4 Economic effects of population growth and ageing in Australia

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4.1 Introduction

Population ageing is a worldwide demographic phenomenon that has resulted from changes in fertility and mortality. Australia, like other developed countries, has been experiencing ageing of its population, with mortality and fertility rates falling over the past three decades. Furthermore, population ageing in Australia is expected to accelerate in the next few decades, reducing population growth and having vast implications for people's economic behaviour and for the economy as a whole.

In this chapter we outline past and future demographic trends in Australia, concentrating on the recent and projected changes in fertility, mortality and immigration rates. We then discuss the economic and fiscal effects of population ageing in reference to related literature and present some preliminary long-run macroeconomic and fiscal results for the effects of ageing in Australia using a computable dynamic model. Finally, we offer some concluding remarks.

4.2 Recent trends and future demographic projections

In this section we report the recent and future trends in mortality, fertility and net immigration rates and document the past and projected future size and age distribution of Australia's population.

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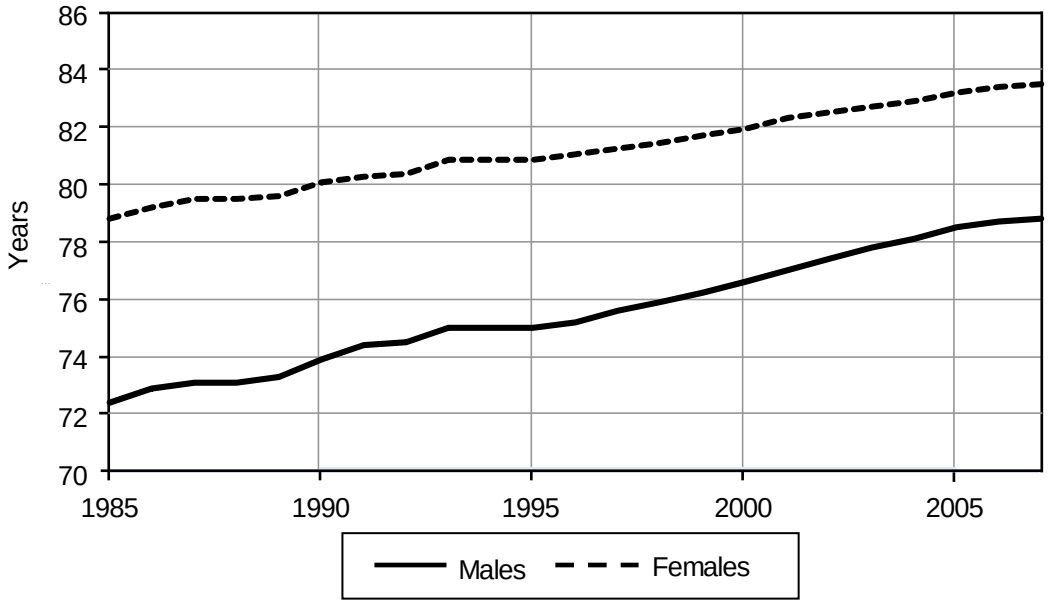
Mortality rates

Average mortality rates in Australia have been falling significantly over the past century. In the past 30 years, the standardised death rate has almost halved, falling from 12.7 deaths per 1000 population in 1971 to 6.4 in 2001 (Productivity Commission 2005). There has been a substantial reduction in the likelihood of death for all ages, with significant improvements in infant mortality. The major cause of the falling mortality rates in the first half of the last century was the improvement in living conditions, while lower death rates over the past 40 years have been attributed to advances in the medical research.

The decline in mortality rates has led to higher life expectancy, which has increased by over 30 years since the 1880s. As shown in figure 4.1, life expectancy at birth increased by 6.6 years to 78.7 years for males and by 4.7 years to 83.5 years for females during the period 1985 to 2007 (ABS 2008). Moreover, the improvement in life expectancy has been greatest at older ages; the life expectancy of males (females) aged 80 years increased by 31 per cent (24 per cent) to 8.22 (9.95) years between 1985 and 2007, whereas life expectancy at birth for males (females) increased by just 9.2 per cent (6 per cent).

