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PLANNING RETIREMENT INCOME IN AUSTRALIA: ROUTES THROUGH THE MAZE

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1. INTRODUCTION

The wide range of choices available to individuals in Australia regarding the use of their financial resources at the time of retirement presents a complex set of decisions which may be characterised as a 'retirement maze'. The decisions are complicated by the interactions among the various taxation, superannuation and age pension structures. Elements of these include the standard system of income taxation, capital gains tax, superannuation taxation (involving contributions, fund investment earnings and benefits) and the eligibility conditions for the age pension; see Bateman et al (1991), Bateman and Piggot (1992) and McDiarmid (1994). These interdependencies make it difficult for individuals to make decisions in respect of their financial assets at the time of retirement. They also complicate policy debates, and it is not clear that the overall incentive structure that has evolved was fully anticipated by policy makers, politicians or the community.

The purpose of this paper is to attempt to clarify the incentives which arise from the current structure of taxes and benefits. The method used is to consider in detail the implications, for individuals in receipt of a selection of income streams, of taking alternative routes through the retirement maze. For this purpose the LITES simulation model developed by Atkinson, Creedy and Knox (1994) is used; this is described briefly in Appendix 1. The taxation system at and after retirement, and the age pension system are described in Section 2. The complexity of the current tax system is demonstrated and the plan of the decision maze is also described. The tax system operating during the working life of individuals is described in Appendix 2. Section 3 presents the implications for representative individuals of following a selected number of routes through the retirement maze. The 'optimal' decisions, valued according to several criteria, are compared. Results are presented for an assumption of uniform mortality and an assumed specification of

differential mortality whereby the individuals with higher lifetime earnings live relatively longer. For the purposes of this paper, the model is restricted to males who are assumed to be homeowners at retirement and who, for the purposes of calculating the tax liability and age pension, have no dependents. Section 4 provides brief conclusions.

2. ALTERNATIVE RETIREMENT DECISIONS

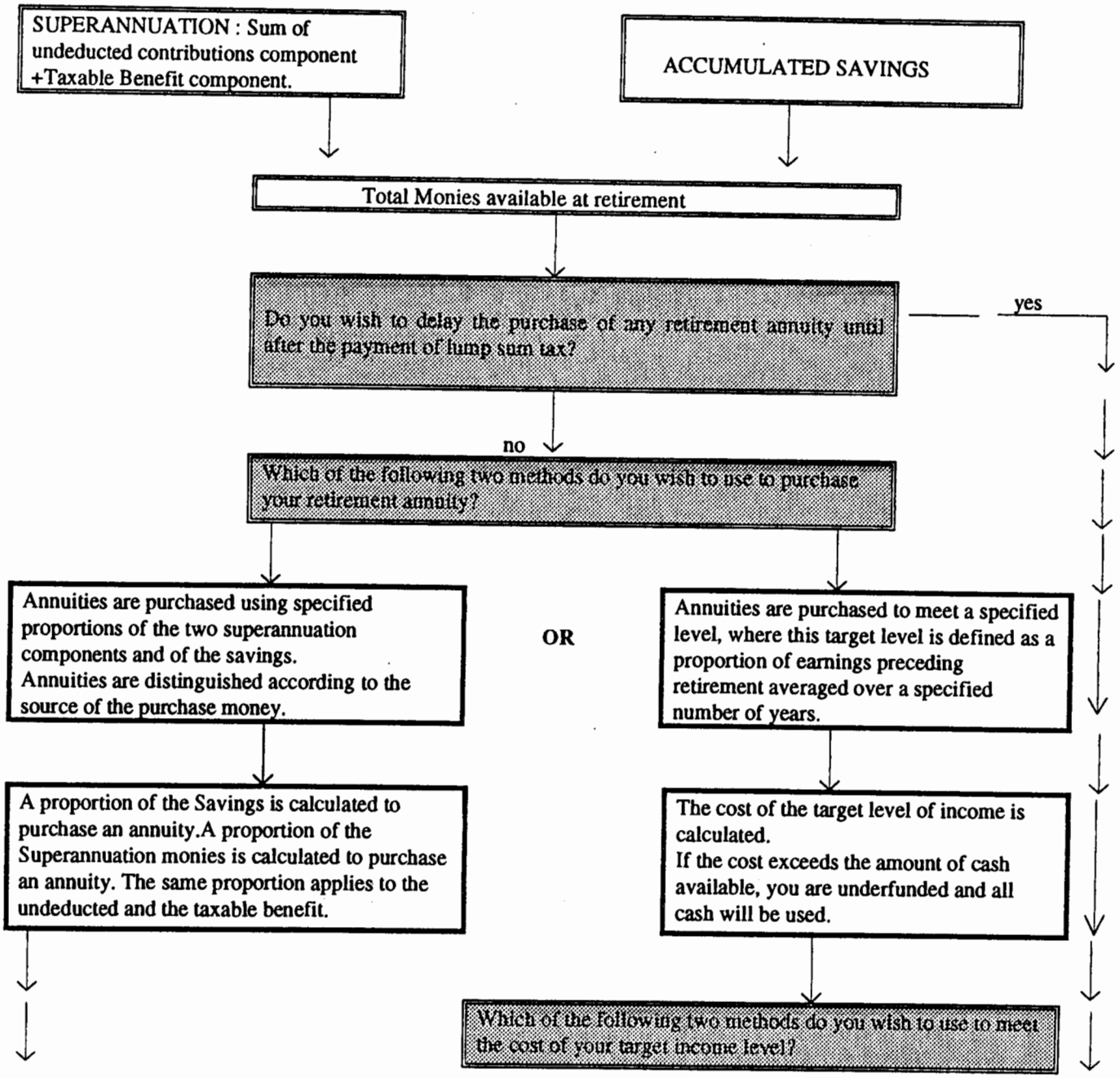
This section describes the range of choices which constitute the retirement maze, that is, the set of choices available in Australia to retiring individuals. It also describes the tax system and eligibility for the age pension as implied by these choices. The various limits and thresholds used are those applying at July 1994. In the calculations, thresholds are assumed to increase annually in line with increases in average weekly ordinary time earnings, AWOTE.

