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## 6 Sensitivity analyses

As part of its research on Superannuation Policy for Post-Retirement the Commission has developed a model — referred to as the Productivity Commission Retirement Model (PCRM) — to assess the effects of increasing the preservation age. The PCRM can be described as a ‘behavioural microsimulation’ model. Behavioural microsimulation models seek to simulate individual or household level decisions, and are commonly used within an economic framework to assess the impact of policy changes (such as changes in tax and benefits) on governments’ fiscal positions and on labour supply. They are particularly useful where there is a wide variety of decision makers, and where complex policy changes are likely to impact these different decision makers in different ways.

The model’s results are highly sensitive to a number of key assumptions. The role of this paper is to detail how results under Policy 1A (a delayed, phased increase in the preservation age) change when some of the assumptions are varied. The importance of a range of key assumptions cannot be readily tested and have been excluded from sensitivity analysis.

Analysing the effects of changing key assumptions involves two simulations — a base case simulation and a policy simulation (both of which employ the alternate assumptions). The difference in outcome variables between the alternate base case and the alternate policy simulation, and the original base case and the original policy simulation, can be attributed to changes in the assumptions.

### **SA1: Different returns to savings**

Sensitivity Analysis (SA) 1 involves varying the returns to savings by one percentage point (table 6.1). This sensitivity analysis involves recalibrating the model.<sup>1</sup>

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<sup>1</sup> The preferences for non-work activities are increased relative to consumption and bequest preferences when the returns to savings are increased, and vice versa.

**Table 6.1 SA1 assumptions**  
Per cent

	<i>Lower returns</i>	<i>Original</i>	<i>Higher returns</i>
Returns to superannuation in the accumulation phase	5.5	6.5	7.5
Returns to superannuation in the retirement phase	4.0	5.0	6.0
Returns to non-super savings	5.0	6.0	7.0

Increasing the returns to savings produces a larger increase in the participation rate of 50-64 year olds and a larger increase in the net government fiscal position (table 6.2). This is because under the revised base case, the savings balances of low- and middle-wealth households are significantly higher. This enables some of them to retire earlier (before 65) and hence increases the number of households who are affected by a preservation age change. Increases in taxation receipts are also larger because more households are affected by a preservation age change and the returns to superannuation are higher.

While the reverse is true for the low returns scenario, the effect is more muted. This is because under the revised base case high-wealth households have sufficient wealth, such that changes to superannuation returns alone do not appear to affect their behaviour.

**Table 6.2 SA1 results in 2055**

	<i>Units</i>	<i>Lower returns</i>	<i>Original</i>	<i>Higher returns</i>
Change in participation rate of 50-64 year olds	Percentage point	1.7	2.0	2.8
Government expenses	\$b in 2015 prices	-1.4	-2.0	-3.0
Government tax receipts	\$b in 2015 prices	3.9	5.2	6.8
Net government fiscal position	\$b in 2015 prices	5.4	7.2	9.8

*Source:* Commission estimates.

## **SA2: Alternative parameter values**

SA2 tests the sensitivity of the model to alternative sets of parameter values (table 6.3). Specifically, SA2 uses a higher (lower) preference for non-work activities, a lower (higher) preference for bequests, and an associated decrease (increase) in the rate of time preference.

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**Table 6.3 SA2 assumptions**

	<i>Alternative parameter set 1</i>	<i>Original</i>	<i>Alternative parameter set 2</i>
Share parameter representing preference for non-work activities	0.40	0.385	0.37
Share parameter representing preference for bequests	0.57	0.65	0.72
Rate of time preference	0.03	0.04	0.05

Changes in these parameter values have a material impact on the model results. Under the revised base case using alternative parameter set 1, households are more likely to retire later. This decreases the pool of households who are affected by a preservation age change, leading to a smaller change in the participation rate for older workers, and a smaller increase in the government's net fiscal position (table 6.4).<sup>2</sup>

Conversely, under the revised base case using alternative parameter set 2, a larger pool of households retire earlier (before 65), and hence the preservation age change leads to a larger increase in the participation rate and the government's net fiscal position.

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**Table 6.4 SA2 results in 2055**

	<i>Units</i>	<i>Alternative parameter set 1</i>	<i>Original</i>	<i>Alternative parameter set 2</i>
Change in participation rate of 50-64 year olds	Percentage point	0.8	2.0	3.7
Government expenses	\$b in 2015 prices	-1.2	-2.0	-2.5
Government tax receipts	\$b in 2015 prices	3.3	5.2	7.9
Net government fiscal position	\$b in 2015 prices	4.5	7.2	10.4

*Source:* Commission estimates.

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### SA3: Savings response to policy

Under the original scenario, it is assumed that households do not alter their savings rates in response to a change in the preservation age. However, to the extent that increasing the preservation age makes investing in superannuation less desirable, we would expect some individuals to substitute (at least part) of their savings away from superannuation into other savings vehicles.

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<sup>2</sup> This result is driven by the lower rate of time preference, which more than offsets the two other parameter changes which tend to encourage earlier retirement.

