (2005a, pp. 385-401) notes that SPP are very difficult to project. There are three possible methods for calculating SPP by inflation and population, by GDP, or by service needs.

Regardless, the total fiscal pressure remains the same, as the SPP and HFE only serve to shift the fiscal pressure between the various governments. HFE and SPP cause tension between the Commonwealth and state governments already. All these factors make it very difficult to project the movement of fiscal pressure between governments. Further, the Commonwealth government wants the states to decrease taxes as part of the GST agreement. Additionally, the Commonwealth from 2017 onward may require some of the SPP and or GST monies to decrease its own fiscal pressure.

In summary, the financial interrelatedness of the governments and complexity of the intergovernmental financial flows justifies this study's use of an 'All levels of government'. The financial interlacing of the governments and the large projected difference in fiscal pressure between the states and Commonwealth indicates the need for the governments to develop a coordinated approach to population ageing.

6.3 Conclusion

The proposed policies that are effective are discussed first followed by those that are ineffective.

The PAYGP is effective. This study finds that a PAYGP still has growth in after-tax GDP per capita under selected adverse conditions. The growth in after-tax GDP per capita under a PAYGP is greater than a non-PAYGP with a slightly lower LPGR. This makes policies to increase LPGR important in any PAYGP implementation.

Participation policies are effective but poorly implemented. Sections (6.2.1) and (6.2.2) show that the participation policies to increase the retirement age and the LFPR (15-64) without tax-cuts could be very effective in reducing fiscal pressure. However, this study finds that the Treasury's policies to increase the LFPR are inconsistent, counterproductive, and inadequate or lacking. The policies are inconsistent because they decrease the PPS but increase the FTB. The policies are inadequate or lacking because paid parental leave and childcare subsidies are low. The policies are counterproductive because the means tested ASP and superannuation combination decreases the LFPR.

Conclusion: The most appropriate policy mix is a participation policy to increase the LFPR with a PAYGP covering the remaining fiscal pressure. Additionally, the PAYGP benefits from policies to increase the LPGR to ameliorate the increases in tax.

The tax-cut policy is counterproductive. Section (6.2.6) evaluates the tax-cut policy and finds it counterproductive even assuming a high TELS value and a high LPGR. The tax-cut policy is only sustainable with cuts in government service and privatisation once the demographic gift has passed.

Productivity policies are ineffective. Section (6.2.3) shows productivity policies to increase the LPGR are ineffective in reducing fiscal pressure. This study finds that this is due to the link between labour productivity and government expenditure and revenue. The policies that might appreciably break that link appear too difficult to implement.

Population policies are ineffective. Section (6.2.9) indicates that population policies are ineffective. The mortality rate is not a policy instrument. The NOM has a very small effect. The TFR is not effective for three reasons. It is difficult to change. In the short-term, it increases the CDR and TDR increasing fiscal pressure. The subsidies to increase the TFR increase fiscal pressure.

Conclusion: The policies proposed by government aren't the most appropriate ones and their overstatement of the problem is giving a false sense of urgency to pass policies that are inappropriate to meet population ageing.

This study clarifies a number of policy issues relating to population ageing. The clarification was sought because earlier studies provided contradictory conclusions. The OECD (2003) views population ageing and the induced fiscal pressure as a crisis requiring action. Day and Dowrick (2004) claim the need for action is exaggerated. Guest and McDonald (2000, p. 11) advocate a PAYGP to meet the fiscal pressure and believe large policy changes are unwarranted. The Treasury (2002, p. 66) advocates decreases in spending growth and/or increases in taxes to cover the projected pressure. The Treasurer (2004, pp. 8, 13-6, 25-6) and Secretary to the Treasurer (Henry 2004, p. 6) advocate tax-cuts and increases in the LFPR to increase economic growth. This study clarifies the following issues. A tax-cut policy to increase economic growth is not compatible with an economic growth policy to reduce fiscal pressure. The fiscal pressure problem has been overstated. Most of the fiscal pressure can be met with increases in the LFPR. The remainder can be easily accommodated with a PAYGP. Productivity policies to increase the LPGR are ineffective at reducing fiscal pressure and population policies are, at best, only slightly effective in reducing fiscal pressure.

This study reveals that there are four areas where further research will provide policy makers with valuable information. One, there exists uncertainty over the value for TELS. The values assumed for TELS have a large effect on the fiscal pressure projection for the tax-cut policy and PAYGP. Two, intergenerational equity issues feature in the choice between the PAYGP and the tax-cut policy, a policy often associated with cuts in government services and privatisation. The PAYGP policy transfers wealth from the working-age to the aged, and the other policies reverses this flow. Three, the projection of health expenditure is uncertain. This uncertainty makes all fiscal pressure projections uncertain. The government overstates the fiscal pressure problem by ignoring this uncertainty. More accurate methods for projecting health expenditure are required. Four, the projection of large fiscal pressure differences between the states and the Commonwealth indicates the potential for future friction between them. This signifies the need to develop cooperation between the Commonwealth and state governments in planning to meet population ageing.

7 Conclusion

7.1 Summary and Implications

Edey (2005, p. 8) notes that the population ageing transition is affecting virtually all countries around the world. Countries are at differing stages in the transition, moving at different speeds, and affected with varying intensity. The developed countries are in the later stages of population ageing and many developing countries are in the initial phase. Increases in fiscal pressure resulting from population ageing are largely conditional on how and in what form the government is involved in social outlay provision. The projected increase in fiscal pressure has implications for governments as they must decide on an appropriate policy response. Worldwide opinion differs on whether population ageing is a crisis that requires drastic change (OECD 2003) or population ageing is problem that may require some minor adjustments (Day & Dowrick 2004; Guest & McDonald 2000).

The OECD (1996) forecast show Australia's population ageing induced fiscal pressure to be moderate by international standards. Two factors contribute to this. First the Australian government's pension liabilities are comparatively moderate. Second population ageing in Australia is projected to be moderate compared to many other OECD countries. This study focuses on two policy responses to the increase in fiscal pressure: economic growth policies and tax policies. The economic growth policies are investigated under the headings of participation, productivity, and population (Productivity Commission 2005a, p. xvii). The tax policies investigated are a tax-cut policy, and a pay as you go policy (PAYGP). The ‘Tax elasticity of the labour supply’ (TELS) plays an important role in their investigation.

7.1.1 EGM and Solow Model

The literature review in Chapter 2 covers the population ageing effect on economic growth, savings, and international linkages. The Solow model and endogenous growth model (EGM) are used to determine the effect of population ageing on economic growth and to source solutions. Both models acknowledge the importance of labour productivity in increasing economic growth. The EGM stresses increases in human capital as a way to increase the labour productivity rate and total factor productivity (TFP) whereas the Solow model indicates increasing human capital or any other factor, only at best, increases economic growth temporarily.

Analysing population ageing with the Solow and endogenous growth models (EGM) neither provides a common outcome for economic growth nor gives a consistent direction for policy formulation to increase economic growth. Consequently this study uses a simulation model rather than the Solow model or EGM to analysis the research questions. The theoretical models predict conflicting outcomes from population ageing. The EGM indicates savings are important at all GDP output levels to increase economic growth whereas the Solow model indicates savings or investments beyond the equilibrium GDP output level are counterproductive. This has implications for human capital accumulation which is expected to increase with population ageing. According to the EGM increasing human capital is useful in increasing economic growth whereas the Solow model indicates increases human capital/investment beyond the equilibrium output level is wasted. An additional difference is the Solow effect, which indicates the expected decreases in labour supply growth and savings from population ageing offset each other so helping to maintain the GDP output level.

7.1.2 Savings, Capital Formation and International Linkages

The Permanent Income Lifecycle Hypothesis (PI-LCH) indicates population ageing has a mixed effect on savings. The overall outcome is uncertain but a little dissaving is expected. International linkages could be useful in offsetting population ageing by allowing superannuation investment in countries in a different phase of population ageing. However, in general, the countries that are safe places to invest with low corruption levels are in the same phase of population ageing as Australia. Australia experiences large exchange rate fluctuations making superannuation invested overseas subject to high levels of exchange rate risk. This limits international linkages for use in moderating population ageing effects.

Most OECD countries are experiencing advanced population ageing and expect to have some dissaving. The OECD countries are the source for most of the world capital, thus this factor may push up world interest rates. Australia has a history of consistent capital formation despite changing global conditions. Consequently this study's methodology does not simulate population ageing effects on savings, capital formation or international capital flows because they are complex, uncertain, ambiguous, and potentially small in size.

7.1.3 Population Projections

Chapter 3 discusses the population ageing effect using ABS (2003b, table 9b) Population Projection (Series B). The population ageing effect leads to a large increase in the aged dependency ratio (ADR) and a small decrease in the child dependency ratio (CDR). The health costs for the aged are much higher than that for children, and ‘Social security and welfare’ (SS&W) largest payment is for the ‘Age and service pensions’ (ASP). Consequently government social outlays increase with population ageing because SS&W and health expenditure increases by a large amount while education expenditure decreases by a small amount. Further the relative tax revenue may decrease as the ADR increases. The increase in government social outlays and decrease in revenue acts to increase fiscal pressure.

7.1.4 Labour Productivity Rate and Labour Force Participation Rate

Labour productivity may be affected by population ageing but the effect is uncertain and most probably small. The labour supply may decrease as the population ages as the older age groups have lower labour force participation rates (LFPR). This could be offset by increases in the female LFPR and in aged part-time work, and by decreases in the unemployment rate. Overall population ageing is expected to decrease the labour supply leading to a decrease in economic growth. This in turn leads to a decrease in tax revenue growth given a constant tax rate.

7.1.5 Complex Interdependencies

Day and Dowrick (2004) give a contrary view noting population change involves complex interdependencies. The treatment of population ageing as exogenous is perhaps too simplistic. Consequently, the population ageing effect on government social outlays may have been oversold as a problem. The literature does reveal many compensating factors that ameliorate the population ageing effect on social outlays. For instance, the decrease in unemployment rate as people retire offsets the reduced labour supply. The decrease in the TFR and associated increase in the females LFPR offsets the reduced labour supply. There is a reduction in savings as more people retire, which is offset by a reduce savings requirement because the growth in the labour supply decreases. The ageing population increases human capital making people more productive, which will offset a reduced labour supply.

7.1.6. Methodology

The method of analysis involves using a simulation model to project future government expenditure and revenue. Two sensitivity analysis methods are then used to test policies that have been proposed to solve the problem of population ageing induced fiscal pressure. The proposals are economic growth policies and tax policies. One sensitivity analysis method uses the 'Change in time to achieve a negative cumulative net operating balance (NOB)' from a baseline projection. This proves a simple way to compare the effectiveness of various policy options and provides a more precise fiscal pressure change measure. The other sensitivity analysis method 'After-tax GDP per capita' proves a simple way to assess the impact of the PAYGP proposal.