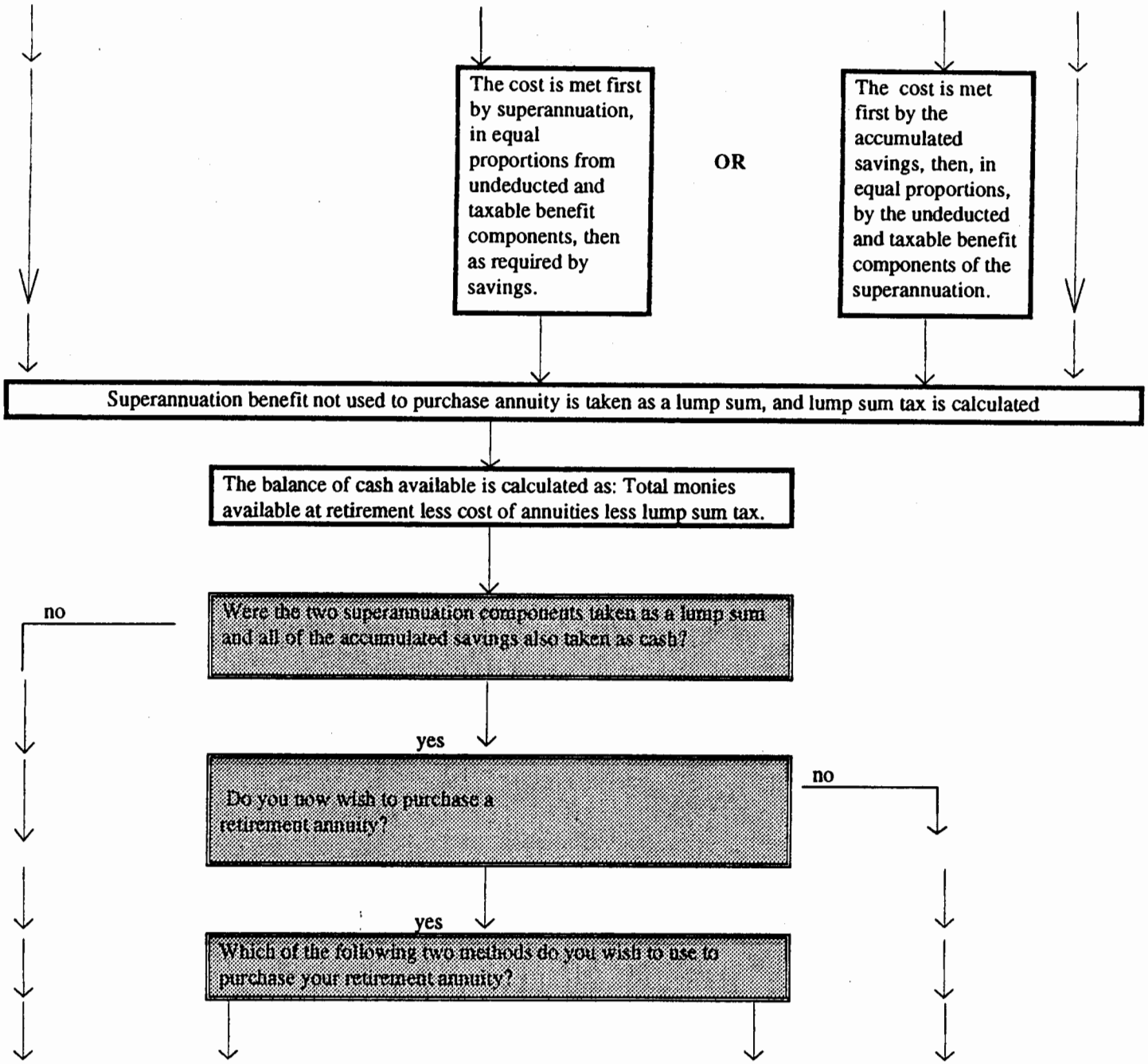
A Plan of the Maze

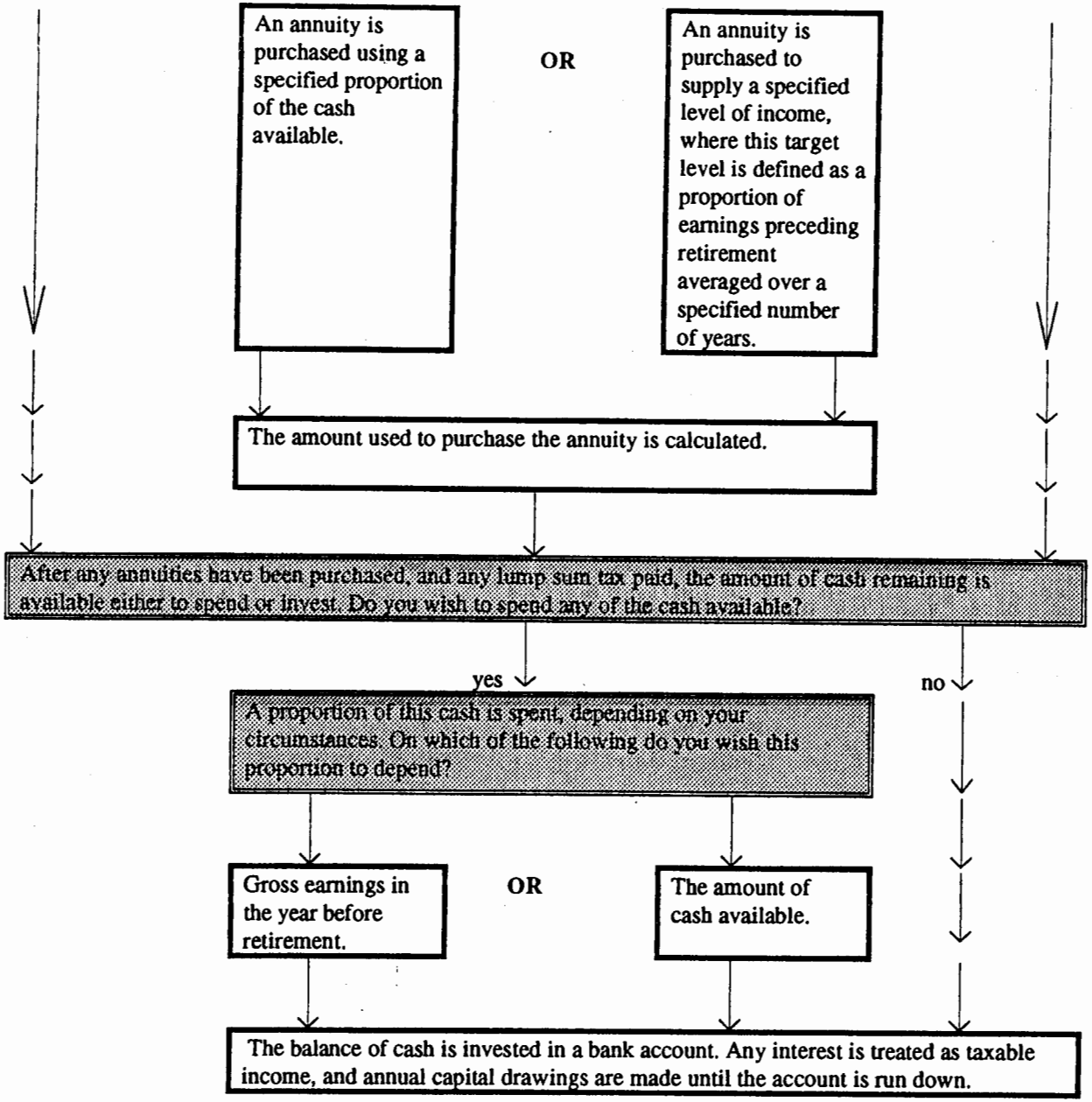
In negotiating the retirement maze the individual transforms assets accumulated during the working life into other forms, such as expenditure, interest bearing assets, and annuities. Assets established at retirement may also provide capital for bequests on the death of the retiree. The route chosen by the individual determines the level of net retirement income. The essential features of the maze are illustrated in Figure 1. For the purposes of this paper each individual is considered to enter the maze with an accumulation of superannuation contributions plus an accumulation of other savings. The superannuation is considered to be held in a personal account as part of a collective superannuation fund. In addition the individual is assumed to be a home owner. The home is an asset which may affect the entitlement to the age pension, but is not otherwise relevant to this study.

The superannuation account is divided into two components. One component is the sum of 'undeducted contributions' which have been made; these are employee

FIGURE 1. DECISIONS AT RETIREMENT




The cost is met first by superannuation, in equal proportions from undeducted and taxable benefit components, then as required by savings.
OR
The cost is met first by the accumulated savings, then, in equal proportions, by the undeducted and taxable benefit components of the superannuation.
Superannuation benefit not used to purchase annuity is taken as a lump sum, and lump sum tax is calculated
The balance of cash available is calculated as: Total monies available at retirement less cost of annuities less lump sum tax.
Were the two superannuation components taken as a lump sum and all of the accumulated savings also taken as cash?
no
yes
Do you now wish to purchase a retirement annuity?
no
yes
Which of the following two methods do you wish to use to purchase your retirement annuity?


An annuity is purchased using a specified proportion of the cash available.
OR
An annuity is purchased to supply a specified level of income, where this target level is defined as a proportion of earnings preceding retirement averaged over a specified number of years.
The amount used to purchase the annuity is calculated.
After any annuities have been purchased, and any lump sum tax paid, the amount of cash remaining is available either to spend or invest. Do you wish to spend any of the cash available?
yes
no
A proportion of this cash is spent, depending on your circumstances. On which of the following do you wish this proportion to depend?
Gross earnings in the year before retirement.
OR
The amount of cash available.
The balance of cash is invested in a bank account. Any interest is treated as taxable income, and annual capital drawings are made until the account is run down.

contributions which have not been claimed as a deduction against personal income tax. The balance of the account may be called the 'taxable benefit', which includes all other contributions, including those made by employers, and all investment income, including that earned by the undeducted contributions. These two components are treated differently for taxation purposes, as are the lump sums or annuities arising from them. However, each component contributes the same proportion either to a lump sum benefit or an annuity purchase. That is, it is not possible to manipulate the tax liability by, for example, taking all of the undeducted contribution component as a lump sum and all of the taxable benefit component as an annuity.

The initial decisions made on entering the maze determine the liability to lump sum tax. The superannuation account may be used to purchase an annuity directly, with the remainder being taken as a lump sum. Alternatively, the total superannuation account may be taken as a lump sum, so that the appropriate level of lump sum tax is paid, and the remaining post-tax cash is then combined with any other savings before a retirement annuity is purchased. Once an amount from the account has been converted to a lump sum and the appropriate lump sum tax paid, the cash amount resulting is no longer identified in terms of its source. However, any annuity income purchased directly by the superannuation account or by other non-superannuation savings continues to be identified according to the source of the money used to purchase it. This has continuing implications for the taxation of the annuity and the individual's age pension entitlement. Thus, an annuity purchased by cash arising from a taxed lump sum attracts the same treatment for taxation as an annuity purchased by savings, but not the same as that for an annuity purchased directly by the superannuation account.