Figure 4.1 **Life expectancy at birth from 1985 to 2007**



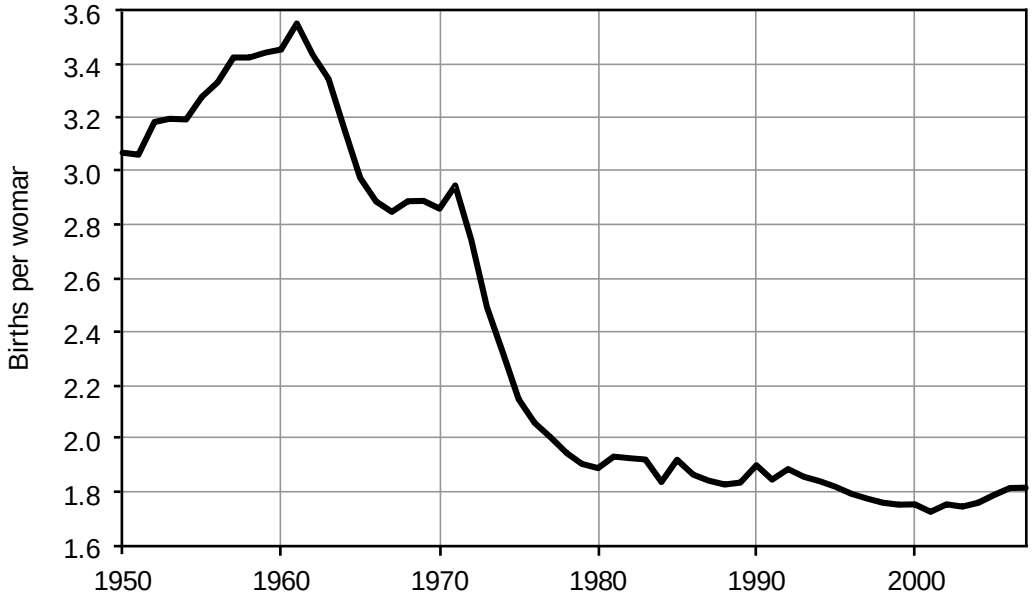
Mortality rates are expected to continue to fall. The Productivity Commission's MoDEM 2.0 demographic model, documented in Cuxson et al. (2008), provides age- and sex-specific mortality rates from 2008 to 2053 for low, medium and high

survival scenarios. Under all three scenarios, mortality rates are assumed to decline, implying higher life expectancy; under the medium survival scenario, life expectancy at birth is projected to increase to 88.2 years for males and to 90.8 years for females by 2053.

Fertility rates

Total fertility rates have been falling since the early 1960s because of medical progress (for example, the availability of the oral contraceptive pill) and increases in labour force participation by women. As depicted in figure 4.2, the total fertility rate (TFR) reached a peak of almost 3.6 births per woman in 1961, after which there were sharp falls until the late 1970s. Since then, TFRs have continued to fall, reaching about 1.8 births per woman in 2007 (ABS 2008). The general view is that fertility rates will continue to decline, despite the recent small revival in rates. MoDEM 2.0's medium scenario has TFRs declining from 1.8 babies per woman in 2007 to 1.7 by 2018, thereafter remaining constant.

Figure 4.2 **Total fertility rates from 1950 to 2007**



Migration

Australia has been experiencing a strong inflow of migrants since World War II, the net inflow being 184 400 in 2007 (ABS 2008). The potential impact of migration is to mitigate population ageing in Australia, since the age distribution of immigrants

is skewed towards the young. In 2002, most net immigrants were aged between 20 and 30 years, and the share of immigrants over 50 years of age was relatively small (Productivity Commission 2005). The Productivity Commission (2005) reports that, had there been zero net migration after 1944, the aged dependency ratio would have been only several percentage points higher in 2004 but would be around 9 percentage points higher than otherwise by 2045.

The population projections by the Productivity Commission's MoDEM 2.0 assume low, medium and high scenarios for net overseas immigrants, with annual net immigration of 117 000 people for the low, 177 000 for the medium and 237 000 for the high scenarios.

Population size and age structure

Table 4.1 shows Australia's population and annual population growth in selected years over the period 1901 to 2007, by which year the population reached 21.02 million. Since 1901, Australia's population has increased by over 17 million, mainly because of a natural increase which accounted for about two-thirds of the total growth during that period. Net overseas migration has contributed about one-third of the total growth since 1901. In 2007, the total annual growth rate of 1.53 per cent consisted of a natural growth rate of 0.67 per cent, the remaining 0.86 per cent being contributed by net overseas migration (ABS 2008).