7.1.7 Economic Growth Policy

The economic growth policies investigated are participation, productivity, and population: participation increasing the retirement age and LFPR (15-64); productivity increasing the labour productivity rate; and population changing the mortality, net overseas migration (NOM) and total fertility rates (TFR).

7.1.7.1 Participation Policy

The results show that increasing the retirement age and LFPR (15-64) are very effective in reducing fiscal pressure. However the Treasury's policies to increase the LFPR appear inadequate, inconsistent, and counterproductive. They lack adequate childcare subsidies and or paid parental leave. They are inconsistent by increasing the family tax benefits (FTB) and decreasing the parenting payment single (PPS). This provides incentives to both decrease and increase the LFPR. The private superannuation and means tested ASP combination decreases the LFPR by increasing the incentive to retire early and decreasing the incentive to work for those already retired.

7.1.7.2 Productivity Policy

The results show that an increase in the LPGR to reduce fiscal pressure is ineffective because increasing the labour productivity rate increases both government revenue and expenditure. This makes policies to increase labour productive ineffective to reduce fiscal pressure given a constant tax rate. Making increases in the LPGR an effective tool to reduce fiscal pressure requires breaking the links between it and government expenditure, such as CPI, indexing benefits and/or keeping wage rises below labour productivity growth. Both of these are difficult to achieve to a degree that would have a substantial impact. However increases in the LPGR do increase the growth in after-tax GDP per capita.

7.1.7.3 Population Policy

The results show that policies to change mortality, NOM, and TFR have slight effect on fiscal pressure: increasing the mortality rate is not really a policy option; increasing NOM has a very slight effect as immigrants themselves age; increasing the TFR has the counterproductive effects of increasing the CDR, reducing the female LFPR, and requiring tax-breaks.

7.1.8 Tax Policy and TELS

The tax policies investigated are tax increases and tax-cuts under changing values for the TELS. In addition, the PAYGP is investigated, a policy to progressively increase the tax rate to cover fiscal pressure induced by population ageing. The TELS was found to have a large effect on tax policy and its value require further research.

7.1.8.1 Tax-cut Policy

The model found that the tax-cut policy was counterproductive even under optimal conditions. The tax-cut policy – decreasing taxes to increase the LFPR and LPGR thereby reducing fiscal pressure – is counterproductive even when assuming the maximum LPGR and value for the TELS. Consequently a tax-cut policy is feasible while in the demographic gift phase of population ageing but unsuitable afterwards without a cut in government services and privatisation or issuing government bonds.

7.1.8.2 Pay As You Go Policy

This study finds that a PAYGP proposal maintains a positive growth rate in after-tax GDP per capita even under adverse conditions, such as, a high value for the TELS, a low LPGR, and with a health premium. A further finding is that an increase in the LPGR increases growth in after-tax GDP per capita under a PAYGP. The growth in after-tax GDP per capita under a PAYGP is higher than at a slightly lower LPGR without a PAYGP. This indicates policies to increase the LPGR are an important part of a PAYGP solution.

The Productivity Commission (2005d) recommends a variety of ways to increase labour productivity without tax-cuts. The EGM discussed in Chapter 2 finds increasing human capital through education and R&D is an effective way to increase labour productivity. Chapter 3 notes increasing the educational level is of particular use as it is associated with increases in both the LFPR and labour productivity.

7.1.9 Taxation and Intergenerational Aspects

The tax-cut policy and PAYGP have implications for the transfer of wealth between generations. The tax-cut policy transfers wealth from the aged to the working-age, the PAYGP moves wealth in the reverse direction. The tax-cut policy is associated with cuts in government services and privatisation. For instance the Treasury advocates a tax-cut policy, and is simultaneously using tax-subsidies to foster private health insurance and private superannuation accounts. These reduce government service provision and private superannuation is moving Australia toward pre-funding population ageing liabilities. The efficiencies and intergenerational equity of the alternative tax policies require further research.

7.1.10 Levels of Government

The results show that fiscal pressure is most acute for the Commonwealth and much less a problem for the states. However the discussion in Chapter 6 notes that the interrelated nature of government finances, through the special purpose payments (SPP) and horizontal financial equalisation (HFE), makes treating the Commonwealth or a state government in isolation misleading. This justifies this study's focus on 'All levels of government'.

7.1.11 Non-demographic Health Expenditure

The results show that the uncertainty in the health premium values for projecting non-demographic health expenditure growth creates considerable uncertainty in the forecast of fiscal pressure. The alternative methods for projecting non-demographic health expenditure also convey the uncertainty in non-demographic health expenditure projection. Health expenditure projection is an area requiring further refinement. The uncertainty in health expenditure projection is acknowledged in Treasury (2002) but the Treasurer (2004, p. 23) uses the same information without an uncertainty acknowledgement. The Productivity Commission (2005a, pp. 167, 8) more recent projection finds a smaller health expenditure increase and recognises a greater uncertainty. The debate over population ageing and the resulting fiscal pressure is incomplete without acknowledgement of the full extent of the uncertainty in forecasting future health expenditure and may overstate the problem as a result.

7.1.12 Concluding

This study finds that population and productivity policies are ineffective in reducing fiscal pressure. In addition, the tax-cut policy is not sustainable past the demographic gift phase of population ageing without cuts in government expenditure or government bond issues. This study finds that increases in the retirement age and the LFPR (15-64) are effective in reducing fiscal pressure, and a PAYGP is sustainable with growth in after-tax GDP per capita. The growth in after-tax GDP per capita under a PAYGP is higher than at a slightly lower LPGR without a PAYGP.

Population ageing is not a crisis but a tax-cuts policy could turn it into a crisis. A suitable policy mix to meet the fiscal pressure includes participation policies to increase the LFPR and a PAYGP to cover the remaining fiscal pressure. Enhanced with productivity policies to increase the LPGR to ameliorate the tax increases.

7.2 Further Research

This study finds that the value of TELS has an impact on the effectiveness of tax policy and has implications for economic growth. There is information missing in the literature on this important variable.

A topic for further investigation is the plausibility of using a bond-issue policy to maintain a balanced budget over the population ageing transition. Such a study into the transitional effects on the economy would require a much longer duration than this study's 47 years to 2051. The population ageing transition features surpluses and a deficit period for government paralleling a single but very long business cycle. The demographic gift parallels a boom and surplus for the government. The bulk of the baby-boomers in retirement parallels a recession and deficits for government. The bulk of the baby-boomers expiring parallels a boom and surplus for government.

In terms of intergenerational equity the tax-cut policy and bond-issue policy are extreme opposites and the PAYGP appears a midway policy. The bond-issue policy transfers wealth from tomorrow's working-age to today's retired because the future generations have to repay the bonds and the retired have in effect taken out the bonds as they use the proceeds. The PAYGP transfers wealth from today's working-age to today's retired. The tax-cut policy – fostering private health insurance and private superannuation – transfers wealth from today's retired to the working-age. The efficiency and intergenerational aspects of the alternative tax policies require consideration.

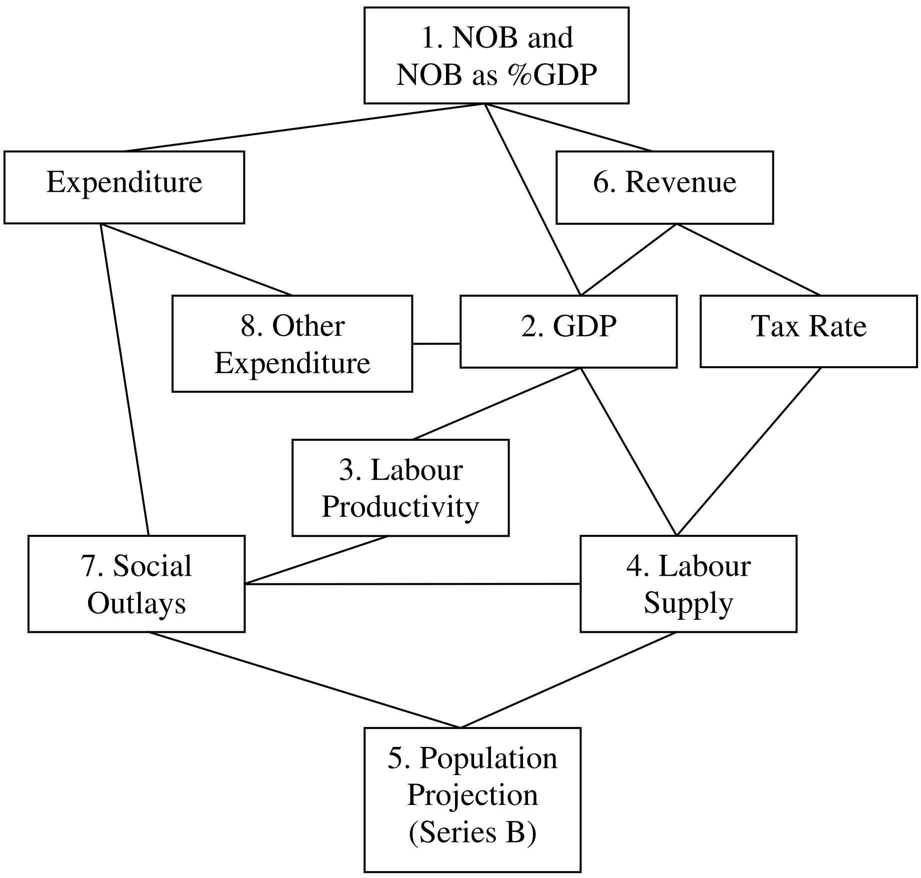
Section (3.5.2) notes that the health industry has a low LPGR compared to other industries. The health premium indicates the health industry is growing faster than the overall economy. The combination of the health industry's growth in size as a percentage of GDP and the low LPGR has negative feedback implications using a health premium methodology.

The organisation of the health industry and the health insurance industry has fiscal pressure implications. The coordination of funding and fiscal pressure differentials between the states and Commonwealth governments requires examination.

A. Simulation Model Design

This study's simulation model uses a similar methodology to Productivity Commission (2005a) and Treasury (2002). The simulation model calculates the net operating balance (NOB) as a percentage of GDP from government expenditure, government revenue, and GDP. The section relationship diagram in Figure A.1 shows how the sections in this appendix are interrelated to calculate the NOB as a percentage of GDP. Figure A.1 also shows how the sections are ordered in this appendix: 1. NOB and NOB as a percentage of GDP; 2. GDP; 3. Labour Productivity; etc.

Figure A.1 Section Relationship Diagram



A.1 Net Operating Balance and NOB as a percentage of GDP

This study uses the Net Operating Balance (NOB) from the ABS (2005c) Government Financial Statistics (GFS) and ABS (2004f, table 9) Estimated Residential Population (ERP) to calibrate the model. Equation (4.2) shows the NOB as a percentage of GDP.

$$\text{NOB} = \text{GFS Revenue} - \text{GFS Expenditure} \tag{4.1}$$

$$\text{NOB as a percentage of GDP} = \text{NOB / GDP} * 100 \tag{4.2}$$

A.2 GDP

Equation (2.1) calculates the GDP per capita as the product of labour productivity (GDP per hour worked) and labour supply (total hours worked) per capita.

$$Y/N = Y/L \times L/N \tag{2.1}$$

The following sections develop the calculations for the labour supply and labour productivity.