The cost of purchasing an annuity at retirement is independent of the source of the funds used in the purchase. However, as explained below, the taxation and means-test treatment of the annuity income in retirement depends on the source of the funds used to purchase it. Hence, the same amount of gross income annuity purchased directly by

superannuation money and purchased by savings money do not produce the same net income.

In terms of the model used, there are two basic ways of determining the amount used to purchase an annuity. The 'money purchase' approach specifies a proportion of the funds to be used to purchase an annuity, while in the 'defined benefit' approach the division is determined by reference to the cost of providing a defined level of income. In the latter case, the income level is most commonly defined with reference to an average of income in the years leading up to retirement. The results presented in Section 3 include defined benefit cases which assume provision of an annuity of 60% of the average gross earnings in the three years preceding retirement. As the annuity level is pre-determined, it is possible that an individual will have insufficient assets to purchase the desired level of income. However, with the 'money purchase' method the level of income provided by the purchased annuity is dictated by the amount of the funds available.

Having purchased an annuity, taken any lump sum and paid the tax due on it, there may remain a cash balance. The decision available is whether to spend this money, or use it to provide interest income. Any money placed in an interest bearing bank account contributes to the assets of the individual, and is assessed in the application of the assets means-test associated with the age pension. In this paper it is assumed that the account is reduced by annual capital drawings and eventually extinguished, so that if the retiree dies during the drawing-down period the balance in the account provides a capital bequest. Also the interest which is earned on this account is subject to income tax in the usual way, and is assessable as income in the application of the age pension income test. These means-tests apply only in a limited way to purchased retirement annuities, as explained below. However, these differences give rise to another possible source of disparity in net retirement income between individuals who have provided the same gross income by different routes through the maze.

Taxation in retirement

The receipt of a superannuation account has several implications for taxation in retirement, namely lump sum tax, income tax and a rebate, and these are explained in this subsection. Amounts taken from the superannuation account in the form of lump sums, rather than in the form of income, are subject to lump sum tax. Benefits may be regarded as coming from the two components of the superannuation account described above (undeducted contributions and taxable benefit), and from the other savings. For the purposes of this paper, it is assumed that the accumulations are initially used to purchase an annuity or remain as cash. These amounts are defined as follows:

L_U = Lump sum taken from undeducted contributions

L_T = Lump sum taken from the taxable superannuation benefit

A_U = The amount of the undeducted contributions used to purchase an annuity, S_U

A_T = The amount of the taxable superannuation benefit used to purchase an annuity, S_T

L_S = Lump sum retained from non-superannuation savings

A_S = The amount of non-superannuation savings used to purchase an annuity, S_S

The total assets available from the superannuation account are $L_U + L_T + A_U + A_T$ and those from other savings are $L_S + A_S$. The method of attributing the source of these amounts to the undeducted and taxable contributions is not discretionary. Define δ as the proportion of the total superannuation account which arises from undeducted contributions, so that $\delta = (L_U+A_U)/(L_U+L_T+A_U+A_T)$. Current legislation requires that the proportion of the total lump sum which is attributable to undeducted contributions is also required to be δ. The same rule applies to A_U and A_T.

The lump sum taken from the superannuation account, $L_U + L_T$, is tested against a 'reasonable benefit limit', L_B, which depends upon the proportion of the superannuation account which is taken as a lump sum. If more than half is taken as a lump sum, the limit is \$400,000, otherwise it is \$800,000. The part of the taxable benefit in excess of the appropriate reasonable benefit limit is called the 'excessive proportion', E, and is defined as:

$$E = 0 \qquad \text{if } (L_T + A_T) \leq L_B$$

$$E = (L_T + A_T - L_B) / (L_T + A_T) \qquad \text{if } (L_T + A_T) > L_B \qquad (1)$$

For example, suppose there is a superannuation account of \$700,000, and consider the following two scenarios. In the first, \$200,000 is taken as a lump sum, giving a reasonable benefit limit of \$800,000, and an excessive proportion E = 0. Alternatively, if a lump sum of an amount greater than half of \$700,000 is taken, the reasonable benefit limit is \$400,000. If the undeducted contributions are assumed to be 5% of the total value, then:

$$(L_T + A_T) = (0.95)(700{,}000) > 400{,}000 \qquad (2)$$

Substitution in (1) gives:

$$E = 265/665 = 0.398 \qquad (3)$$

This proportion, E, is used in the calculation of lump sum tax and of income tax during retirement. Lump sum tax, T_L, is calculated using the following tax schedule:

If E = 0 then

$$T_L = 0 \qquad \text{if } L_T \leq 77{,}796$$

$$= 0.164\ (L_T - 77{,}796) \qquad \text{if } L_T > 77{,}796$$

If $E > 0$ then

$$T_L = 0.164 \{L_T (1 - E) - 77,796\} + 0.484 L_T E \quad (4)$$

The six items, L_U, L_T, A_U, A_T, L_S and A_S, affect the tax liability in retirement in various ways. An allowance is made to compensate for the capital cost of purchasing an annuity by assuming that some fixed amount received as income each year represents a repayment of capital. This amount is calculated as the cost of the relevant annuity divided by the expected term of the annuity. For present purposes, it is assumed that the purchase is of whole life annuities, and the expected term is the expectation of life, according to the Australian Life Tables 1985/87; for males aged 65 this is 14.6 years. The taxable income of the retiree is reduced by these purchase price allowances as follows. The savings annuity allowance is $A_S/14.6$, and the superannuation annuity allowance is $A_U/14.6$. These exempt amounts remain constant throughout the term of each annuity.

As a result of these exemptions, the income in retirement subject to income tax is interest income plus the taxable part of the savings annuity, $(S_S - A_S/14.6)$, plus the taxable superannuation annuity, $(S_T + S_U - A_U/14.6)$, using the standard personal income tax tables. The Medicare levy also applies to this amount subject to the usual conditions.

Finally, the special income tax treatment relating to retirement annuities involves a tax rebate in respect of the contributions tax which was levied during the accrual period of the fund. This rebate is 15% of the non-excessive proportion of the taxable annuity purchased by the superannuation taxable benefit. It is therefore given by:

$$\text{Income tax rebate} = 0.15 (S_T + S_U - A_U/14.6)(1 - E) \quad (5)$$

The 15% rebate was introduced to compensate for the 15% tax on deductible contributions and investment income which is exacted during the accrual period; details are given in Appendix 2. Hence the 15% rebate excludes the capital repayment of the

employee contributions which have not been subject to the superannuation contribution tax and are not subject to income tax in retirement.

Eligibility for the age pension

The age pension is subject to means-tests of income and assets with the test depending on marital status and whether or not the pensioner is a home owner. The individuals considered for the purposes of this paper are all male and assumed to be single home owners. The full annual rate of pension for single individuals is $8,115 at July 1994.

A reduction to the full rate of pension is calculated based on the income of the retiree. The income which is subject to the means-test includes all taxable income from sources other than the age pension, but excludes the repayment of capital amounts associated with annuities, $(A_L+A_S)/14.6$ and $A_U/14.6$. The value of A_L represents the cost of any annuity purchased by lump sum cash, that is, by after-tax superannuation benefits. Current legislation requires notional amounts, including a deemed interest income and unrealised capital gains, to be included in the income subject to the means-test. These items are not relevant to the calculations presented in this paper. Defining M as the income subject to the means test, the reduction, R_I, is:

$$\begin{aligned} R_I &= 0 && \text{for } M \le \$2{,}236 \\ R_I &= 0.5\,(M - 2{,}236) && \text{for } \$2{,}236 \le M \le \$18{,}466 \\ R_I &= 8{,}115 && \text{for } M > \$18{,}466 \end{aligned} \qquad (6)$$

Thus the full pension, $8,115, is reduced by R_I to calculate the age pension payable, until the entitlement is extinguished.

The pension payable also depends on the asset test. In the cases considered a retiree has only three possible relevant assets.

(i) An interest bearing bank account, in which case the balance in the account is an assessable asset. It is assumed that the bank balance is reduced by capital drawings each year in such a way as to extinguish the account at age 80, so that this component is irrelevant after that age.

(ii) An annuity purchased using after-tax money, (that is, either savings or taxed lump sum) such that the entitlement to the remaining future income stream is deemed to have an assessable asset value. If k is the number of complete years since the first annuity payment, the asset value of the assessable future whole life income stream in year k is taken to be $(A_L+A_S)(14.6 - k)/14.6$. This component of the asset test will therefore cease to have any relevance beyond age 80.

(iii) An annuity purchased directly by the superannuation account, which is not assessable under the assets test.