This sensitivity analysis attempts to analyse (albeit simply) the effect of this substitution by assuming that households respond to an increase in the preservation age by switching 30 per cent of their voluntary concessional contributions to non-superannuation savings if they are past the age of 50. This leads to a smaller increase in the participation rate of older workers (because the amount of savings that is affected by a preservation age change is smaller) and an increase in the government's net fiscal position (because non-superannuation assets are taxed at a greater rate than superannuation assets for households that make large concessional contributions) (table 6.5).

**Table 6.5 SA3 results in 2055**

	<i>Units</i>	<i>Original</i>	<i>Savings response to policy</i>
Change in participation rate of 50-64 year olds	Percentage point	2.0	1.9
Government expenses	\$b in 2015 prices	-2.0	-1.5
Government tax receipts	\$b in 2015 prices	5.2	6.5
Net government fiscal position	\$b in 2015 prices	7.2	8.1

*Source:* Commission estimates.

## **SA4: Alternative TTR behaviour**

Under the original scenario, wealthy households use Transition to Retirement (TTR) arrangements to reduce their tax liabilities (modelling supplement 2) but only to the extent that it is currently observed in the data. Under this sensitivity analysis scenario, wealthy households use this strategy to its fullest extent by contributing up to the concessional cap and withdrawing an equivalent amount from their account-based pension.

Assuming alternative TTR behaviour results in a smaller increase in the participation rate and a larger increase in the government's net fiscal position (table 6.6):

- Under the revised base case, the incentive to retire is reduced because households have higher after-tax incomes while working. This leads to a smaller increase in the participation rate.
- Individuals are minimising their tax more aggressively under the revised base case and increasing the preservation age limits this form of tax minimisation. This leads to larger increases in the government's net fiscal position.

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**Table 6.6 SA4 results in 2055**

	<i>Units</i>	<i>Original</i>	<i>Alternative TTR behaviour</i>
Change in participation rate of 50-64 year olds	Percentage point	2.0	1.9
Government expenses	\$b in 2015 prices	-2.0	-1.3
Government tax receipts	\$b in 2015 prices	5.2	8.3
Net government fiscal position	\$b in 2015 prices	7.2	9.6

*Source:* Commission estimates.

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### **SA5: Alternative population projections**

Under the original scenario, the base population projections from the 2013 ‘*An Ageing Australia: Preparing for the Future*’ (modelling supplement 3) were employed. This sensitivity analysis scenario employs the ‘high life expectancy’ scenario presented in that research paper (table 6.7).

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**Table 6.7 SA5 assumptions**  
Age in years

	<i>Original</i>	<i>High life expectancy scenario</i>
Male life expectancy in 2060	89.1	92.6
Female life expectancy in 2060	91.4	95.0

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Assuming a higher life expectancy leads to a slightly larger increase in the government’s net financial position because there are more individuals alive at older ages and hence more individuals who are affected by policy changes (table 6.8). The slightly larger increase in the participation rate is due to their being relatively more individuals in the 60-64 year old cohort (who tend to be more responsive to changes in the preservation age).

**Table 6.8 SA5 results in 2055**

	<i>Units</i>	<i>Original</i>	<i>High life expectancy scenario</i>
Change in participation rate of 50-64 year olds	Percentage point	2.0	2.0
Government expenses	\$b in 2015 prices	-2.0	-2.1
Government tax receipts	\$b in 2015 prices	5.2	5.3
Net government fiscal position	\$b in 2015 prices	7.2	7.4

*Source:* Commission estimates.

### SA6: Health-driven decrease in involuntary retirement probabilities

The original scenario does not assume any improvement in involuntary retirement rates over time. This sensitivity analysis scenario assumes modest health-driven improvements in involuntary retirement rates based on projections from Headey et al. (2010). These improvements are larger for those aged above 65 years (table 6.9).

**Table 6.9 SA6 assumptions**

<i>Age cohort</i>	<i>Involuntary retirement rates in 2055 as a proportion of base case rates (Males/Couples)</i>	<i>Involuntary retirement rates in 2055 as a proportion of base case rates (Females)</i>
50-54	0.991	0.975
55-59	0.984	0.967
60-64	0.937	0.896
65+	0.892	0.842

These health-improvements in involuntary retirement (IR) rates have a negligible impact on model results (table 6.10). This is because there are limited improvements for retirement ages that are most affected by an increase in the preservation age (that is, 50-64 year olds).

**Table 6.10 SA6 results in 2055**

	<i>Units</i>	<i>Original</i>	<i>Improvements in IR rates over time</i>
Change in participation rate of 50-64 year olds	Percentage point	2.0	2.0
Government expenses	\$b in 2015 prices	-2.0	-2.0
Government tax receipts	\$b in 2015 prices	5.2	5.2
Net government fiscal position	\$b in 2015 prices	7.2	7.2

*Source:* Commission estimates.