A.3 Labour Productivity

The GDP per capita is calculated in the base year 2004 from the GFS and ERP. This value is multiplied by the labour productivity growth rate (LPGR) each year. This study uses a baseline LPGR of 1.75% per annum for three reasons. First, the Productivity Commission (2005a, p. 102) cite the ABS (National Accounts, cat no 5204.0 and 5206.0) LPGRs, 1966-67 to 2003-2004 for the market and non-market sectors ranging between 1.45% and 2.05% providing symmetry around a long-term average of 1.75%. Second, the Treasury (2002, p. 25) and the Productivity Commission (2005a) use a

LPGR of 1.75% in their baselines making baseline comparisons easier. Third, Guest and McDonald (2000) cite the LPGR at 1.75%.

A.4 Labour Supply

Equation (A.1) derives the hours worked per capita (labour supply per capita) (Productivity Commission 2005a; 2005b, p. 53).

Hours/Pop = (LF/CPop) x (1–(U/LF)) x (Hours/Emp) x (CPop/Pop) (A.1)

Where Labour supply per capita = (Hours/Pop)
Labour force participation rate = (LF/CPop)
Unemployment rate = (U/LF)
Average hours per worker = (Hours/Emp)
Share of population over 15 years = (CPop/Pop)
Pop = Total Population
CPop = Civilian Population
LF = Total number in Labour Force
U = Total number of Unemployed
Hours = Total Hours Worked
Emp = Total number of workers (employed)

Equation (A.2) shows the calculation for the 'Average hours per worker' (Hours/Emp). This calculation allows recognition of the increasing prevalence of part-time work and its effect on 'Average hours per worker'.

Hours/Emp = PTShare*AveHoursPT + (1 – PTShare)*AveHoursFT (A.2)

Where PTShare = share of total employment that is in part-time work
AveHoursPT = Average Hours Worked Part-time
AveHoursFT = Average Hours Worked Full-time

Tables used in the Labour Supply Projection

The variables in the above equations are captured in trend tables by sex and age. The age comes in two forms: age groups 15-19, 20-24, 25-29, etc; and age by single year. The age by single year tables are converted to age group tables prior to the calculations. The Productivity Commission (2005a; 2005b) uses the following data sources – unpublished ABS data to create population projections 2004-2051, the ERP, and ABS (2005e, table LM8) Labour Force status by age and by sex 1978-2004 – to develop tables of trends by sex and by age for following.

1. Estimated and Projected Resident Population 1971-2051
2. Participation rate projections 2004-2051
3. Unemployment rate projections 2004-2051
4. Part-time work ratio 2004-2051
5. Average hours worked per week full-time 2004-2051
6. Average hours worked per week part-time 2004-2051
7. Civilian population/Total Population ratio 2004-2051

A projection of the labour supply is found by multiplying together the variables from the above tables as described in Equations (A.1) and (A.2). This study uses the same method to calculate the labour supply. But replaces the Productivity Commission's (2005a) population projection calculations with the ABS (2003b, table 9b) Population Projection (Series B) 2002-2051.

A.5 Population Projections

There are three ABS (2003b, tables 9a, 9b, and 9c) Population Projections (Series A, B, and C) high, medium, and low. This study uses Series B as the baseline projection because it is the most likely of the three projections. Figure A.1 shows Series B is pivotal in determining government revenue and government social outlays projections. Table A.1 identifies the values for the population parameters: mortality, net overseas migration (NOM), and total fertility rates (TFR) for each series.

Table A.1 Population Projections

	TFR	NOM	Life expectancy at birth (years)		2051	2101
	Babies per woman	Persons	Males	Females	million	million
Series A – High	1.8	125,000	92.2	95.0	31.4	37.7
Series B – Baseline	1.6	100,000	84.2	87.7	26.4	26.4
Series C – Low	1.4	70,000	84.2	87.7	23.0	18.9

(Source: ABS 2002a, p. 1)

A.6 Government Revenue

This section addresses the how the model projects tax revenue and non-tax revenue. All tax rates are given as a percentage of GDP.

Tax Revenue

Treasury (2002, p. 53) notes that it is common to project taxation revenue as a constant share of GDP. This approach has been adopted by the US Congressional Budget Office, the UK Treasury, the NZ Treasury and Treasury (2002) itself. The Productivity Commission (2005a, p. 323) notes that taxes of all types and across all tiers of government comprised around 31.2 percent of GDP in 2003-04 – and remain roughly stable over their baseline projections. This study uses a constant 31.2 percent of GDP for tax revenue. The following provides a breakdown and justification.

The Productivity Commission (2005a, pp. 257-76) tax revenue projection provides a very detailed analysis by Commonwealth and state level, breaking-down state taxes into payroll, gambling, conveyancing and GST. The Productivity Commission's (2005a, p. 257) finds that gambling, conveyancing, and GST are age sensitive. However compensating effects made any net changes negligible. The ABS (2005a) notes that these age sensitive taxes only form a small percentages of total tax revenue: gambling (1.6%), conveyancing (4.5%), and GST (13.3%). Therefore, this study treats government revenue as a fixed proportion of GDP as given in Equation (A.3). The breakdown of the ABS (2005a) government tax revenue (31.6%) is Commonwealth (22.4%), GST (3.3%), and State (5.9%).

$$\text{Government Revenue} = \text{Tax Rate} * \text{GDP} \tag{A.3}$$

Where Tax Rate = 22.4% + 3.3%+ 5.9% = 31.6% (ABS (2005a))
Or Tax Rate = 22.4% + 3.3% + 5.5% = 31.2% (baseline this study)

The following explains why this study assumes a 31.2 percentage baseline tax rate rather than the ABS (2005a) 31.6 percentage tax rate. Gruen & Garbutt (2004, p. 4) and Treasury (2002, p. 7) state that Commonwealth revenue has remained static at about 22.4 percent of GDP projected to stay about this level. The Treasury (2002, p. 55) reduce their tax rate to 20.8 percent in their projection from 2005 to 2042. The Productivity Commission (2005c) uses 21.20 percent for the Commonwealth tax rate in their model. This model uses a baseline Commonwealth tax rate of 22.4 percent and assumes no tax-cuts. Tax-cuts form part of the sensitivity analysis.

The ABS (2005a, p. 8) notes that total taxation revenue as a percentage of GDP increased from 31.3% in 2002-3 to 31.6% in 2003-4. However, the tax rate for the Commonwealth remained unchanged at 25.7% (22.4% + 3.3% GST), while total taxation revenue from state and local governments rose. The state revenue is expected to reduce as the Commonwealth government is insisting the state governments abolish certain state taxes in lieu of receiving all the GST revenue. The ABS (2005a, p. 8) also notes that total taxation revenue as a percentage of GDP has oscillated between 30 percent and 32 percent from 1998-99 to 2003-04 indicating the 31.6% in 2003-04 is a high value.

This study's baseline uses an 'All levels of government' revenue of 31.2% of GDP and a Commonwealth tax rate of 22.4% of GDP as it allows easier comparison with the Productivity Commission's (2005a) 'All levels of government' projection.

Non-Tax Revenue

Non-taxation revenue includes the sale of goods and services, interest, dividends and petroleum royalties. The Treasury (2002, p. 55) notes that non-tax revenue is difficult to relate to economic parameters and they set non-tax revenues at 1.6% of GDP for the projection period. This model uses the GFS calculating a Commonwealth non-tax revenue of 1.5% and state government non-tax revenue of 5.1%. Treasury (2002, p. 57) notes that the total Commonwealth revenue in their projection is 22.4 % of GDP (1.6% non-tax revenue and 20.8% tax revenue). This is lower than ABS (2005a) implying Treasury (2002) has underestimated the tax revenue and total revenue.

Special Purpose Payments

Special Purpose Payments (SPPs) are tied grants paid from the Commonwealth government to the state and or local governments for service provision such as schooling and hospitals. SPPs are not modelled.

Horizontal Financial Equalisation

Horizontal Financial Equitation (HFE) is used to allocate GST revenue to the states. This study does not model HFE but does provide an aggregate state projections.

A.7 Government Social Outlays

This model projects the total government social outlays by summing the projections of each social outlay of both the Commonwealth and state governments. The social outlays are listed below. Those asterisked have both Commonwealth and state expenditure. The remainder have only Commonwealth expenditure. The Commonwealth and state revenues are linked via financing from the Commonwealth to the states, also various functions of government change between the levels, so which level of government pays any portion of any service can be complex and change over time.

1 Health*

2 Aged Care*

3 Carers

4 Education*

Personal Benefit Payments

5 Age and service pensions (ASP)

6 Family tax benefit A and B (FTB)

7 Disability Support Pension (DSP)

8 Unemployment allowances

9 Parenting Payment Single (PPS)

The following sections describe how each government social outlay expenditure projection is derived. However, before doing so, features common to all the projection derivations are outlined. Each social outlay has input tables of expenditure by sex and by age. These tables usually need modifying before a projection can be made. For example, some tables use the ERP to find a per capita basis for payments, others require expenditure figures deflated or inflated into base year 2004 values using the ABS (2004c) CPI.

Personal Benefit Payments

In some cases, the input tables are extensive allowing trend analysis to produce projections from 2004 to 2051 of the probability of receiving an allowance per capita by sex and age. Alternatively for simpler input tables the probability of receiving an allowance per capita by sex and age for the base year only is calculated. Either way, the modified input table is multiplied by Series B. The resultant projection is the 'Number of individuals collecting the allowance by sex and age from 2004 to 2051'. The next step depends on whether the allowance is indexed by the Average Total Male Weekly Earnings (ATMWE) or by the CPI. If the allowance is indexed by CPI or for inflation then the 'Number of individuals collecting the allowance by sex and age from 2004 to 20051' projection is multiplied by the allowance by age for the base year to find the social outlay expenditure for each year. Alternatively, if the allowance is indexed by the ATMWE then the assumption that the labour productivity and ATMWE grow at the same rate is made. Thus the allowance by age for the base year is factored by the LPGR prior to multiplying by the 'Number collecting the allowance by sex and age from 2004 to 2051' to find the social outlay expenditure for each year.

Health and Education

Health and education generally differ from personal benefit payments in that they have average expenditure by age and sex per capita input tables and do not need probability distribution calculation but still display many commonalities.

The sources of the input tables and any differences to the above generalised projection method are now discussed under each government social outlay.

A.7.1 Health

The simulation model for health is the most complex and is treated first. The health model uses three subdivisions: the level of government, either Commonwealth or state; growth in health expenditure, either demographic or real non-demographic growth; and four health areas – hospital, Medicare, PBS, or 'Other'. The Treasury (2002, p. 81) and Productivity Commission (2005a, p. 165) use similar subdivisions. The reasons for using four health areas are that each has differing real non-demographic growth, and differing demographic average cost per capita-age profiles.