Where applicable, the reduction arising from the asset test, R_a, is:

$$
\begin{aligned}
&R_a = 0 && \text{for assets} \leq \$112{,}750 \\
&R_a = 0.078\ (\text{assets} - 112{,}750) && \text{for } \$112{,}750 \leq \text{assets} \leq \$216{,}788 \\
&R_a = 8{,}115 && \text{for assets} > \$216{,}788
\end{aligned}
\qquad (7)
$$

The two reductions, R_I and R_a, are compared and the largest one is applied to the full rate of pension to give the pension payable. That is, whichever means-test results in the lower pension is the test which applies.

A tax rebate, P_r, may attach to the age pension. This is calculated as:

$$
\begin{aligned}
&P_r = 972 && \text{if taxable income} \leq \$10{,}260 \\
&P_r = 972 - 0.125\ (\text{taxable income} - 10{,}260) && \text{if } \$10{,}260 \leq \text{taxable income} \leq \$18{,}036 \\
&P_r = 0 && \text{if taxable income} > \$18{,}036
\end{aligned}
\qquad (8)
$$

If the pension rebate is non-zero, the tax payer is exempt from the medicare levy.

In addition, there is provision for a rebate to low income earners. The amount of rebate, E_r, is calculated in the following way.

$$
\begin{aligned}
E_r &= 150 && \text{if taxable income} \leq \$20{,}700 \\
E_r &= 150 - .04\,(\text{taxable income} - 20{,}700) && \$20{,}700 < \text{taxable income} \leq \$24{,}450 \\
E_r &= 0 && \$24{,}450 < \text{taxable income}
\end{aligned}
\tag{9}
$$

This rebate is also payable throughout the working life, subject to the same thresholds and conditions.

There are thus three income tax rebates which may apply during the post-retirement years to the individuals considered here; these are the low income earners rebate, the rebate attaching to the age pension, and the 15% rebate relating to the superannuation contributions. If the sum of these rebates exceeds the amount of tax payable, the total rebate allowed is limited to that amount. This excludes the possibility of negative tax being due.

3. SOME COMPARISONS

Individual Earnings profiles

It is possible to examine different alternative routes through the maze for arbitrary assumptions about the accumulated values of superannuation and other savings. However, it is more useful to use values which are in some way representative of different types of income experience during the working life. Hypothetical earnings profiles of three individuals are constructed, where each person is assumed respectively to obtain in each year of working life the earnings equivalent to the lower quartile, median and upper quartile of his age group. The calculation of these three earnings streams is described in Appendix 1, and the three profiles of real (that is, inflation adjusted) earnings are

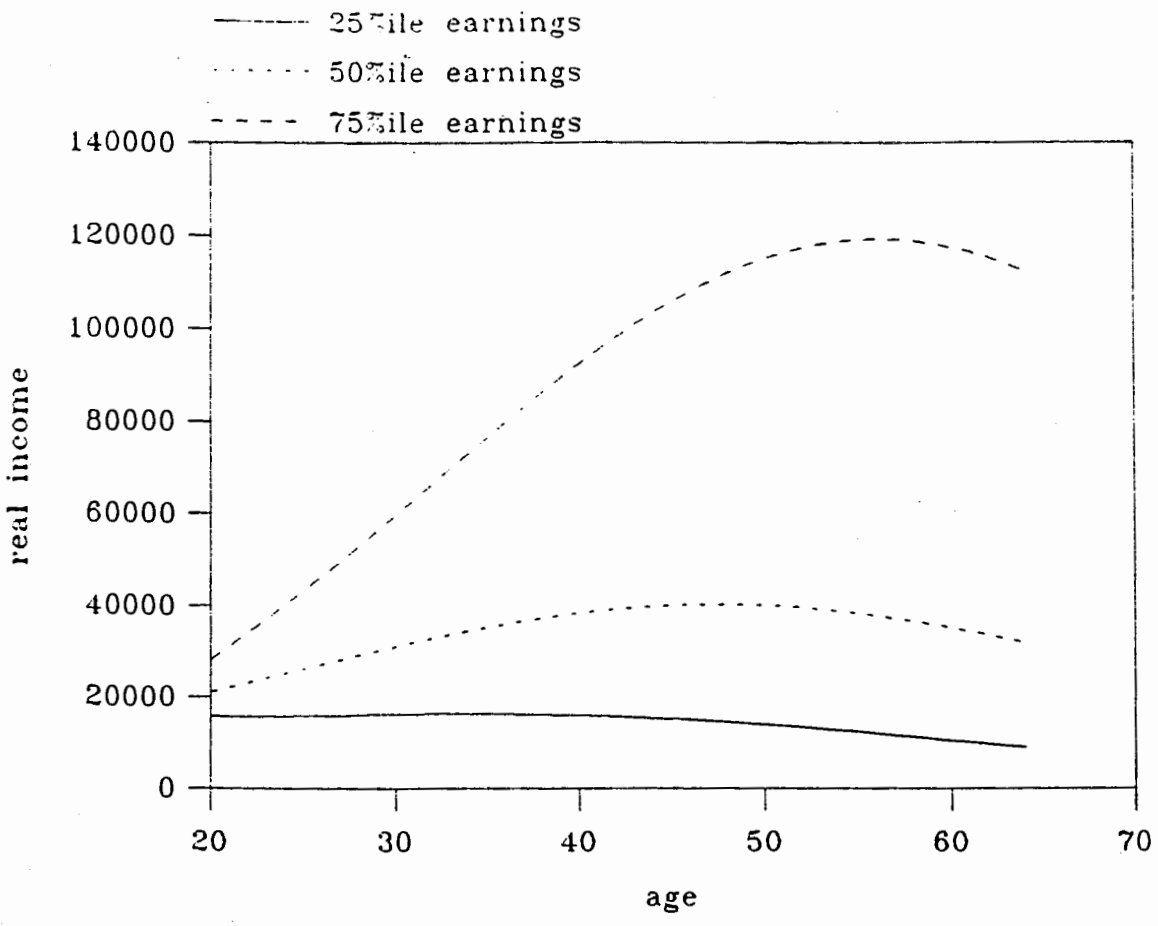


Figure 2. EARNINGS PROFILES

illustrated in Figure 2. In practice, individuals do not have such smooth earnings progressions, but experience relative earnings movements. Nevertheless, the emphasis of the present paper is on the implications of adopting alternative strategies at retirement, and the assumed profiles provide useful benchmark cases.

Each individual under consideration begins a working life of 45 years at age 20, retires at age 65, and dies in retirement. The individual is subject either to average life expectancy at retirement or to differential mortality, dependent upon relative lifetime earnings The calculation of differential mortality is described in Appendix 1, and reflects the tendency for individuals of relatively higher total lifetime earnings to experience lower mortality rates. The uniform mortality assumed is the expectation of life of males aged 65 according to the Australian Life Tables (1985/87).

Appendix 2 describes the tax and benefit system which applies in each year of the working life and the assumed levels of contribution, taxation and subsidy. The assumptions concerning the year to year adjustments that are made in constructing the lifetime experience of each individual are listed in Appendix 1.

The three individuals accumulate superannuation and other savings accounts at the date of retirement whose present values are shown in Table 1. These values reflect these assumptions: It is assumed that individuals are credited with an employer superannuation

Table 1. Accumulated Savings and Superannuation

	25 th percentile	50 th percentile	75 th percentile
Superannuation	$ 157,179	$ 342,821	$ 799,553
Savings	$ 29,185	$ 59,428	$ 121,594
Total	$ 186,364	$ 402,249	$ 921,147

contribution of 9% of gross earnings, and make an employee contribution of 3% of gross earnings in each working year. These contribution rates are in line with the Federal Government's objective of a total contribution rate of 12%. In addition, individuals are assumed to make other savings of 5% of disposable income in each year.

Alternative routes through the maze

There is in principle a vast number of ways of progressing through the retirement maze. This paper considers the implications of eleven routes, described in Table 2. These cases have been chosen to represent a range of possible decisions at retirement. The routes 1 to 4 involve all the superannuation account being taken as a lump sum, so the appropriate tax is paid immediately and any annuity is purchased with after-tax benefits. The first three routes involve different strategies for purchasing annuities with the remaining assets, while in route 4 all cash is simply deposited in a bank account. In routes 5 to 8 an annuity is purchased, using a given proportion of the available assets. In routes 9 and 10 annuities are purchased in order to achieve, where possible, a defined annuity level in relation to gross pre-retirement earnings. Route 11, like route 4, does not involve the purchase of an annuity, but all the available money is assumed to be consumed at retirement. Hence the individual following route 11 must rely entirely on the age pension for an income stream in retirement.