Table 4.1 **Australia's resident population in selected years**

Year	*Population (mil)*	*Annual increase (%)*
1901	3.79	
1923	5.69	1.87
1943	7.23	1.21
1963	10.95	2.09
1983	15.39	1.72
2000	19.15	1.29
2001	19.41	1.36
2002	19.65	1.23
2003	19.90	1.24
2004	20.13	1.17
2005	20.39	1.33
2006	20.70	1.49
2007	21.02	1.53

Note: Percentage annual increases from 1901 to 2000 are calculated as compound population growth rates in each of the selected periods.
Source: ABS (2008)

The age distribution of Australia's population has also changed significantly since the beginning of the last century. Table 4.2 reports that the share of children aged 0 to 14 years decreased by 15.7 percentage points between 1901 and 2007, but the proportion of the people aged 65 years and over increased from 4.1 per cent in 1901 to 13.1 per cent in 2007. The last row of the table shows the median age of the population, which increased by 14.3 years between 1901 and 2007.

Table 4.2 **Age and sex distribution of Australia's resident population**

	1901			*2007*		
	Males	*Females*	*Persons*	*Males*	*Females*	*Persons*
Age distribution (%)	%	%	%	%	%	%
0 – 14 years	17.8	17.4	35.1	9.9	9.4	19.4
15 – 64 years	32.2	28.4	60.7	33.8	33.7	67.4
65 – 84 years	2.2	1.7	3.9	5.4	6.1	11.5
85 years and over	0.1	0.1	0.2	0.5	1.1	1.6
Total	**52.3**	**47.6**	**100.0**	**49.7**	**50.3**	**100.0**
Median age (years)	23.6	21.5	22.5	36.1	37.6	36.8

Source: ABS (2008)

Population projections are based on the current age distribution of the population and the forecast of future fertility, mortality and immigration rates using deterministic or stochastic (Alho and Spencer 2005) forecast models. MoDEM 2.0 assumes low, medium and high deterministic scenarios for these vital rates. Using these, we construct the following three population scenarios.

- Low population scenario with (i) the total fertility rate decreasing from 1.8 to 1.5 babies per woman by 2018, (ii) net annual immigration of 117 000 people and (iii) the implied life expectancy at birth increasing from 78.9 years in 2007 to 88.2 years by 2053 for males and from 83.7 years to 90.8 years for females.
- Medium scenario with (i) the total fertility rate decreasing to 1.7 babies per woman by 2018, (ii) net annual immigration of 177 000 people and (iii) the implied life expectancy at birth increasing to 88.2 years by 2053 for males and to 90.8 years for females.
- High scenario with (i) the total fertility rate increasing to 1.9 babies per woman by 2018, (ii) net annual immigration of 237 000 people and (iii) life expectancy at birth increasing to 93.8 years for males and to 95.8 years for females by 2053.

Table 4.3 shows the actual size and age structure of the Australian population in 2007 and the projected size and age structure in 2030 and 2053 based on the three population scenarios. Under each scenario, population increases — rising least in the low scenario and most in the high scenario. Under the medium population

scenario, the population increases by over 12.8 million people between 2007 and 2053.