Government Levels

The model allocates health expenditure to Commonwealth or state levels but not to individual states. This allows for comparison with the Treasury's (2002) Commonwealth projection and avoids the complexity of SPP and GST allotment projections to individual states.

Demographic factors

The projection of the demographic effect on health expenditure by area is calculated by multiplying Series B with the average health expenditure per capita by age, sex, and health area. Then each year is adjusted for non-demographic factors. The total health expenditure is then calculated by summing the four health areas' expenditure.

Health Areas

Finding the average expenditure for each health area by sex and age proved difficult, requiring simplifying assumptions or the use of secondary data. The sources include the Productivity Commission's (2005a, pp. 356-7, tables C1 & C2) 'Index of the age profile of government hospital and health expenditure' table, the ABS (2005c, p. 31) GFS 2003-04 supplemented with an unpublished ABS breakdown of health expenditure by health area, and the ERP in 2004. They are used to find the average expenditure per capita by sex, age group, and health area.

The Productivity Commission's (2005a, pp. 356-7, tables C1 & C2) data is crosschecked against the following sources. For the hospital area, the National Centre for Social and Economic Modelling (NATSEM 1995, p. 7) provides a table of public hospital bed utilisation rates, by age, sex and state derived from the average annual bed days per person. This is sourced from AIHW unpublished data for acute care hospitals and repatriation general hospitals which provides a means to allocate total hospital expenditure by bed days then produce average hospital expenditure per capita by sex and age. For the Medicare area, the Health Insurance Commission (HIC 2005, table 14)

Medicare Statistical tables provides average expenditure per capita by age and sex for 2003-04. For the PBS area, NATSEM (1998, p. 15; 2003a, p. 16; 2003b, p. 13; 2005, p. 13) analysis provides relative PBS expenditure distributions by age and sex. The HIC (2005) PBS tables do not provide average expenditure per capita by age and sex but do provide aggregates. The AIHW (2004b, pp. 21-3) allocates total health expenditure by sex and by age.

None demographic factors

The non-demographic effects on health expenditure are inflation and real non-demographic growth. The model deals with inflation by giving all monetary figures in 2004 dollars. A similar approach is used by the other three studies.

Real non-demographic growth in health expenditure is handled differently by the other three studies. Guest and McDonald (2000) assume real non-demographic growth in health expenditure is enmeshed in the general economy so it grows at the same rate as the rest of the economy. The Treasury (2002) calculates a real non-demographic growth rate for each health area, and some area's real non-demographic growth rates by sex and age. The Productivity Commission (2005a) uses a 'Health premium above the growth in real GDP per capita' (health premium) to model real non-demographic growth in health expenditure.

This model uses the health premium method. The reasons for using the health premium method are. The Productivity Commission's (2005a) health premium method is midway between the Treasury's (2002) unrestrained exponential growth model and Guest and

McDonald's (2000) flat or implicit growth model. This allows for better comparison between the models. The Treasury's (2002) real non-demographic growth model allows unchecked exponential growth which is acceptable for short term projections but becomes unrealistic for long-term projections. For instance, the Productivity Commission (2005a, p. 374) notes three facts since the release of Treasury (2002) with its high real non-demographic growth rate for PBS. First, there has been a slowing in the growth of PBS expenditure. Second, a number of higher priced drugs are due to come off patents in the next few years. Third, the Pharmaceutical Benefit Pricing Authority has introduced risk sharing arrangements with drug companies in case drugs become more widely prescribed than was originally anticipated. However, past real non-demographic growth in PBS expenditure is considerably higher than that in other areas of health. Therefore, separate PBS and non-PBS health premiums are developed.

This study uses a baseline non-PBS health premium of 0.6% with a minimum and maximum of 0.3% and 0.9%. These maximum and minimum values are used in the sensitivity analysis. The following outlines the calculations for the health premium values. The Productivity Commission (2005a, pp. 371-2) notes that there is uncertainty on the modelling and the measurement of the health premium. The Productivity Commission (2004a, p. D7) calculates the non-PBS residual or health premium for Australia from 1984-85 to 2001-02 using the AIHW (2005) expenditure data-cube. A data-cube is a multidimensional representation of data. The calculation starts with the nominal health expenditure growth (8.1%) then subtracts the following, inflation (3.7%), population growth (1.3%), structural age adjustment (0.5%), and GDP growth per capita (2.1%), which leaves a residual (0.5%) the health premium. The residual implies health care costs are increasing in addition to the factors subtracted. The Productivity Commission (2005a, p. 373) finds that the residual ranges from 0.3% to 0.9% by using the same subtractive method above but using a differing start date with the same end date 2002-03. So this study's minimum and maximum are 0.3% and 0.9%. The baseline value is the midpoint 0.6%

This study uses a baseline PBS health premium of 0.6%. The sensitivity analysis uses a PBS health premium of 5% in 2004 drifting down to 0.6% in 2051. The Productivity Commission's (2005a, p. 373) estimates of the health premium for the PBS area at 4.9% from 1984-85 to 2001-02 calculated using the AIHW (2005) expenditure data cube. The Productivity Commission (2005a, pp. 373-5) introduces a logistic function which retains some balance between health areas by reducing the PBS growth rate to that of the other areas of health expenditure over the duration of the projection. Equation (A.4) shows the unpublished logistic function that reduces the initial PBS health premium of 5% in 2004 to 0.62% in 2045, close to 0.6% the non-PBS health premium.

$$PBS(year) = (\{c / [1 + (a * e \wedge \{ -b * [year - 2003]\})]\} + n) / 100 \qquad (A.4)$$

Where PBS(year) = PBS health premium in a given year

a = 0.0448091668527078

b = –0.192882494037682

c = 4.74520947176921

e = exp(1) = 2.718281828459045 …

n = 0.6, which is the non-PBS health premium

year > 2002

A.7.2 Aged Care

Aged care expenditure has a health and a 'Social security and welfare' (SS&W) component. The ABS (2005c, p. 41) GFS descriptions are 'Nursing homes for the aged' and 'Welfare services for the aged'. The reasons for separating 'Nursing homes for the aged' from other health areas are aged care does not exhibit a health premium; and the average cost by sex and age per capita profile differs significantly from that of the other health areas.

The Productivity Commission (2005a, p. 185) and Hogan (2004) uses an annual 0.25 percent reduction in disability rates. This study also uses the 0.25 percent reduction in rates. Aged care is nearly all used on those over 70. Therefore, a simplifying assumption is made that aged care is evenly divided amongst those over this age. The average expenditure per person over 70 is found using the GFS and ERP. The average expenditure figure is indexed by labour productivity minus the reduction in disability rate. The indexed average expenditure figures in conjunction with Series B are used to produce expenditure projections.

A.7.3 Carers

The Productivity Commission (2005a, p. 188) notes that the carers of the disabled receive two forms of payment: carers payment indexed by the ATMWE and means tested; and carers allowance indexed by the CPI and not means tested.

The Steering Committee for the Review of Government Service Provision (SCRGSP 2005, p. 13.7, Box 13.4) cites unpublished Department of Family and Community Services (FaCS) data noting carers payments totalled $921 million with 84,100 recipients and carers allowance totalled $965 million with 315 100 recipients. The monetary amounts are for the period 2003-04 and the recipient number as at the 30 June 2004. Calculations provided averages for each payment. The FaCS (2001, p. 32, table 2.5.3) 'Characteristics of recipients of Carer Payment, 1989 to 1999' is used to create an age-sex profile for carer payments and allowances. The age-sex profile, average payment, and Series B are used to project carers' payments and allowances.

A.7.4 Education

Expenditure projections for education are derived by calculating the average government expenditure per student by age and developing participation rate projections by age then multiplying these by Series B.

The model uses average government expenditure per student by tertiary or school level. The participation rate age groups are, 5 and below, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15-19, 20-24, 25-34, 35-44, 45-54, and 55-64. The 5-14 year group covers pre-year 1, primary, and some secondary school, the 15-19 year group covers the transition from secondary to tertiary, and the 20-64 year groups are tertiary. The calculation for average government expenditure for the tertiary and school levels follows. These calculations also allocate expenditure by percentage to the state or Commonwealth levels.

School Level – Average Expenditure per School Student

ABS (2005b, p. 12, table 6) School shows that the total number of school students in 2004 is 3,385,402 including part-time students and those over 20. Two simplifying assumption are made. First, those over 20 are included in the age group 15-19 as the numbers older than 20 are small. Second, part-time students are treated equally to full-time students on the assumption that the part-time to full-time ratio stays constant and/or cost per part-time to full-time student does not differ greatly.

ABS (2005c, pp. 41,2, tables 31 & 32) government education expenditure categories – ‘primary and secondary’ and ‘Other’ (on a pro-rata basis) – are summed to produce the total government expenditure on schools. The average government expenditure per school student is produced by dividing the total school government expenditure by the total number of school students.

Tertiary Level – Average Expenditure per Tertiary Student

The total number of tertiary students is calculate from ABS (2004g, p. 7 , table 1) Education and Work ‘Persons enrolled in a course of study 15-64 years old’. The persons enrolled in Years 12, 11, 10, and below are subtracted from the total persons enrolled leaving only those enrolled at tertiary level. A small adjustment is made to make the ABS (2004g, p. 7, table 1) Education and Work figures balance with the ABS (2005b, p. 12, table 6) School figures for those enrolled aged 15-19 and attending Years 12, 11, 10 and below.

The total tertiary government expenditure is found by summing the ABS (2005c, p. 41, table 31) government education expenditure categories: university; ‘Technical and further education’; ‘Other tertiary’; and ‘Other’ (on a pro-rata basis). The average government expenditure per tertiary student is the total tertiary government expenditure divided by the total number of tertiary students.

Student Participation Rate Projections for Ages 5-14

ABS (2005d, tables 41 & 42) School tabulates the number of school students enrolled by sex and age in 2004. The participation rates of students age 6-14 are between 98% and 100%. A simplifying assumption is made that these participation rates will continue.

Student Participation Rate Projections for Ages 15-64

ABS (2004g, p. 8, table 2) Education and Work tabulates all persons enrolled in a course of study by age groups and sex from 1994 to 2004. The age groups used are 15-19, 20-24, 35-44, 45-54, and 55-64. The different sex age group's participation rates show a long-term increasing trend but this has been disrupted since 2002 making any long-term trend participation rates projections uncertain. So the 2004 participation rates are used in the projection. The age group 15-19 contains both tertiary and school level students so a participation rate for the school and tertiary levels is calculated on a pro-rata basis.