In the cases where an annuity is purchased, this is assumed to be a whole life annuity, escalating at 5% per annum. The purchase price used for such annuities is 12.5, so that an amount of $1000 purchases an annual lifetime income with a value of $80 in the first year. This rate has been chosen to reflect the market rates current during the twelve months to June 1994 as reported in the Rice-Kachor Research Rollover/Annuity League Table. It is also consistent with the long term economic assumptions used in the simulations. In the defined benefit cases considered here, the target level of income is

THE SUPERANNUATION MAZE

TABLE 2.

RETIREMENT DECISIONS: ROUTES THROUGH THE ALTERNATIVES

ROUTE 1	ROUTE 2	ROUTE 3	ROUTE 4	ROUTE 5	ROUTE 6	ROUTE 7	ROUTE 8	ROUTE 9	ROUTE 10	ROUTE 11
100 % LUMP SUM	100 % LUMP SUM	100% LUMP SUM	100% LUMP SUM	ANNUITY PURCHASE	ANNUITY PURCHASE	ANNUITY PURCHASE	ANNUITY PURCHASE	ANNUITY PURCHASE	ANNUITY PURCHASE	100% LUMP SUM
LUMP SUM TAX PAID	LUMP SUM TAX PAID	LUMP SUM TAX PAID	LUMP SUM TAX PAID	BY PROPORTION	BY PROPORTION	BY PROPORTION	BY PROPORTION	BY DEFINITION: Defined Benefit is 60% of average earnings over final 3 years	BY DEFINITION: Defined Benefit is 60% of average earnings over final 3 years	LUMP SUM TAX PAID
ANNUITY PURCHASE	ANNUITY PURCHASE	ANNUITY PURCHASE	NO ANNUITY PURCHASED	100% of Super Nil of Savings	50% of Super 50% of Savings	100% of Super 100% of Saving	Nil of Super 100% of Saving	Cost met by Super monies first	Cost met by Savings first	NO ANNUITY PURCHASED
BY PROPORTION :100 % of cash available	BY PROPORTION: 50 % of cash available	BY DEFINITION: Defined Benefit is 60% of average earnings over final 3 years	↓	NO LUMP SUM TAX PAYABLE	LUMP SUM TAX PAID	NO LUMP SUM TAX PAYABLE	LUMP SUM TAX PAID	LUMP SUM TAX PAID	LUMP SUM TAX PAID	↓
Nil balance of cash available	Balance of cash deposited in Bank account	Balance of cash deposited in Bank account	All cash deposited in Bank account	Balance of cash deposited in Bank account	Balance of cash deposited in Bank account	Nil balance of cash available	Balance of cash deposited in Bank account	Balance of cash deposited in Bank account	Balance of cash deposited in Bank account	All cash spent. No capital or income value retained.
ROUTE 1	ROUTE 2	ROUTE 3	ROUTE 4	ROUTE 5	ROUTE 6	ROUTE 7	ROUTE 8	ROUTE 9	ROUTE 10	ROUTE 11

assumed to be 60% of the average of gross earnings in the three years preceding retirement.

Where there is cash available to place in a bank account, the account is assumed to earn interest at a constant rate during the retirement years. Withdrawals are made in each year, the amount of the withdrawal being the balance divided by the number of years remaining to age 80. Thus the account is extinguished by age 80, and no residual amount is available for a bequest for individuals who survive beyond that age.

Common Mortality

Tables 3, 4 and 5, present results describing income and consumption experience during retirement as a result of following the different decision routes at retirement for individuals who experience average mortality, surviving for 14 years after retirement at age 65. Table 3 presents results for an individual whose earnings represent the 25th percentile, Table 4 presents results for an individual with median earnings, and Table 5 for an individual with the 75th percentile earnings.

Several criteria may be used to compare these results, depending on the objectives of the individuals. For example, the evaluation may involve multi-dimensional comparisons of the precise nature of the post-retirement income or consumption streams. However, in order to produce some basic comparisons, it is useful to concentrate on a selection of summary measures. Two of the four summary measures used relate to income, and these are the present value of gross income in retirement, and the present value of after-tax income in retirement plus the value of the residual estate at the time of death. Two summary measures relating to consumption are used, the present value of the total net consumption in retirement, and the present value of the net consumption in retirement plus the residual estate.

Routes 1 to 10 describe different methods of attempting to make some income provision in retirement, while Route 11 makes no such attempt. For this reason

comparisons are first given for the 'income-driven' routes, where the aim of behaviour is directly comparable.

Table 6 ranks these ten routes using the four present value criteria for the three individuals considered. The final row of the table gives the ratio of the value of the highest ranking route divided by the value of the lowest ranking route. The choice of Route 1 is preferred by the 25th and 50th percentile earners, on all income and consumption criteria.

Table 6. The ranking of the routes according to Income and Consumption in Retirement with Average Mortality

	25 th percentile				50 th percentile				75 th percentile			
ROUTE:	Gross income	Net inc + estate	Net Cons	Cons + estate	Gross income	Net inc + estate	Net Cons	Cons + estate	Gross income	Net inc + estate	Net Cons	Cons + estate
Route 1.	1	1	1	1	1	1	1	1	5	2	6	6
Route 2.	3	4	2	2	6	6	3	3	8	8	8	8
Route 3	5	5	3	3	3	3	2	2	5	2	6	6
Route 4.	10	10	8	6	10	10	8	6	10	10	10	10
Route 5.	4	3	10	10	4	4	10	10	2	5	4	4
Route 6.	6	6	7	8	8	8	5	7	7	7	5	5
Route 7.	2	2	9	9	2	2	9	9	1	1	1	2
Route 8.	9	9	5	4	9	9	6	4	9	9	9	9
Route 9	8	8	6	7	7	7	7	8	3	6	3	3
Route 10	7	7	4	5	5	5	4	5	4	4	2	1
Ratio best:worst	1.53	1.47	1.12	1.12	1.95	1.81	1.13	1.12	2.88	2.41	1.15	1.09

For these individuals it is more advantageous to take all the superannuation as a lump sum and pay the lump sum tax incurred than to purchase annuities directly from the

THE RETIREMENT MAZE

TABLE 3

RESULTS for 25 percentile Earnings Profile
experiencing Average Mortality

RESULT	ROUTE 1	ROUTE 2	ROUTE 3	ROUTE 4	ROUTE 5	ROUTE 6	ROUTE 7	ROUTE 8	ROUTE 9	ROUTE 10	ROUTE 11
Total Gross retirement income	$362,399	$301,771	$285,282	$236,360	$299,699	$280,945	$320,138	$258,558	$265,724	$274,624	$180,776
Retirement yr 1											
gross inc:	$25,930	$22,362	$21,240	$18,115	$20,889	$20,321	$22,292	$19,518	$19,401	$20,234	$12,132
net inc:	$25,930	$21,883	$20,622	$17,110	$20,881	$19,864	$22,292	$18,686	$18,764	$19,608	$12,132
net cons:	$25,930	$23,596	$22,787	$20,535	$21,451	$21,672	$22,292	$21,546	$21,117	$21,877	$184,602
year 5											
gross inc:	$26,095	$21,797	$20,662	$17,499	$21,190	$20,141	$22,610	$18,919	$19,127	$19,821	$12,601
net inc:	$25,796	$21,320	$20,138	$16,844	$21,190	$19,834	$22,610	$18,322	$18,726	$19,363	$12,601
net cons:	$25,789	$24,183	$23,758	$22,577	$22,140	$22,857	$22,610	$23,107	$22,664	$23,169	$12,601
year 10											
gross inc:	$25,739	$21,248	$20,062	$16,662	$21,607	$19,971	$23,090	$18,241	$18,819	$19,380	$13,213
net inc:	$25,087	$20,813	$19,684	$16,469	$21,607	$19,857	$23,090	$17,951	$18,711	$19,150	$13,213
net cons:	$25,071	$25,114	$25,125	$25,087	$23,031	$24,401	$23,090	$25,143	$24,629	$24,869	$13,213
year 14											
gross inc:	$25,645	$20,917	$19,526	$14,873	$21,970	$19,876	$23,532	$16,962	$18,599	$19,080	$13,723
net inc:	$24,762	$20,540	$19,312	$14,873	$21,970	$19,876	$23,500	$16,962	$18,599	$19,040	$13,723
net cons:	$24,740	$25,992	$26,211	$25,796	$23,774	$25,635	$23,500	$26,081	$26,099	$26,290	$13,723
Residual Estate	$0	$5,891	$7,447	$11,782	$1,946	$6,212	$0	$9,836	$8,090	$7,821	$0
Total Net retirement cons'n	$355,535	$345,644	$342,515	$330,641	$316,305	$330,940	$320,078	$336,396	$330,994	$336,513	$353,246
Net retirement income	$355,993	$295,495	$279,076	$230,186	$299,691	$277,967	$320,080	$252,551	$261,959	$269,844	$180,776
Net cons'n +residual estate	$355,835	$351,535	$349,962	$342,423	$318,251	$337,152	$320,078	$346,232	$339,084	$344,334	$353,246
Net retirement income + estate	$355,993	$301,386	$286,523	$241,968	$301,637	$284,180	$320,080	$262,388	$270,049	$277,666	$180,776
Lump Sum Tax	$9,636	$9,636	$9,636	$9,636	$0	$0	$0	$9,636	$0	$4,024	$9,636

Value of Savings fund accumulation = $29,185 Value of Superannuation benefit accumulation = $157,179

All values are given in terms of prices current at entry to the workforce.