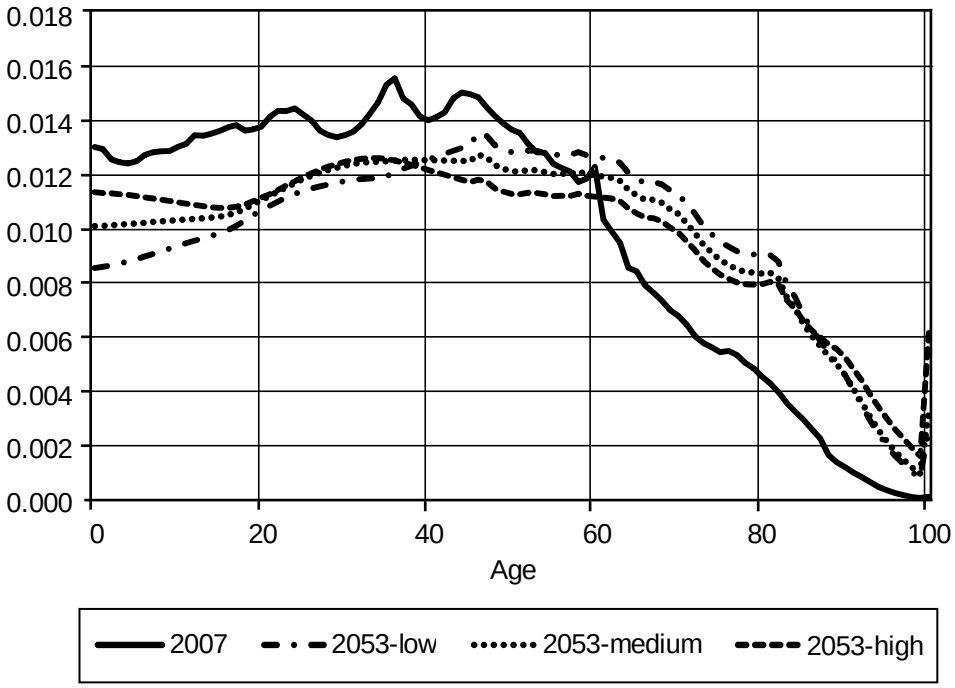
Population ageing between 2007 and 2053 is clearly demonstrated under each population scenario. Under the medium population scenario, the share of the population aged 65 years or over increases from about 13 per cent in 2007 to over 24 per cent. Moreover, the population share for those aged 85 years or over increases from only 1.64 per cent to 5.8 per cent. In contrast, the 15–64 year cohort share declines by about 7 percentage points. Consequently, the aged dependency ratio increases from 19.5 per cent in 2007 to over 40 per cent in 2053. Similar aged dependency ratios are projected for the other scenarios.

Table 4.3 **Population projections for Australia with MoDEM 2.0**

	Low scenario			*Medium scenario*			*High scenario*		
	2007	*2030*	*2053*	*2007*	*2030*	*2053*	*2007*	*2030*	*2053*
Population (million)	21.20	25.52	28.20	21.20	27.97	34.07	21.20	30.74	41.16
Age distribution	%	%	%	%	%	%	%	%	%
0 – 14 years	19.39	15.18	13.70	19.39	16.87	15.41	19.39	18.34	16.72
15 – 64 years	67.45	63.86	60.58	67.45	63.10	60.14	67.45	61.92	58.58
65 years and over	13.16	20.96	25.72	13.16	20.02	24.45	13.16	19.73	24.70
85 years and over	1.64	2.87	5.68	1.64	2.85	5.75	1.64	3.13	6.89
Dependency ratios	%	%	%	%	%	%	%	%	%
Youth (0 – 14/15 – 64)	28.75	23.76	22.61	28.75	26.74	25.63	28.75	29.62	28.55
Aged (65+/15 – 64)	19.51	32.82	42.45	19.51	31.73	40.66	19.51	31.87	42.17
Total (Youth + Aged)	48.26	56.58	65.06	48.26	58.47	66.29	48.26	61.49	70.72
Median age (years)	36	41	45	36	40	43	36	39	42

Figure 4.3 depicts the age cohort population shares in 2007 and the projected cohort shares in 2053 generated by the MoDEM's low, medium and high population scenarios. Under all three projection scenarios, the proportion of the population at ages less than 50 years is projected to fall, while the shares of cohorts older than about 60 years are projected to be larger in 2053.

Figure 4.3 **Cohort shares derived from MoDEM 2.0**



4.3 Some economic effects of ageing

Population ageing experienced in the developed world is expected to affect the behaviour of people and businesses, and to have vast macroeconomic and fiscal implications. Here, we outline methodological frameworks applied to analyse the economic implications of ageing and briefly discuss some of the literature. Research on the economic implications of ageing yields controversial results, suggesting that ageing effects are likely to vary across countries of different size and across different fiscal and social security systems.

The 'standard' models used to analyse population ageing issues embody dynamics and general equilibrium. An essential feature of the overlapping generations (OLG) type of model is the assumed life-cycle behaviour of households, whereby households face longevity risk and choose their labour supply and consumption (hence savings and retirement age) over their complete lifetime to maximise their expected lifetime welfare. A second essential feature is the government budget constraint that requires expenditures on the age pension and other government programs to be matched by taxes. A third feature is that markets clear every period and that the economy evolves through time via capital accumulation and population growth.

Analysts use this framework to determine the effects of population ageing on household behaviour, general equilibrium effects (for example, on wages, employment and capital formation) and the fiscal effects on government expenditures and revenue. We now briefly review some literature to give a flavour of potential implications; many of these positions depend on the source of population ageing and provide little consensus.