A.7.5 Age and Service Pensions

The 'Age and service pensions' (ASP) are paid by the FaCS and the Department of Veteran Affairs (DVA) respectively. FaCS (2004, sec. 3.4) notes that the age pension is a payment for people of pension age who cannot support themselves fully in retirement. Pension age is currently 65 for men and 62.5 for women. The qualifying age for women is being progressively raised to 65 and will reach 65 by 2014. This study models ASP projection by taking an expenditure and revenue compensating approach. The Treasury (2002, p. 83) and Productivity Commission (2005a, p. 198) both use the Treasury (1992) Retirement Income Model (TRIM) which takes an expenditure only approach. The TRIM does not calculate the loss in government revenue from the tax-breaks given to individuals for voluntary superannuation contributions or from the low marginal tax rates on those contributions already in superannuation funds. The TRIM group projects fewer individuals claiming full age and service persons and more partial claimants (Mitchell & O'Quinn 1997). It does not consider the loss in government revenue. This study models the NOB so both revenue and expenditure must be considered. It should be remembered that the simplifying assumption is made that all males over 65 and females over 62.5 receive an equal share of the total current ASP expenditure. FaCS (2004, sec. 3.4, table 60) notes that the actual expenditure on age pension in 2003-04 is $19,540,401,000. The DVA (2004, p. 84, table 20) puts the actual administered expenses for 2003-04 at $3,897,866,000 including third party payments. The Productivity Commission (2005a, p. 192) notes that the service and widows pensions actual expenditure for 2003-04 was $3,800,000,000. An average payment per retiree is calculated using the ERP. The ASP are indexed to the ATMWE so the payment is indexed to the LPGR. Series B is then used to create the ASP projections.

A.7.6 Family Tax Benefit

The Family Tax Benefit (FTB) comes in two parts A and B. FaCS (2004, pp. 22-3) notes that FTB A helps families with the cost of raising dependent children. It is paid to families for children up to 21 years of age and for young people between ages 21 and 24 who are studying full-time (and not receiving Youth Allowance or a similar payment). Additionally, FTB B provides extra assistance to families with only one main income-earner, including sole parents. It is paid to families for children under 16 years old and for children between the ages 16 and 18 studying full-time. The Productivity Commission (2005c) notes that FTB A is indexed to wage growth and FTB B is indexed to the CPI. How this model handles wage and CPI indexation was covered earlier.

FaCS (2004 sec. 1.1, tables 2 & 5) provides the actual expenditure on FTB in 2003-04 and the number of recipients of FTB assisted fortnightly as at 25 June 2004. The information is used to find the average FTB A and B payment per person aged 0-24 and 0-18 respectively. The differences to the generic method covered earlier are as follows: the limited age range 0-24; the FTB A using CPI indexing; the FTB B using ATMWE indexing; and the projected expenditure not based on a trend analysis.

A.7.7 Disability Support Pension

FaCS (2004 sec. 3.2, tables 50) provides the actual expenditure on Disability Support Pensions (DSP) in 2003-04 and the number of recipients. The ABS (2004h, p. 5, table 1) notes that if the 1998 disability figures were modified to the 2003 population age structure then the probability of disability is a constant 19.1% for both years. This observation makes using constant probability of disability by age for projections a plausible assumption. FaCS (2001, p. 11, table 2.4.1) 'Characteristics of Disability Support, June 1989 to 1999' provides the numbers of recipients by sex and age. This is used with the ERP in 1999 to calculate a probability of recipient age sex profile. The probability profile is multiplied by the ERP in 2004. The product is then scaled to equal the total number of recipients in 2004. This scaled table is multiplied by the average DSP to produce a table of expenditure by sex and age, which is divided by the ERP in 2004 to provide an average expenditure per capita by sex and age. There are two differences between the DSP and generic projection methodologies. DSP has no trend analysis and is indexed to the ATMWE.

A.7.8 Unemployment allowances

The Productivity Commission (2005a, p. 193) notes that unemployment allowances are difficult to measure as there is a the range of allowances available. The main payments are 'New start allowance', 'Youth allowance', and 'Mature age allowance'. FaCS (2004, sec. 1.2) observes that comparing income and support data with ABS data presents definitional problems, and there are differences in the applicable published age cohorts. Thus an aggregate approach to unemployment is adopted. FaCS (2003, pp. 29-44) notes that nearly all the 'Mature age allowance' is paid to persons aged 60-64. The 'Youth allowance' and 'New start allowance' have a tapering overlap. The bulk of the 'Youth allowance' goes to the group aged 16-20 then there is a tapering off until 24. The bulk of 'New start allowance' goes to persons aged 18-59. A simplifying assumption is made that the allowances match the age groups as follows: youth 15-19; new start 20-59; and mature age 60-64. This assumption is made as these age groups approximate the allowance data and fit the unemployment rate projection tables from Appendix (A.4) used to project the labour supply. The June 2004 FaCS (2004, secs. 1.2 & 3.1, tables 7 & 48) 'Aggregate expenditure for youth, new start, and mature age allowances' are divided by the number of unemployed persons for the age groups 15-19, 20-59, and 60-64. The number of unemployed persons in each group is derived form the tables described in Appendix (A.4). These average expenditures per age group are then used to create a projection of unemployment expenditure with the unemployment rate projection from Appendix (A.4) and Series B.

The differences to the generic method covered earlier are, the unemployment allowance is indexed to the CPI, and projected expenditure is based upon a trend analysis.

A.7.9 Parenting Payment Single

The parenting payment single (PPS) is a payment made to single parents with insufficient income. The ABS (2004i, pp. 64-77) 'Household and Family Projections Series II' (Series II) projects the number of single parent households by age and sex, for the years 2001, 2006, 2011, 216, 2021, and 2026. The ABS (2004i, p. 6) notes Series I, II, and III are low high, medium, and high projections and based upon Series B, this study's baseline population projection. The reason for using Series II is that it is the most likely projection.

Series B and Series II with interpolations are used to create probability densities for each age sex group from 2005 to 2026. Then the 2026 probability densities are used for the remainders of the projection out to 2051. Series B is multiplied by the probability density to give the projected number of single parents.

The FaCS (2004, sec. 3.1, table 41) provides the combined total expenditure on Parenting Payments (Partnered and Single). The responsibility for PPS has swapped from the FaCS to the Department of Employment and Workplace Relations (DEWR) in January 2005. There was uncertainty over who could or should supply the exact PPS total actual expenditure so a weighted average is used to estimate the total expenditure on PPS. This estimate is divided by the total number of single parents in 2004 to find an average. The average is then multiplied by the projected number of single parent to provide projections of the expenditure.

The differences to the generic method covered earlier are, the PPS is indexed to the ATMWE, and projected number of single parents is based upon the trend analysis in Series II.

A.8 Other Government Expenditure

This model uses 'Other government expenditure' to balance and calibrate the initial year 2004 with the ABS (2005c, p. 41, table 31) GFS. 'Other government expenditure' covers any government expenditure not explicitly modelled and is generally government expenditure that is not sensitive to population ageing. This includes everything other than the age sensitive components of education, health, and 'Social security and welfare'.

'Other government expenditure' in 2004 is the difference between the GFS total government expenses and the sum of all the age sensitive social outlays in Appendix (A.7). This ensures the model balances with the GFS in 2004. The 2004 'Other government expenditure' as a percentage of GDP is calculated. This percentage of GDP is used to calculate 'Other government expenditure' in monetary terms from 2005 to 2051.

B. Baseline Comparison

B.1 Introduction

This study's baseline projection is compared with the baseline projections from the Treasury (2002), the Productivity Commission (2005a), and Guest and McDonald (2000). The comparison establishes how suitable this study's model is for sensitivity analysis. Significant differences between this study's baseline and the other studies' baselines are highlighted. The following factors limit the comparison between the baseline from this study and the other studies. This study uses the following categories health, education, aged care, 'Age and service pensions' (ASP), unemployment allowance, disability support payment (DSP), family tax benefit (FTB), and parenting payment single (PPS). These categories match those of the Productivity Commission (2005a) and Treasury (2002) but not Guest and McDonald (2000) who use the categories education, health, and 'Social security and welfare' (SS&W). The difference in categories only allows for a partial comparison with Guest and McDonald (2000). This study's baseline contains projections for both the state and Commonwealth levels of government. However the Treasury's (2002) focus is on the Commonwealth government, Guest and McDonald's (2000) focus is on 'All levels of government', and the Productivity Commission (2005a) provides coverage of both the Commonwealth and state governments but tend to focus on 'All levels of government'.

The baseline comparison is made under the following subsections: population projections; GDP and growth; government social outlays; and fiscal pressure.

B.2 Population Projection

Table B.1 compares this study's population projections the ABS (2003b, tables 9a, 9b, and 9c) Series A (high), Series B (medium), and Series C (low) with the Productivity Commission's (2005b, pp. T1.14-5) population projections PC-H (high), PC-M (medium), and PC-L (low) population projections. The baseline projections for this study and the Productivity Commission (2005a) are the medium projections Series B and PC-M. The Productivity Commission (2005a, p. 7) have developed their own projections from more recent ABS data. The life expectancies in this study and the Productivity Commission (2005a) are the same in the equivalent population projections. It should be noted that the Productivity Commission's net overseas migration (NOM) and total fertility rate (TFR) are higher than this study's. The PC-M projects the TFR to increase from 1.75 to 1.8 in 2013 then stabilise. The PC-M projection for the NOM are at a constant 115,000 persons per year, PC-H projects the NOM at 115,000 rising to 140,000 in 2014-15 then staying constant, and PC-L projects the NOM at 115,000 decreasing to 90,000 then staying constant. This study and the Productivity Commission (2005a) use the same base year June 2004. Generally, the Productivity Commission's (2005a) TFR and NOM are higher than this study's.

Table B.1 Comparison of Population Projection Parameters

	TFR	**NOM**	**Life expectancy at birth (years)**		**2051**	**2101**
	Babies per woman	**Persons Thousand**	**Males**	**Females**	**million**	**million**
Series A	1.8	125	92.2	95.0	31.4	37.7
Series B	1.6	100	84.2	87.7	26.4	26.4
Series C	1.4	70	84.2	87.7	23.0	18.9
PC-H	1.75-→ 2.05	115 → 140	92.2	95.0	50.4	–
PC-M	1.75 → 1.8	115	84.2	87.7	36.6	–
PC-L	1.75 → 1.55	115 → 90	84.2	87.7	26.7	–

(Source: ABS 2002a, p. 1; Productivity Commission 2005a, p. 32; 2005b, T1.1-24)

The Treasury (2002) and Guest and McDonald (2000) use an earlier 1999 version of the ABS Population Projections.

The ABS (2003a, p. 31) notes the ABS (2003b) Population Projections are based on the 2002 ABS Estimated Resident Population (ERP). This study uses the 2004 ERP to calibrate the base year 2004 then the ABS (2003b) Population Projections from 2005 onwards. Consequently this study may exhibit a lack of smoothness between the base year 2004 and the projection year 2005.

These population projection variations may make the results between the models differ.

B.3 GDP and Government Revenue

Table B.2, Figure B.1 and Figure B.2 compare the projected percentage growth in GDP per capita between this study and the Productivity Commission (2005a).