THE RETIREMENT MAZE

TABLE 4

RESULTS for 50 percentile Earnings Profile
experiencing Average Mortality

RESULT	ROUTE 1	ROUTE 2	ROUTE 3	ROUTE 4	ROUTE 5	ROUTE 6	ROUTE 7	ROUTE 8	ROUTE 9	ROUTE 10	ROUTE 11
Total Gross retirement income	$503,927	$381,757	$412,069	$257,816	$411,903	$366,025	$452,973	$298,827	$367,723	$385,406	$180,776
Retirement Yr 1											
gross inc:	$28,435	$23,104	$24,427	$17,772	$29,665	$27,601	$32,148	$19,512	$27,309	$28,957	$12,132
net inc:	$28,435	$23,104	$24,427	$16,876	$28,204	$26,288	$31,697	$19,324	$25,829	$27,801	$12,132
net cons:	$28,435	$26,658	$27,099	$23,962	$29,328	$29,956	$31,686	$25,268	$29,150	$30,952	$367,575
year 5											
gross inc:	$38,569	$29,711	$31,909	$19,883	$29,322	$26,667	$32,213	$23,115	$26,646	$28,022	$12,601
net inc:	$37,584	$28,359	$30,648	$18,472	$28,073	$25,674	$31,521	$21,716	$25,717	$27,075	$12,601
net cons:	$37,560	$34,250	$35,071	$30,285	$29,975	$31,817	$31,504	$31,596	$31,291	$32,350	$12,601
year 10											
gross inc:	$37,097	$27,842	$30,138	$18,587	$29,418	$25,586	$32,438	$21,607	$25,865	$26,982	$12,213
net inc:	$35,405	$26,597	$28,782	$17,788	$28,718	$25,005	$31,493	$20,663	$25,451	$26,322	$13,213
net cons:	$35,363	$35,452	$35,430	$35,541	$31,600	$34,242	$31,470	$35,512	$33,837	$34,254	$13,213
year 14											
gross inc:	$36,287	$26,543	$28,960	$16,093	$29,537	$24,782	$32,717	$19,978	$25,277	$26,240	$13,723
net inc:	$34,137	$25,436	$27,594	$16,093	$28,991	$24,539	$31,600	$19,574	$25,200	$25,826	$13,723
net cons:	$34,084	$36,664	$36,024	$38,604	$32,650	$36,251	$31,572	$38,402	$35,833	$35,883	$13,723
Residual Estate	$0	$12,141	$9,129	$24,281	$3,962	$12,640	$0	$20,320	$11,471	$10,859	$0
Total net retirementcons'n	$487,259	$471,929	$475,748	$452,892	$432,109	$462,698	$441,372	$460,323	$455,646	$466,674	$536,219
Net retirement income	$487,661	$368,584	$398,142	$245,846	$398,607	$355,036	$441,651	$287,101	$357,933	$374,226	$180,776
Net cons'n + residual estate	$487,259	$484,070	$484,877	$477,173	$436,071	$475,338	$441,372	$480,643	$467,117	$477,533	$536,219
Net retirement income + estate	$487,661	$380,725	$407,271	$270,127	$402,569	$367,676	$441,651	$307,421	$369,404	$385,085	$180,776
Lump Sum Tax	$38,028	$38,028	$38,028	$38,028	$0	$11,526	$0	$38,027	$2,886	$12,074	$38,028

Value of Savings fund accumulation = $59,428 Value of Superannuation benefit accumulation = $342,821

All values are given in terms of prices current at entry to the workforce.

THE RETIREMENT MAZE

TABLE 5

RESULTS for 75 percentile Earnings Profile
experiencing Average Mortality

RESULT	ROUTE 1	ROUTE 2	ROUTE 3	ROUTE 4	ROUTE 5	ROUTE 6	ROUTE 7	ROUTE 8	ROUTE 9	ROUTE 10	ROUTE 11
Total Gross retirement income	$844,933	$598,538	$844,933 *POOR	$349,178	$920,987	$663,911	$1,006,821	$429,159	$917,520	$915,853	$180,771
Retirement yr 1											
gross inc:	$59,449	$48,303	$59,449	$37,156	$68,356	$56,189	$71,916	$40,716	$68,212	$68,002	$12,132
net inc:	$59,449	$45,794	$59,449	$28,538	$56,092	$46,308	$61,805	$33,854	$55,952	$58,067	$12,132
net cons:	$59,449	$53,164	$59,449	$43,187	$58,162	$54,156	$61,556	$46,174	$58,119	$60,207	$755,247
year 5											
gross inc:	$59,449	$43,348	$59,449	$27,248	$66,774	$50,794	$71,916	$32,390	$66,566	$66,412	$12,601
net inc:	$58,770	$41,135	$58,770	$23,125	$55,224	$43,143	$61,096	$29,088	$55,052	$56,542	$12,601
net cons:	$58,753	$53,466	$58,753	$47,793	$58,894	$56,442	$60,828	$49,822	$58,883	$60,273	$12,601
year 10											
gross inc:	$61,162	$41,813	$61,162	$22,107	$64,796	$44,050	$71,916	$28,644	$64,508	$64,424	$13,213
net inc:	$56,785	$38,851	$56,785	$20,192	$54,191	$38,895	$60,429	$26,317	$53,976	$54,847	$13,213
net cons:	$56,676	$57,356	$56,676	$57,300	$59,862	$58,999	$60,146	$57,482	$59,888	$60,574	$13,213
year 14											
gross inc:	$59,449	$38,463	$59,449	$18,091	$63,214	$38,655	$71,916	$24,597	$62,862	$62,834	$13,723
net inc:	$52,999	$35,808	$52,999	$17,617	$53,386	$35,458	$60,043	$23,427	$53,137	$53,630	$13,723
net cons:	$52,839	$59,275	$52,839	$64,669	$60,659	$61,005	$59,750	$62,946	$60,716	$60,955	$13,723
Residual Estate	$0	$25,382	$0	$50,764	$8,016	$27,641	$0	$42,658	$8,434	$8,147	$0
Total Net retirement cons'n	$804,275	$778,413	$804,275	$735,002	$831,420	$807,535	$847,466	$749,043	$831,524	$846,541	$923,891
Net retirement income	$805,255	$562,560	$805,255	$302,667	$766,027	$573,732	$851,306	$385,849	$763,315	$780,322	$180,776
Net cons'n + residual estate	$804,275	$803,795	$804,275	$785,766	$839,526	$835,176	$847,466	$791,701	$839,958	$854,688	$923,891
Net retirement income + estate	$805,255	$587,942	$805,255	$353,342	$774,133	$601,373	$851,306	$428,507	$771,749	$788,469	$180,776
Lump Sum Tax	$159,681	$159,681	$159,681	$159,681	$0	$45,958	$0	$159,681	$0	$4,306	$159,681

Value of Savings fund accumulation = $ 121,594 Value of Superannuation benefit accumulation = $799,553

All values are given in terms of prices current at the date of entry to the workforce.

superannuation accumulation, despite the fact that lump sum tax would thereby be avoided. Annuities purchased with post-tax assets give rise to an exempt amount based on the total purchase price, rather than one based only on the undeducted contribution component as is the case for the pre-tax superannuation annuity. The income means-test relating to the age pension distinguishes in the same way between the annuities, allowing a greater non-assessable amount for the post-tax annuity. Thus, the lower income earners using Route 1 are more likely to receive an age pension, the associated rebate and the low income earners rebate. For these individuals Route 7, (namely, direct purchase of an annuity) on the income criteria, is the next ranked option. For the higher income earner, Route 7 is the best option in terms of income and net consumption. The advantages of Route 1 received by the lower income earner are either not available to a high income earner, or are outweighed for this individual by the value of avoiding lump sum tax. Table 6 suggests that it is better for all individuals to expend all assets on the purchase of an annuity rather than to make a bank investment.