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## SA7: Increases in labour force participation of women

This sensitivity analysis scenario alters the parameters relating to female labour force participation by reducing the gap between males and females by 25 per cent prior to the age of 50. The restriction of the age of 50 is necessary due to the workings of the PCRM, as retirement decisions made beyond this age form part of the calculations of the model. (In practice, this restriction is not likely to affect the sensitivity analysis greatly, as the peak earnings and participation gap between men and women happens at earlier ages.)

Under the revised base case, those households with women (households headed by couples or single females) have higher incomes, and as a result accumulate greater savings. Households headed by single males are unaffected. The change to the base case did not require the model to be recalibrated.

The change in participation rates resulting from a change in the preservation age are slightly smaller under this scenario (table 6.11). This is because the increased amount of non-superannuation savings held by households with women, which can be accessed at any time, reduces the need for some of these households to retire later.

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**Table 6.11 SA7 results in 2055**

	<i>Units</i>	<i>Original</i>	<i>Improvement in labour force participation of women</i>
Change in participation rate of 50-64 year olds	Percentage point	2.0	1.8
Government expenses	\$b in 2015 prices	-2.0	-1.6
Government tax receipts	\$b in 2015 prices	5.2	5.5
Net government fiscal position	\$b in 2015 prices	7.2	7.1

*Source:* Commission estimates.

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The net fiscal effects are fairly similar.<sup>3</sup> This is because, under the new base case, fewer women make calls upon the Age Pension as they have greater assets from increased participation, and the shift in the preservation age does little to reduce Age Pension incidence further. The greater government tax receipts arise due to higher income tax revenues and a longer period to collect taxes on non-superannuation savings (the stock of which is larger than under the original base case) as some households defer retirement as a result of the change in policy.

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<sup>3</sup> Although they come about from a smaller fall in government expenses (\$1.6 billion) and a larger increase in government tax receipts (\$5.5 billion), relative to the outcome in Policy 1A.

The results of this sensitivity analysis should be considered with several caveats in mind:

- the increased level of participation is assumed not to have an effect on the wages (or wage growth) of those already participating in work — in practice, an increasing rate of participation may be expected to have an effect on wages
- the PCRM model assumes that both members of a couple retire at the same age, and so the net effect of the policy change modelled reflects this joint decision — if the assumption were relaxed, then it might be the case that women within a couple may choose a different retirement age based on the policy shock
- the additional women in work under the increase in the participation rate are assumed to be identical to those women already working — in practice, they may have different levels of skills and health, which could affect their wage earnings and risks of involuntary retirement.

### SA8: Alternative bequest motive specification

In the original model specification, the bequest motive is linked to the probability of death. This means that as life expectancies increase (and individuals die at older ages) the weight placed on the bequest motive in the utility function is implicitly decreased (though this is offset by the increase in wealth that arises as the superannuation system matures).

This sensitivity involves testing an alternative bequest motive specification where the implicit weight is fixed (that is, it does not decrease as life expectancies increase). This leads to households retiring much later under the revised base case (as wealth increases over time), which in turn results in a smaller fiscal and participation effect associated with an increase in the preservation age (as there are fewer household who are affected) (table 6.12).

Table 6.12 SA8 results in 2055

	<i>Units</i>	Original	Alternative Bequest motive specification
Change in participation rate of 50-64 year olds	Percentage point	2.0	0.9
Government expenses	\$b in 2015 prices	-2.0	-1.2
Government tax receipts	\$b in 2015 prices	5.2	3.2
Net government fiscal position	\$b in 2015 prices	7.2	4.4

Source: Commission estimates.



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## SA9: Minimum and maximum sensitivity cases

The ‘minimum/maximum’ scenario captures the cumulative effect of multiple low/high sensitivity analysis scenarios. The ‘minimum’ case scenario includes the ‘lower returns’ assumptions from SA1, and the ‘alternative parameter set 1’ assumptions from SA2. The ‘maximum’ case scenario includes the ‘higher returns’ assumptions from SA1, and the ‘alternative parameter set 2’ assumptions from SA2.

The results for these sensitivity analysis scenarios suggest that the effect on mature age participation rates in 2055 of a delayed increase in the preservation age is somewhere between 0.8 and 3.8 percentage points, and the effect on the government’s net fiscal balance is somewhere between \$2.9 billion and \$11.6 billion in 2015 prices (this excludes the effect of assumptions that cannot be readily tested).

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Table 6.13 **SA9 results in 2055: minimum and maximum sensitivity cases**

	<i>Units</i>	<i>Minimum</i>	<i>Original</i>	<i>Maximum</i>
Change in participation rate of 50-64 year olds	Percentage point	0.8	2.0	3.8
Government expenses	\$b in 2015 prices	-0.7	-2.0	-3.3
Government tax receipts	\$b in 2015 prices	2.2	5.2	8.3
Net government fiscal position	\$b in 2015 prices	2.9	7.2	11.6

*Source:* Commission estimates.

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## References

Headey, B., Freebairn, J. and Warren, D. 2010, *Dynamics of Mature Age Workforce Participation: Policy Effects and Continuing Trends*, Project No. 5/2010, September, Melbourne Institute of Applied Economic and Social Research, Melbourne.