Table B.2 Comparison of percentage growth in GDP per capita projections by decade

	Percentage Growth				
	2000s	2010s	2020s	2030s	2040s
Productivity Commission	1.95	1.46	1.27	1.50	1.61
This Study	1.98	1.55	1.28	1.43	1.57

(Source: Productivity Commission 2005a, p. 126, table 5.1)

This study starts with a slightly higher GDP per capita, reaches a minimum later, and recovers more slowly. This in part can be attributed to the differing population projections. The PC-M uses a higher TFR and NOM than Series B. Initially, more babies are predicted which decreases the GDP per capita. Later on when the babies mature, they enter the workforce which increases the GDP per capita.

Figure B.1 Projection of Percentage Growth in GDP per Capita

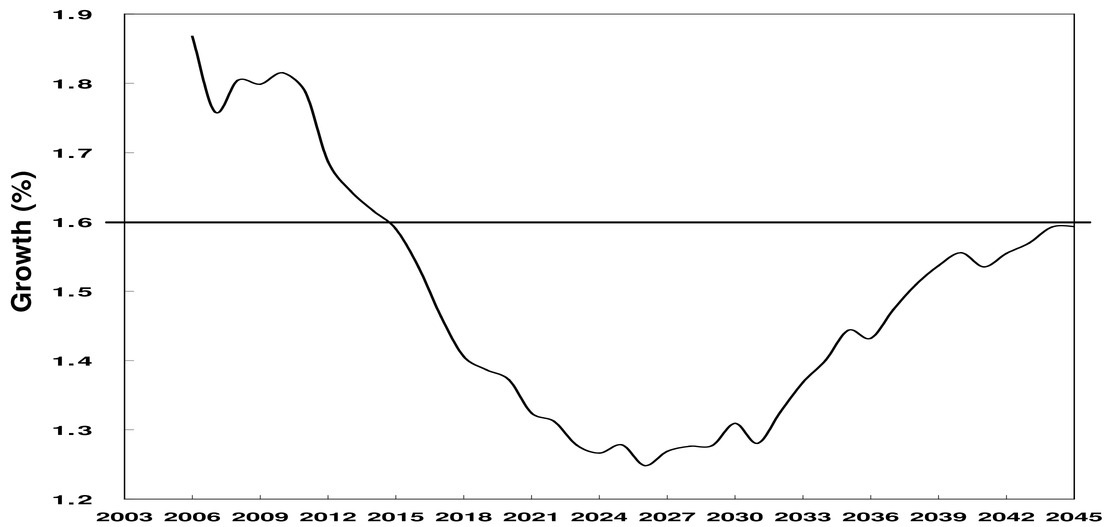
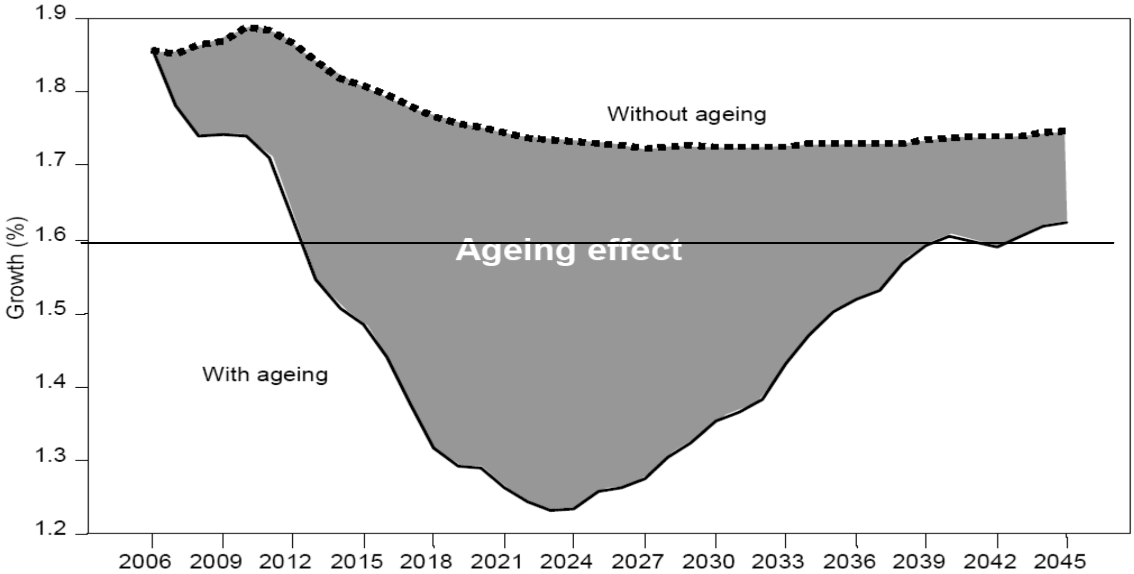


Figure B.2 Productivity Commission Projection of % Growth in GDP per Capita



(Source: Productivity Commission 2005a, p. 127, fig. 5.1)

B.4 Government Social Outlays and Fiscal Pressure

This study's baseline government social outlay projections as a percent of GDP are compared with the other three studies in the following subsections.

B.4.1 Comparison with Guest and McDonald (2000)

Table B.3 and Table B.4 compare this study's baseline with Guest and McDonald's (2000) baseline. The trends are all consistent – a decrease for education and increases for health and SS&W.

Table B.3 Projection of 'All levels of government' Social Outlays as a percentage of GDP

Year	2006	2011	2021	2031	2041	2051	Change
SS&W (not all)	8.0	8.1	9.0	10.4	11.3	11.7	3.7
Health	6.3	6.7	7.8	9.2	10.4	11.3	5.0
Education	5.2	5.0	4.6	4.5	4.5	4.4	–0.8
Total	19.6	19.8	21.5	24.1	26.2	27.5	7.9

Table B.4 Guest and McDonald Projection of 'All levels of government' Social Outlays (%GDP)

Year	2006	2011	2021	2031	2041	2051	Change
SS&W	10.5	10.9	12.4	13.8	14.6	15.0	4.5
Health	5.9	6.1	6.9	7.9	8.6	8.9	3.0
Education	4.4	4.2	4.1	4.1	4.1	4.1	–0.3
Total	20.7	21.2	23.4	25.9	27.3	28.0	7.2

(Source: Guest & McDonald 2000, pp. 54, table 3)

This study's 2006 values in Table B.3 differ from those in Table B.4, contributing reasons are. First, this study uses the ABS (2005c) government financial statistics (GFS) 2003-04 for calibration whereas Guest and McDonald (2000) use earlier data. Second, Guest and McDonald (2000) use an earlier version of Series B. Third, Table B.4 underestimates government social outlays as the GFS 2003-04 expenditure for SS&W, health, and education are \$86 706m (10.6%), \$51 588m (6.3%), and \$43 611m (5.4%) with GDP at \$813 225m.

There is 2.5 percent difference between the 2006 SS&W expenditure in Table B.4 and Table B.3. A contributing reason is this study allocates some SS&W expenditure to 'Other government expenditure' whereas Guest and McDonald (2000) include all SS&W expenditure. This study covers the following components of SS&W: ASP;

unemployment allowance; DSP; FTB; and PPS; carer's payment; carer's allowance; and residential care.

The change in health from 2006 to 2051 in Table B.3 and Table B.4 is 5 percent and 3 percent. The large difference is, in part, because this study uses a real non-demographic growth in health expenditure whereas Guest and McDonald (2000) do not.

The baseline totals stay fairly close together and since the sensitivity analysis focus is on an aggregate this makes this study's baseline suitable for answering the research questions.

B.4.2 Comparison with the Productivity Commission (2005a)

Table B.5 and Table B.6 compare this study's base line with the Productivity Commission's (2005a) baseline for 'All levels of government' spending as a percentage of GDP. The trends are all consistent – decreases for education and 'Other social safety net' and increases for health, ASP, and 'Age care and carers'. The Productivity Commission's initial values in the base year 2003-04 are lower than this study's values. A contributing reason is this model using the GFS and the Productivity Commission's model using unpublished data from various government departments to produce expenditure figures for only the age sensitive portion of each government social outlay.

Table B.5 and Table B.6 health care figures show the same increase but this study has higher 2003-4 and 2044-45 values. The higher initial starting value in this model is because this model uses the GFS figures and the Productivity Commission (2005a) uses figures from the Department of Health and Ageing. The Productivity Commission

(2005a) uses unpublished data to isolate the most age sensitive component of health expenditure. This model assumes the whole GFS health expenditure as sensitive to ageing so consequently has a higher initial value and a greater 2044-45 figure.

Table B.5 Projection of 'All Levels of Government' Spending as a percentage of GDP

Thesis	2003-04	2044-45	Increase
Health care	6.3	10.8	4.5
Age care & carers	1.2	2.2	1.1
Age and service pensions	2.9	5.9	3.0
Other social safety net	4.1	3.4	–0.7
Education	5.4	4.5	–0.9
Total	19.8	26.7	6.9

Table B.6 Productivity Commission Projection of 'All Levels of Government' Spending (%GDP)

	2003-04	2044-45	Increase
Health care	5.7	10.3	4.5
Age care & carers	1.1	2.4	1.4
Age and service pensions	2.9	4.6	1.7
Other social safety net	3.8	3.1	–0.6
Education	5.2	4.7	–0.5
Total	18.7	25.2	6.5

(Source: Productivity Commission 2005a, p. 307, table 13.1)

The ASP increases in Table B.5 and Table B.6 show the largest difference at 1.3 percent. The reason is that the Productivity Commission (2005a, p. 198) uses output from the Treasury's (1992) Retirement Income Model (TRIM) to form its own projects base upon its PC-M population projection. Table B.8 and Table B.6 show the Treasury (2002) and the Productivity Commission (2005a) projection results are the same. The Productivity Commission (2005a) notes its and the Treasury's (2002) projections of a low ASP expenditure is conditional on good global conditions giving good returns on superannuation investments, which in turn reduces ASP as they are means tested. Time and data constrains make emulating the TRIM beyond the scope of depth for this study.

Table B.5 and Table B.6 education increases show the second largest difference at 0.4 percent. Factors contributing to the difference include the following. The Productivity Commission's PC-M population projection has a higher TFR and NOM than this study's Series B population projection. This study uses the GFS and the Productivity Commission (2005a) uses the ABS School and the DEST University and VET data in their projection so creating differing initial balances and projections. Also, this study has no trend analysis for education, whereas the Productivity Commission (2005a) introduces trends for the following factors: increases in non-government schools enrolment (2005a, p. 210); increases in participation rates at tertiary institutions (2005a, p. 212); and changes in average student costs (2005a, pp. 215-17). Also, the Productivity Commission (2005a, p. 214) isolates higher education contribution scheme (HECS) payments and their effects on government expenditure. Finally, the Productivity Commission (2005a, p. 219) treats 'Other' expenditure differently by dividing the expenditure by the population under 30, then uses the average in the projection. This study divides 'Other' expenditure by each student, distributing the cost over different age groups thereby reducing the ageing effect in education. The differences taken together mean that this study has a higher initial 2004 balance and the modelling differs considerably. Therefore, the differing 2042 values are not unexpected.