In contrast, the worst decision for all earnings levels, when assessed by the income criterion, is for the individual to pay the lump sum tax, purchase no annuity and deposit all the money in a bank account. This result suggests that the current taxation policies may provide an incentive for the purchase of life annuities, which is consistent with the Government's announced policies. However, before confirming this conclusion, further analysis is required.

Using net consumption, and net consumption plus the estate, as criteria, the results appear at first sight to be different. For the lower quartile and median earners, Route 7 is ranked ninth in apparent contrast to the second ranking given by the income criteria. However the present values of both these streams are identical, since net income and consumption are deemed to be the same for this route. The reason for the change in ranking is that the consumption measure includes the value of the capital withdrawals from the bank account, thereby improving the relative attraction of the options that do not

provide benefits entirely as an annuity. Furthermore, the difference in the values of all the ten routes is now much smaller. Using income as the criterion of value gives a far wider spread of results for all individuals than does using consumption. For all individuals the extreme values of consumption for each of these ten routes varies by between 9% and 15%. The variation between the values of the routes on the net income plus estate criterion is 47% for the low earner, 81% for the median earner, and 141% for the high earner. The choice of route is much less crucial when value is assessed in terms of consumption rather than in terms of income. This also shows that the incentive structure is substantially different using consumption as the criterion and it is no longer clear that the purchase of life annuities is the optimal choice.

Table 7. Route 11 and net Consumption in Retirement with Average Mortality

	25 th percentile	50 th percentile	75 th percentile
	Net Consumption	Net Consumption	Net Consumption
Route 11 ranking with Routes 1-10	2	1	1
Ratio Route 11 to best ranked of Routes 1-10	0.99	1.10	1.09
Ratio Best:Worst for Routes 1-11	1.12	1.24	1.26

Routes 1-10 consider cases where individuals seek to provide retirement income. However the consequences of following Route 11 provide a marked contrast. Route 11 involves the immediate dispersion of all the superannuation and other savings at retirement, so that no income in excess of the basic age pension is provided. Thus all

individuals receive the same annual gross income of the full age pension, and no tax is payable on this income. It is no longer meaningful to compare the gross (or net) income during retirement with other routes, or between individuals, since the age pension is a minimum level of income. Some other basis for comparison must be chosen, since Route 11 involves a different motivation on the part of the individual. It is reasonable to look at consumption as a measure of value of the route. Table 7 shows the rankings by the consumption criterion.

On the assumption of common mortality, the value of the age pension income is the same for all individuals, and the total net value of the superannuation and other savings accumulations dominates the comparison, since this represents the only difference between individuals. The lower income earner is marginally worse off following Route 11 than the best alternative route. The median individual improves by 10%, and the higher income individual improves by 9%, on the value available for consumption. This improvement arises in part from the fact that all assets are realised immediately without incurring any further tax liability, instead of being taken in a delayed and, to some extent, taxable form. It also arises partly because all individuals are eligible for the age pension, which not all would otherwise have received. For some individuals, therefore, the level of assets accruing to them is increased by the value of this additional income. Since all individuals have only the age pension as income, it is not reduced by income tax.

This finding is extremely significant in terms of the development of Australia's retirement income policy. It suggests that there exists an incentive for many retirees to consume all or part of their savings for retirement and rely on the age pension as their major source of retirement income. Such an outcome is inconsistent with the Government's current objectives and suggests that the existing strategy needs further refinement. Of course, it may be argued that many retirees may adopt a conservative approach in the use of their accumulated savings and would not fully consume their funds. If this result occurs it would reflect the risk aversion of the individual retiree.

THE RETIREMENT MAZE

TABLE 8

RESULTS for 25 percentile Earnings Profile
experiencing Differential Mortality

RESULT	ROUTE 1	ROUTE 2	ROUTE 3	ROUTE 4	ROUTE 5	ROUTE 6	ROUTE 7	ROUTE 8	ROUTE 9	ROUTE 10	ROUTE 11
Total Gross retirement income	$182,353	$153,592	$145,663	$123,576	$147,811	$141,308	$157,724	$133,490	$134,373	$139,482	$87,390
Retirement yr 1											
gross inc:	$25,930	$22,362	$21,240	$18,115	$20,889	$20,321	$22,292	$19,518	$19,401	$20,234	$12,132
net inc:	$25,930	$21,883	$20,622	$17,110	$20,881	$19,864	$22,292	$18,686	$18,764	$19,603	$12,132
net cons:	$25,930	$23,596	$22,787	$20,535	$21,451	$21,672	$22,292	$21,546	$21,117	$21,877	$184,602
year 5											
gross inc:	$26,095	$21,797	$20,662	$17,499	$21,190	$20,141	$22,610	$18,919	$19,127	$19,821	$12,601
net inc:	$25,796	$21,320	$20,138	$16,844	$21,190	$19,834	$22,610	$18,322	$18,726	$19,363	$12,601
net cons:	$25,789	$24,183	$23,758	$22,577	$22,140	$22,857	$22,610	$23,107	$22,664	$23,169	$12,601
year 7											
gross inc:	$25,918	$21,558	$20,406	$17,199	$21,352	$20,066	$22,792	$18,638	$18,999	$19,635	$12,842
net inc:	$25,468	$21,093	$19,937	$16,718	$21,352	$19,835	$22,792	$18,163	$18,716	$19,267	$12,842
net cons:	$25,457	$24,531	$24,286	$23,605	$22,491	$23,467	$22,792	$23,911	$23,446	$23,838	$12,842
Residual Estate	$0	$47,128	$59,577	$94,255	$15,565	$49,697	$0	$78,690	$64,716	$62,570	$0
Total Net retirement cons'n	$180,868	$168,282	$164,632	$154,467	$153,784	$157,936	$157,724	$159,030	$155,944	$159,933	$259,860
Net retirement income	$180,904	$150,255	$141,834	$118,377	$147,803	$138,899	$157,724	$128,906	$131,156	$135,977	$87,390
Net cons'n + residual estate	$180,868	$215,410	$224,209	$248,722	$169,349	$207,633	$157,724	$237,720	$220,660	$222,503	$259,860
Net retirement income + estate	$180,904	$197,383	$201,411	$212,632	$163,368	$188,596	$157,724	$207,596	$195,872	$198,547	$87,390
Lump Sum Tax	$9,636	$9,636	$9,636	$9,636	$0	$0	$0	$9,636	$0	$4,024	$9,636

Value of Savings fund accumulation = $ 29,185 Value of Superannuation benefit accumulation = $157,179
All values are given in terms of prices current at entry to the workforce.