Changes in fertility rates

How do changes in fertility rates affect the government budget, savings, living standards and growth rates? There are no clear answers.

Fehr et al. (2008) argue that whether the short-run fiscal savings on child-specific government outlays exceed the long-run fiscal costs is country specific, as fiscal systems are quite different across countries. For example, Guest and McDonald (2000) find that greater social expenditures by the Australian Government arising from low fertility rates would not occur until after 2040, with minimal increases in taxation. On the other hand, simulations of lower fertility rates in Europe and Japan by Fehr et al. (2008) result in lower labour supply and generate significant increases in social security tax rates for the two world regions.

Guest and McDonald (2002) and Guest (2006) find that lower fertility rates yield higher future living standards in Australia, while the empirical results of Hondroyiannis and Papapetrou (2005) suggest that an increase in fertility is associated with higher output per capita in their sample of eight European countries.

Kulish et al. (2010) find that lower fertility generates a higher capital labour ratio (that is, capital deepening) using a model abstracting from taxation. The ageing effect on capital deepening simulated by models with a government sector is more subdued because of the increased tax and social security contribution rates required to balance government budgets (Auerbach et al. 1989; Miles 1999; De Nardi et al. 1999; Fehr 2000). Kotlikoff et al. (2007) even find capital shallowing, reflecting significant increases in payroll and income tax rates. Similar results are simulated by the multiregional demographic OLG model developed by Fehr et al. (2004, 2008).

Lower mortality rates and higher longevity

There is considerable certainty among demographers that survival rates will improve and life expectancy will increase in the future. Increased longevity means higher benefit payments to current and future elderly citizens, increasing fiscal and

social security burdens. On the other hand, lifespan extension should induce higher labour supply, delayed retirement and greater saving to better fund a longer retirement (Bloom et al. 2003 provide empirical evidence).

The simulation of the extended household lifespan by Kulish et al. (2010) generates larger household savings, capital deepening and higher real wages, but the effect on work hours is almost unchanged. Fehr et al. (2008) simulate projected increases in life expectancies in the United States, Europe and Japan and show that greater longevity increases labour supply and capital stock, while social security contribution rates increase significantly due to a higher aged dependency ratio hindering capital accumulation and causing capital shallowing.

Changes in immigration rates

Higher immigration of young and skilled workers is often seen as a way to mitigate the negative economic effects of ageing on the government budget because they will work and accumulate capital, increasing tax revenues. However, since some (especially older) immigrants will also collect social security and public health benefits, the fiscal and economic effects of immigration will depend on the age of immigrants and the size of the economy.

Guest and McDonald (2000, 2001) show that the fiscal and economic effects of higher net immigration are significantly positive for a small open economy like Australia (reduced immigration would yield a significantly lower rate of growth of living standards and higher social security and health outlays). They argue that immigration mitigates the effects of population ageing, as the Australian immigrants are heavily concentrated in the 15–35 year age group. However, the effects of higher immigration are far less significant for a large economy, as shown by Fehr et al. (2004) for the United States; even a significant increase in skilled immigration will do little to alter capital shortages, tax hikes and wage falls caused by population ageing.

Innovation and technology improvements

There are several arguments supporting negative effects of ageing on labour productivity. First, older workers are less educated, less trained and less healthy than their younger contemporaries. Older workers also tend to be less creative, innovative and less entrepreneurial, mainly due to their high risk aversion. Second, lower population growth makes innovation less profitable by reducing the gains from economies of scale through the spreading of fixed costs (Cutler et al. 1990). On the other hand, ageing may positively affect labour productivity, as a higher

relative price of labour driven by lower population growth provides incentives to innovate through capital investment.

Retirement policy reactions

Governments may alter the retirement policy settings to mitigate the effects of population ageing. Guest and McDonald (2000) find that an increase in the Australian retirement age from 65 to 70 years increases GDP and reduces government outlays. Pension reforms (both parametric and systemic) have been analysed by researchers, including Auerbach et al. (1989), Miles (1999), Fehr (2000), Kotlikoff et al. (2007), De Nardi et al. (1999), Hviding and Merette (1998) and Borsch-Supan et al. (2006). The common findings are that both parametric and systemic pension reforms improve fiscal outcomes, generate higher savings and increase real wages. While some older generations suffer lower welfare, the reforms yield long-run welfare gains.