The two baselines in Table B.5 and Table B.6 are fairly comparable making this study's baseline suitable for answering the research questions and sensitivity analysis.

B.4.3 Comparison with the Treasury (2002)

Table B.7 from this study and Table B.8 from Treasury (2002) compare Commonwealth demographic spending as a percentage of GDP. The Treasury's (2002) initial year is

2002 and this study's initial year is 2004 thereby accounting for some variability. The 'Increase' column in each table is the increase from the initial year to 2042. The increase column's signs are consistent, indicating the trends are all consistent.

Table B.7 Projection of Commonwealth Demographic Spending as a percentage of GDP

Category	2004	2007	2012	2022	2032	2042	Increase
Health and Aged Care	4.6	4.7	5.0	6.0	7.1	8.1	3.4
Education	1.6	1.6	1.5	1.4	1.4	1.4	–0.3
Age and Service Pensions	2.9	2.9	3.1	4.0	5.0	5.8	2.9
Family Tax Benefit (Part A and B)	1.6	1.5	1.4	1.3	1.2	1.2	–0.4
Disability Support Pension	1.0	1.0	1.1	1.1	1.1	1.1	0.1
Unemployment Allowances	0.9	0.8	0.7	0.6	0.5	0.4	–0.5
Parenting Payment (Single)	0.6	0.6	0.6	0.6	0.7	0.7	0.1
Total	13.2	13.2	13.5	15.0	16.9	18.6	5.3

Table B.8 Treasury Projection of Commonwealth Demographic Spending – percentage of GDP

Category	2002	2007	2012	2022	2032	2042	Increase
Health and Aged Care	4.7	4.8	5.1	6.2	7.9	9.9	5.2
Education	1.8	1.8	1.7	1.6	1.6	1.6	–0.2
Age and Service Pensions	2.9	2.8	2.9	3.6	4.3	4.6	1.7
Family Tax benefit (Part A and B)	1.6	1.3	1.2	1.1	1.0	0.9	–0.7
Disability Support Pension	0.9	0.7	0.8	0.8	0.9	0.9	0.0
Unemployment Allowances	0.8	0.8	0.7	0.6	0.5	0.4	–0.4
Parenting Payment (Single)	0.6	0.6	0.6	0.6	0.6	0.6	0.0
Total	13.3	12.8	13.0	14.5	16.8	18.9	5.6

(Source: Treasury 2002, p. 59, table 13)

Health and aged care has the largest difference between the increase in Table B.7 and the increase in Table B.8 at 1.8% of GDP. This in part is attributed to differing non-demographic health expenditure growth projection methods, and to differing health expenditure allocation between the state and Commonwealth levels of government.

ASP have the second largest difference between the increase in Table B.7 and the increase in Table B.8 at 1.2% of GDP. The Treasury (2002) and the Productivity Commission (2005a) both use the Treasury (1992) Retirement Income Model to produce their ASP projections. Comments on this topic were made in the previous subsection.

Family Tax Benefits (FTB) have the third largest difference between the increase in Table B.7 and the increase in Table B.8 at 0.3% of GDP. This study's FTB projection does not contain trend analysis unlike the Treasury's (2002) which accounts for some of the difference.

The total demographic spending as a percent of GDP for Table B.7 and Table B.8 is comparable making this study's suitable for baseline suitable for answering the research questions and sensitivity analysis.

B.4.3.1 Commonwealth and State Social Outlays

Figure B.3 from this study and Figure B.4 from the Treasury (2002) show the Commonwealth and state spending on social outlays as a percent of GDP. The figures demonstrate this study's starting values for state expenditure is about 2% higher. As with the Productivity Commission, the Treasury (2002) uses unpublished data from various government departments in making its projects. And the Treasury's (2002) projections are made from only the age sensitive part of government expenditure, so have lower initial starting values than the GFS values used in this study's baseline. Another consequence of the differing data sources is expenditure being attributed to the different levels of government. Figure B.4's state health and education spending is nearly a flat line which indicates the increase in health expenditure and the decrease in education expenditure are compensating in the Treasury (2002) model. Whereas, Figure B.3's rising state health and education line indicates the increase in health exceeding the decrease in education expenditure in this study.

Figure B.3 Projection of Commonwealth and State spending as a percentage of GDP

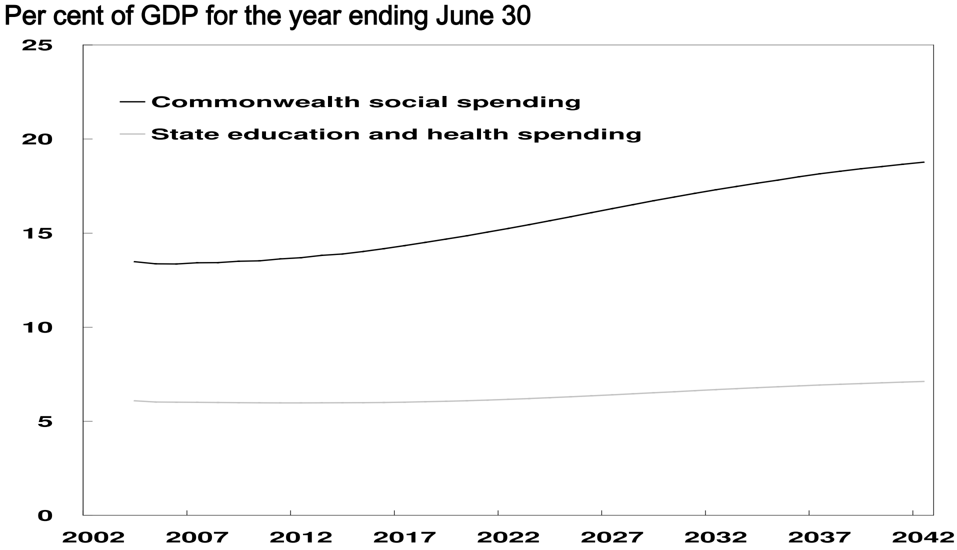
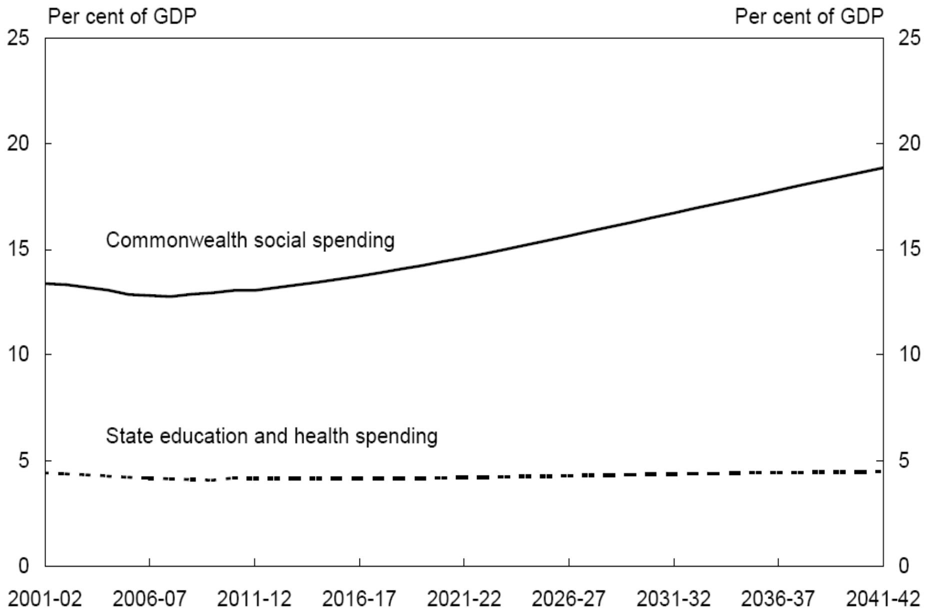


Figure B.4 Treasury Projection of Commonwealth and State spending as a percentage of GDP



(Source: Treasury 2002, p. 58, chart 31)

B.4.3.2 Fiscal pressure as a percentage of GDP

Figure B.5 from this study projects the Net Operating Balance (NOB) and Figure B.6 from Treasury (2002) projects the Fiscal Pressure for the Commonwealth. The figures' profiles are similar – a positive balances until 2017-2019 then a smooth transition to a negative balance of around 4.5-5% of GDP in June 2042. The differences include a

2002-03 start date for Treasury (2002), a 2003-04 start date for this study, and the derivation of the NOB and fiscal pressure.