Health

Population ageing may generate changes in fertility rates or in the age structure of health, which may alter welfare and labour supply. Bloom et al. (2003) show that the increased longevity (longer retirement) effect outweighs the improved health (delay retirement) effect, generating increasing savings. Alternatively, Kulish et al. (2010) find in their simulations of lifespan extensions that the capital labour ratio and savings are smaller when allowing for health improvements (enhancing labour supply) and that an increased lifespan may reduce the time spent working even when health improvements are considered (positive wealth effect dominates the effects of lower interest rates).

4.4 Simulations of long-run economic effects of ageing

In this section, we examine the long-run effects of ageing in Australia using an Australian OLG model similar to that developed by Kudrna and Woodland (2011), but extended to incorporate age-specific public expenditures on health and education derived from AIHW (2010) and OECD (2009), respectively. To compute the long-run effects of population ageing, we undertake the following steps. First, we use the cohort shares and age-specific survival rates in 2007 taken from MoDEM 2.0 to compute a benchmark steady-state solution that closely matches the actual values of the key macroeconomic aggregates in Australia in 2007-08. Second, we re-solve the model using the cohort shares and age-specific survival

rates for 2053 derived from the three projection scenarios discussed earlier. The results are derived under two alternative model assumptions — perfect and imperfect capital mobility. In both cases, the consumption tax rate is assumed to balance the government budget.

Perfect capital mobility

The simulations in this subsection follow the small open economy assumption under which the domestic interest rate is equal to the exogenously given world interest rate. This assumption, combined with constant returns to scale in production, means that the capital labour ratio and the wage rate are determined by the world interest rate.

Table 4.4 shows the long-run implications of population ageing for several macroeconomic variables, government expenditures and the budget-balancing consumption tax rate. The effects are presented as percentage changes in variables from 2007-08 to 2053 under the three population scenarios. These effects reflect a combination of the changes in cohort shares and the general equilibrium effects, especially on the consumption tax rate.

Table 4.4 **Macroeconomic effects of population changes in 2053 — perfect capital mobility**

			2053[b]					
Variable	*2007-08*[a]		*Low*		*Medium*		*High*	
Output	0.521	– %	-7.42	–	-8.44	–	-10.82	–
Consumption	0.269	[51.7] %	5.65	[59.0]	3.39	[58.4]	1.59	[59.0]
Labour supply	0.295	– %	-7.42	–	-8.44	–	-10.82	–
Capital	1.712	– %	-7.42	–	-8.44	–	-10.82	–
Domestic assets	1.369	– %	46.94	–	49.03	–	60.14	–
Foreign debt	0.343	– %	-224.3	–	-237.7	–	-293.9	–
Health expenditures	0.032	[6.1] %	32.44	[8.7]	28.82	[8.6]	29.83	[8.9]
Educational expenses	0.020	[3.9] %	-26.99	[3.0]	-21.20	[3.3]	-17.40	[3.6]
Pension expenditures	0.014	[2.6] %	82.40	[5.1]	66.31	[4.7]	56.01	[4.6]
Consumption tax rate	0.100	– %	45.97	–	42.75		44.40	–

a Level values are expressed as per capita and in units of $100,000 for monetary variables. The values in square brackets represent a percentage of GDP. **b** The effects in 2053 are presented as percentage changes in the selected variables (expressed as per capita) relative to their 2007-08 values.

Under each scenario there is a higher aged dependency ratio, which implies that per capita pension expenditures increase significantly. Under the high scenario, the increase in the age pension expenditures is the smallest because of the pension

means testing of larger assets and asset incomes. As expected, health expenditures to the government increase in 2053 but the public expenditures on education decline as the youth dependency ratio falls in 2053. Because of larger total government expenditures, the consumption tax rate needs to increase to balance the government budget. In the case of the medium projection scenario, the increase in the consumption tax rate is 42.75 per cent, from 10 per cent in 2007 to 14.28 per cent in 2053.

The higher consumption tax rate and greater longevity affect households by reducing consumption and increasing labour supply while young to finance additional consumption over a longer retirement period. However, because of larger population shares of cohorts aged over 50 years in 2053 compared to those in 2007, this demographic effect outweighs the life-cycle effects on households, and so per capita consumption rises while per capita labour supply falls, as recorded in table 4.4. The effects on the consumption output ratio are even more positive (displayed in the square brackets), given the implied output decreases (noting that the changes in labour supply have to be exactly matched by the changes in capital and output). The larger shares of older cohorts and the fact that households need to accumulate more resources to fund greater retirement consumption are also behind the significant increases in per capita domestic assets (especially under the high population scenario).