Figure B.5 Projection of Commonwealth NOB as a percentage of GDP

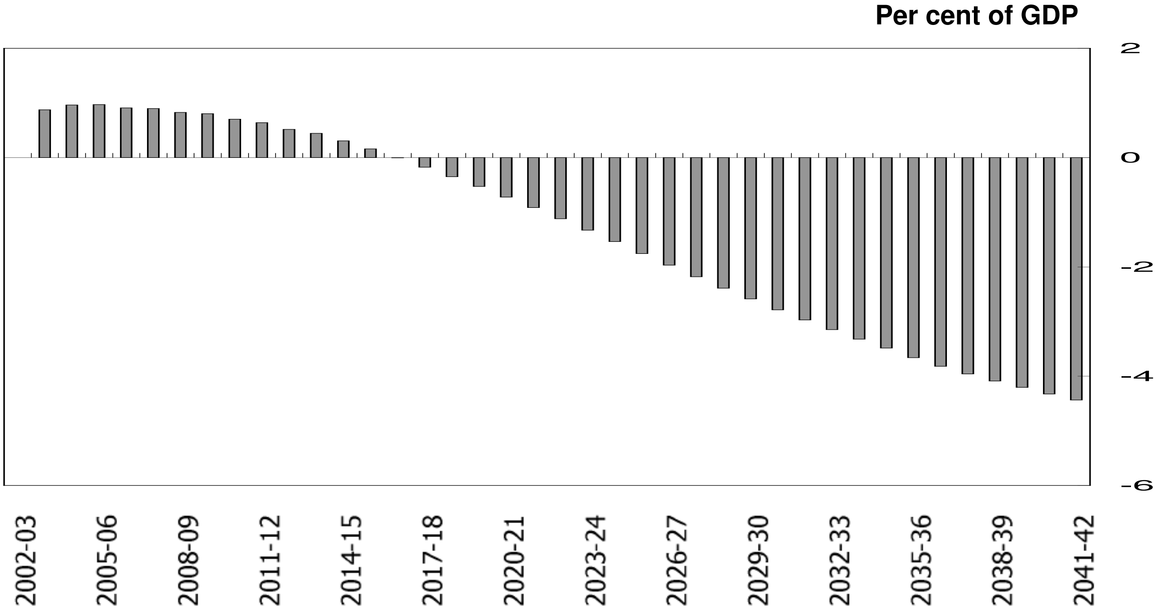
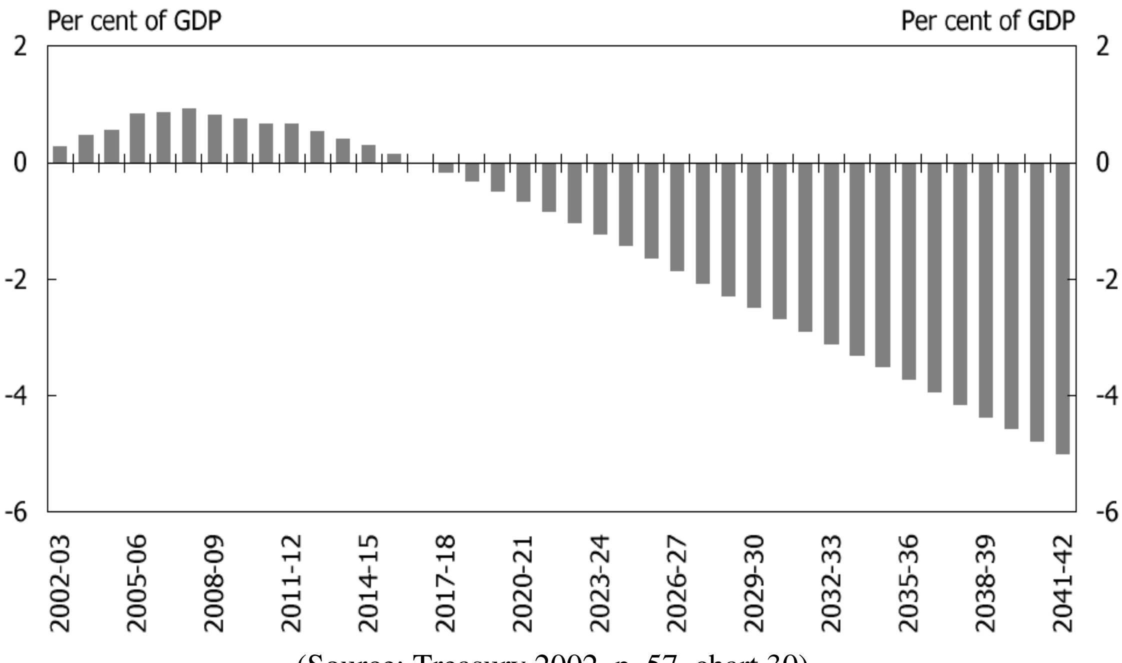


Figure B.6 Treasury Projection of Commonwealth Fiscal Pressure as percentage of GDP



(Source: Treasury 2002, p. 57, chart 30)

The Productivity Commission (2005a, p. 305) notes that the Treasury's (2002, p. 57) fiscal pressure projections of spending and revenue used to derive the fiscal gap do not include all sources of revenue or all types of expenditure. The underlying assumption is that all residual income sources stay fixed as a share of GDP, as do all residual spending items. Whereas this study's NOB projection does include projections for all revenues and expenditure albeit in aggregate form. The consequence of including all expenses is the maintenance of a comparable initial balance in this study's NOB with the Treasury's (2002) fiscal pressure.

Figure B.6's lack of smoothness up to 2013-14 is caused by the Treasury (2002) using forward estimates for budget surpluses. Figure B.5 lack of smoothness between 2003-04 and 2004-05 is caused in part by the switch from the ERP to Series B.

B.5 Conclusion

This study's baseline compares well with the other models at the Commonwealth and 'All levels of government'.

This study's baseline projects a decrease in NOB for the Commonwealth of 5.5 percent from 2003-04 to 2044-45. The Productivity Commission's (2005a, p. 308) fiscal pressure projection is 5.7 percent over the same period.

This study's projects a negative NOB of 4.4 percent in 2041-42. The Treasury's (2002, p. 57) projects the gap between revenue and expenditure to grow to 5.0 percent in the same year.

This study's baseline projects a decrease in NOB for all states of 1.5 percent from 2003-04 to 2044-45. The Productivity Commission's (2005a, p. 308) fiscal pressure projection is 0.8 percent over the same period.

This study's baseline projects a decrease in NOB for 'All levels of government' of 6.9 percent from 2003-04 to 2044-45. The Productivity Commission's (2005a, p. 308) fiscal pressure projection is 6.5 percent over the same period.

This study's baseline for 'All levels of government' projects from 2005-06 a decrease in NOB of 6.6 percent in 2040-41 and of 7.9 percent in 2052-51. Guest and McDonald's (2000, p. 54) projects an increase in fiscal pressure of the same in 2040-41 and of 7.3 percent in 2052-51.

This study's projection is higher than Guest and McDonald's (2000) projection and lower than the Productivity Commission's (2005a) and the Treasury's (2002). This is caused in part by health premium above growth in real GDP per capita. Guest and McDonald (2000) effectively use a zero health premium. The Productivity Commission (2005a) use an additional PBS premium. Noteworthy is that the Treasury (2002) uses various real non-demographic growth rates for health expenditure. This study's baseline NOB projection appears comparable to the fiscal pressure projections of the Productivity Commission (2005a), the Treasury (2002), and Guest and McDonald (2000) so suitable for conducting sensitivity analysis and answering the research questions.

C. Discount Rate Sensitivity Analysis

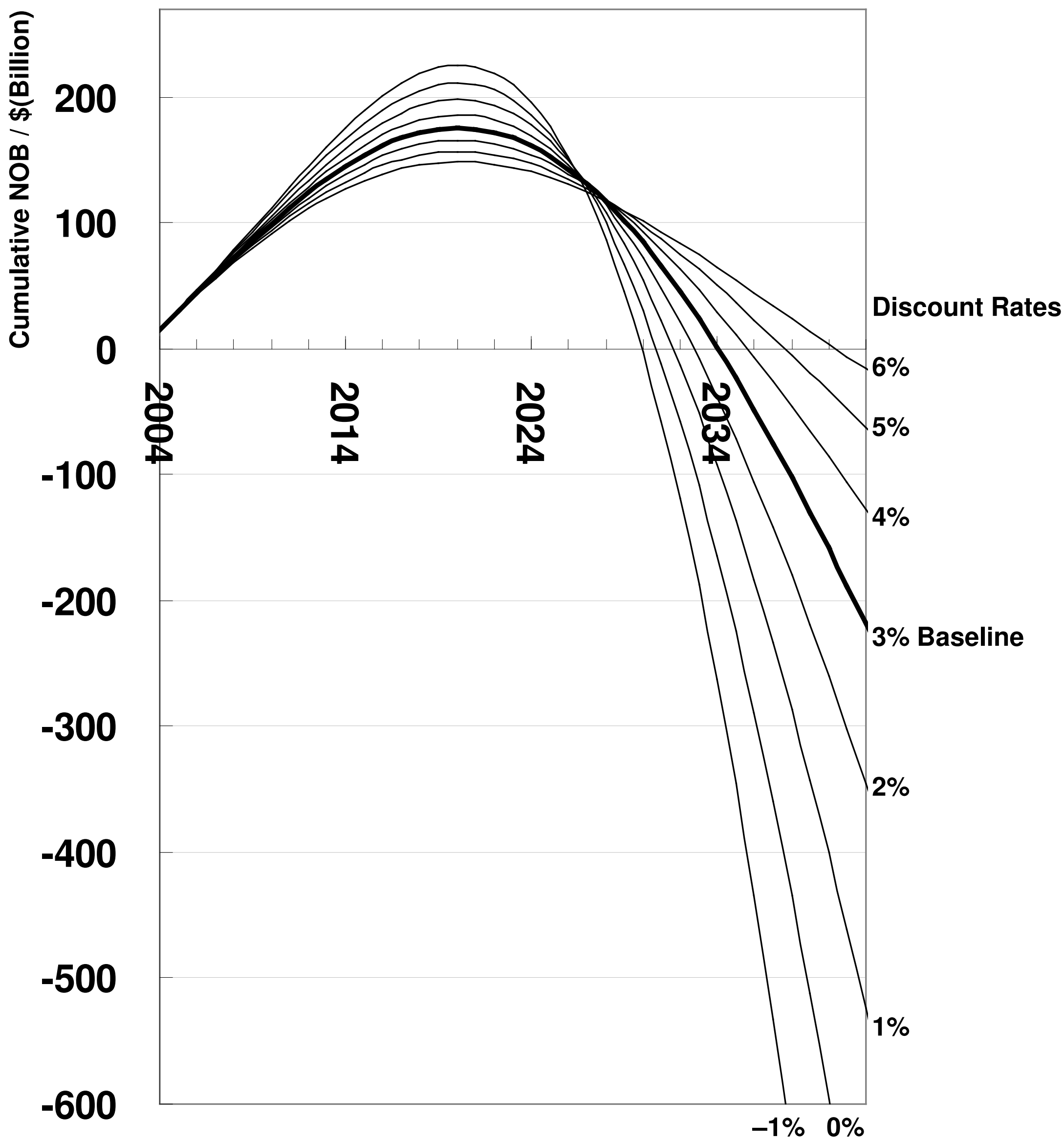
The research questions extensively use a sensitivity analysis method that requires a discount rate. The method is 'Change in time to achieve a negative cumulative net operating balance (NOB)' and is discussed in section (4.3.1). This method measures change in fiscal pressure. Appendix C justifies the choice of discount rate. Additionally it examines the effect of a change in the discount rate on the conclusions drawn from using the method.

The baseline discount rate is set at the real target cash rate of 3.0 percent which is a proxy for the real interest rate. The RBA (2005) has in August 2005 kept the cash target rate at 5.50 percent since 2 March 2005 and reports the CPI to June 2005 at 2.5 percent making a real target cash rate of 3.0 percent. Calculations on the RBA (2005, table G01) 'Measure of consumer price inflation' and the RBA (2005) 'Cash rate target' show the real target cash rate from 1993 to 2005 averaged 3.0 percent with a 1.4 percent standard deviation, a (–1.0) percent minimum, and a 5.3 percent maximum. This study assumes that the real interest rate will remain close to 3.0 percent in the future.

Figure C.1 shows the effect of varying the discount rate on the 'Time to achieve a negative cumulative NOB'. Increasing (decreasing) the discount rate to 6.0 (–1.0) percent from the baseline 3.0 percent increases (decreases) the time to achieve a negative NOB by 6 (4) years from the baseline year 2034. The higher the discount rate the longer the time is to a negative cumulative NOB. The standard deviation of the discount rate indicates the standard deviation of the baseline is less than 2 to 3 years given it is a cumulative sum.

The effect of varying the discount rate is accommodated as the model compares projections by their **change** in time to achieve a negative cumulative NOB. This change in time is relative to the baseline year and is essentially preserved between projections using different discount rates. This ensures derived conclusions are valid across a number of discount rates. The main effect of a change in the discount rate is to change the baseline's time to achieve a negative cumulative NOB.

Figure C.1 Cumulative NOB at various Discount Rates



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