Imperfect capital mobility

We now allow for responsiveness of the domestic interest rate to the changes in the foreign debt to output ratio. Following Guest (2006), we specify the domestic interest rate as $r = \bar{r} + \gamma\left[\left(\frac{FD}{Y}\right)_{2053} - \left(\frac{FD}{Y}\right)_{2007}\right]$, where $\bar{r}$ is the exogenous world interest rate, $\frac{FD}{Y}$ is the foreign debt to output ratio and the parameter γ is set to 0.02. Thus, any reduction in Australia's foreign debt will reduce the domestic interest rate, while higher foreign debt will increase it. As the domestic interest rate changes, so does the capital labour ratio and the wage rate.

The results presented in table 4.5 now include the effect on the interest and wage rates. The asset increases by households to finance longer retirement periods are exported abroad, implying lower foreign debt and a lower interest rate under current model assumptions. One consequence is that the capital stock increases significantly. Per capita labour supply declines because of the relative decrease in the working age population, but the fall is smaller than under perfect capital mobility, due to labour supply incentives from the increased wage rate. Higher

capital and lower labour imply capital deepening. The increases in per capita consumption are larger than in the small open economy case because of smaller hikes in the consumption tax rate.

The effects on the government budget are similar to those in the case of the perfect capital mobility simulations, with lower public expenditures on education and higher expenditures on health and pensions. However, the increases in pension expenditures are significantly larger, which is due to relatively smaller assets and asset incomes assessed under the pension means test. Nevertheless, the consumption tax rate under all three ageing scenarios is not as high as under fixed interest rates, mainly due to higher income tax revenue from higher earnings and pensions.

Table 4.5 **Macroeconomic effects of population changes in 2053 — imperfect capital mobility**

				2053[b]					
	2007-08[a]			*Low*		*Medium*		*High*	
Output	0.521	–	%	1.38	–	0.81	–	0.53	–
Consumption	0.269	[51.7]	%	7.37	[54.7]	5.21	[53.9]	3.39	[53.2]
Labour supply	0.295	–	%	-4.65	–	-5.67	–	-7.57	–
Capital	1.712	–	%	11.89	–	12.17	–	15.05	–
Domestic assets	1.369	–	%	30.24	–	31.87	–	39.65	–
Foreign debt	0.343	–	%	-61.33	–	-66.42	–	-83.08	–
Health expenditures	0.032	[6.1]	%	32.44	[7.9]	28.82	[7.8]	29.83	[7.9]
Educational expenses	0.020	[3.9]	%	-26.99	[2.8]	-21.20	[3.0]	-17.40	[3.2]
Pension expenditures	0.014	[2.6]	%	98.76	[5.1]	84.47	[4.8]	81.04	[4.7]
Consumption tax rate	0.100	–	%	38.40	–	35.53	–	38.51	–
Interest rate	0.050	–	%	-16.29	–	-17.56	–	-21.90	–
Wage rate	1.00	–	%	6.27	–	6.81	–	8.69	–

a Level values are expressed as per capita and in units of $100,000 for monetary variables. The values in square brackets represent a percentage of GDP. **b** The effects in 2053 are presented as percentage changes in the selected variables (expressed as per capita) relative to their 2007-08 values.

4.5 Conclusions

The chapter documents past trends in, and future projections of, the size and age structure of Australia's population. Clearly, the Australian population has been ageing as a result of declining fertility and mortality rates. Population ageing is expected to continue in the future mainly due to further improvement in survival rates.

The economic and fiscal effects of population ageing have been analysed by many researchers. Our brief review indicates that the effects depend upon the source of

population ageing — fertility, mortality and migration. Moreover, the literature does not provide clear answers as to how an ageing population will affect, for example, living standards, capital labour ratio and real wages.

We used a general equilibrium OLG model to provide preliminary, long-run macroeconomic implications of population ageing for the Australian economy. Overall, we show that population ageing will reduce per capita labour supplies and increase asset accumulation by households, while per capita age pension government expenditures and the consumption tax rate will rise substantially. Allowing for adjustments in the domestic interest rates, population ageing leads to capital deepening and higher wages.

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