THE RETIREMENT MAZE

TABLE 9

RESULTS for 75 percentile Earnings Profile
experiencing Differential Mortality

RESULT	ROUTE 1	ROUTE 2	ROUTE 3	ROUTE 4	ROUTE 5	ROUTE 6	ROUTE 7	ROUTE 8	ROUTE 9	ROUTE 10	ROUTE 11
Total Gross retirement income	$1,261,077	$854,543	$1,261,077 *POOR	$448,970	$1,357,947	$915,616	$1,510,231	$587,355	$1,351,794	$1,350,127	$280,568
Retirement yr 1											
gross inc:	$59,449	$48,303	$59,449	$37,156	$68,356	$56,189	$71,916	$40,716	$68,212	$68,002	$12,132
net inc:	$59,449	$45,794	$59,449	$28,538	$56,092	$46,308	$61,805	$33,854	$55,952	$58,067	$12,132
net cons:	$59,449	$53,164	$59,449	$43,187	$58,162	$54,156	$61,556	$46,174	$58,119	$60,207	$755,247
year 5											
gross inc:	$59,449	$43,348	$59,449	$27,248	$66,774	$50,794	$71,916	$32,390	$66,566	$66,412	$12,601
net inc:	$58,770	$41,135	$58,770	$23,125	$55,224	$43,143	$61,096	$29,088	$55,052	$56,542	$12,601
net cons:	$58,753	$53,466	$58,753	$47,793	$58,894	$56,442	$60,828	$49,822	$58,883	$60,273	$12,601
year 10											
gross inc:	$61,162	$41,813	$61,162	$22,107	$64,796	$44,050	$71,916	$28,644	$64,508	$64,424	$13,213
net inc:	$56,784	$38,851	$56,784	$20,192	$54,191	$38,894	$60,429	$26,317	$53,976	$54,847	$13,213
net cons:	$56,676	$57,356	$56,676	$57,300	$59,862	$58,999	$60,146	$57,482	$59,888	$60,574	$13,213
year 15											
gross inc:	$59,449	$36,432	$59,449	$13,854	$62,423	$35,958	$71,916	$21,521	$62,039	$62,039	$13,854
net inc:	$52,534	$33,868	$52,534	$13,836	$52,794	$33,257	$59,964	$20,643	$52,520	$52,944	$13,854
net cons:	$52,363	$33,805	$52,363	$13,836	$52,556	$33,190	$59,669	$20,622	$52,285	$52,720	$13,854
year 21											
gross inc:	$59,449	$36,343	$59,449	$14,665	$62,423	$35,958	$71,916	$22,963	$62,039	$62,039	$14,665
net inc:	$50,200	$33,430	$50,200	$14,665	$53,104	$33,693	$59,613	$22,223	$52,839	$52,798	$14,665
net cons:	$49,772	$33,358	$49,972	$14,665	$52,874	$33,637	$59,309	$22,205	$52,611	$52,569	$14,665
Residual Estate	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Net retirement cons'n	$1,162,080	$1,015,200	$1,162,080	$834,777	$1,200,870	$1,042,720	$1,263,790	$902,261	$1,199,120	$1,215,430	$1,023,680
Net retirement income	$1,164,460	$799,811	$1,164,460	$402,442	$1,137,100	$809,311	$1,269,730	$539,187	$1,132,520	$1,150,790	$280,568
Net cons'n +residual estate	$1,162,080	$1,015,200	$1,162,080	$834,777	$1,200,870	$1,042,720	$1,263,790	$902,261	$1,199,120	$1,215,430	$1,023,680
Net retirement income + estate	$1,164,460	$799,811	$1,164,460	$402,442	$1,137,100	$809,311	$1,269,730	$539,187	$1,132,520	$1,150,790	$280,568
Lump Sum Tax	$159,681	$159,681	$159,681	$159,681	$0	$45,958	$0	$159,681	$0	$4,306	$159,681

Value of Savings fund accumulation = $ 121,594 Value of Superannuation benefit accumulation = $799,553

All values are given in terms of prices current at the date of entry to the workforce.

Differential Mortality

Tables 8 and 9 present results for the lower and higher income earners, assuming that mortality experience is related to lifetime earnings. The model described in Appendix 1 gives a life expectancy at retirement for a male subject to the 25th percentile earnings of 7 years compared to 21 years for the 75th percentile income earner. The individual with median earnings survives for 14 years under this assumption, so the results are the same as for an assumption of common mortality.

The allowance for differential mortality causes two fundamental changes to the results. The rankings are shown in Table 10. First, for the lower income earner, the results are virtually reversed when allowance is made for inclusion of the estate. The cause of this result is that this individual has a life expectancy considerably less than the average and so the estate represents a more significant proportion of the benefit. The only income-producing vehicle which retains a capital value to contribute to an estate is the bank account. Hence, when the effect of an estate is allowed for under the bank investment options, the annuity alternatives become much less advantageous by comparison. The amounts of annual income available to the individual remain the same under each route, irrespective of the mortality assumption. Hence the possible effect of a bequest becomes critical for low income earners in negotiating the retirement maze.

In contrast, the higher income earner benefits to a much greater extent from the annuity options when the lower mortality rate is taken into account. Although the extreme rankings do not change, the higher ratio between the best and worst options illustrate the advantage that this individual derives from the annuity options. The assumption of lower mortality for the higher income earner gives rise to a 'mortality profit' arising from the purchase of annuities which assume a higher average mortality experience. The low income earner is disadvantaged by the purchase of such annuities.

Table 10. Rankings according to Income and Consumption in Retirement with Differential Mortality

	25 th percentile				50 th percentile				75 th percentile			
ROUTE:	Gross income	Net inc + estate	Net Cons	Cons + estate	Gross income	Net inc + estate	Net Cons	Cons + estate	Gross income	Net inc + estate	Net Cons	Cons + estate
Route 1.	1	8	1	8	1	1	1	1	5	2	5	5
Route 2.	3	5	2	6	6	6	3	3	8	8	8	8
Route 3	5	3	3	3	3	3	2	2	5	2	5	5
Route 4.	10	1	9	1	10	10	8	6	10	10	10	10
Route 5.	4	9	10	9	4	4	10	10	2	5	3	3
Route 6.	6	7	6	7	8	8	5	7	7	7	7	7
Route 7.	2	10	7	10	2	2	9	9	1	1	1	1
Route 8.	9	2	5	2	9	9	6	4	9	9	9	9
Route 9	8	6	8	5	7	7	7	8	3	6	4	4
Route 10	7	4	4	4	5	5	4	5	4	4	2	2
Ratio best:worst	1.48	1.35	1.18	1.58	1.95	1.81	1.13	1.12	3.36	3.16	1.51	1.51

These underlying differences in mortality rates have important social and equity implications since the Australian Government states an aim to encourage all retirees to accept an increasing proportion of their retirement provision as an income stream. Although lifetime annuities represent only one possible form of these income streams, the fact that there are important equity considerations arising from the likelihood of different mortality rates must be taken into account when the possible mandating of superannuation in pension form is being considered.

Table 11 shows comparisons of Route 11 with the other ten routes under the differential mortality assumption. In this case the residual estate affects the rankings, and

figures are given for net consumption, and net consumption plus the residual estate. Thus, on either mortality assumption the individuals of lower quartile and median earnings history have more spending power if they make no retirement income provision. The only case where there is an advantage in providing retirement income is that of a higher income earner on a differential mortality assumption. In this case the advantage derives from the fact that the value of annuity payments actually received exceeds the purchase price.

Table 11. Route 11 with Differential Mortality and Net Consumption criteria

	25 th percentile		50 th percentile		75 th percentile	
	Net Cons	Net Cons + est	Net Cons	Net Cons + est	Net Cons	Net Cons + est
Route 11 ranking with Routes 1-10	1	1	1	1	8	8
Ratio Route 11 to best ranked of Routes 1-10	1.44	1.04	1.10	1.10	0.81	0.81
Ratio Best:Worst for Routes 1-11	1.69	1.65	1.24	1.23	1.51	1.51

The above results calculate present values by discounting amounts to the age at entry to the workforce at an annual rate of 5%, which maintains the real value of amounts relative to the assumed rate of inflation of 5%. Results have also been obtained using a valuation rate of 4%, allowing for a risk premium after retirement, relative to an inflation rate of 5%. This basis does not change the order of the relative advantages to each individual. Comparisons of the values of net consumption in retirement plus the residual estate for Route 11 and the best alternative route give the following results. Assuming common mortality of 14 years, Route 11 gives an advantage of 6% to the average earner, and 3% to the higher earner, compared to rates of 10% and 9% respectively under the

previous basis. The lower income earner is disadvantaged by following route 11, which has a value of 96% of the highest valued alternative route. Using the differential mortality assumption the value to the lower earner is 1% greater than by the best alternative route. The higher income earner receives 24% less value by route 11 than by the best alternative.

When the level of earnings and growth rates is lowered by 2%, and the differentials between the rates maintained, the general result is unchanged. For example, for the median earning individual experiencing average mortality, the advantage of using Route 11 rather than the best 'income raising' alternative is an increase in post-retirement consumption value of 7%, as opposed to the 10 % advantage when rates are assumed to be at the higher level. These results allow for the fact that the median earnings profile would be at a lower level than under the original basis, but that the real growth in earnings remains the same.

4. CONCLUSIONS

Individual retirees face a daunting task when they consider how best to invest their accumulated superannuation account and non-superannuation savings. This paper has highlighted the fact that there is rarely an obvious decision in this choice and that the 'correct' decision depends on a number of factors including the level of benefits, the individual's income level, the means-tests, the tax rates on income and superannuation benefits and the person's life expectancy.

The results also suggest that the government's existing retirement income strategy may have a number of unexpected consequences. In particular, using a consumption measure, many retirees will be better off consuming their accumulated savings and relying solely on the age pension for their retirement income. In terms of the need to increase the stock of national savings, this is clearly not a desirable outcome. Further, the current arrangements do not make the purchase of annuities a generally attractive option for retirees. The paper has shown that differential mortality has a substantial effect on the

comparisons among alternative strategies. The implications of any legislation requiring that superannuation to be taken in the form of life annuities should allow for these effects.

It is appropriate to represent the required decision process as a retirement maze. It does not seem desirable that individuals are required to face such a complex set of decisions. Major simplifications are required both to improve the efficiency of the retirement income system and the allocation of resources within the economy.

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Appendix 1: The LITES model

The model is designed to calculate the costs and benefits associated with earnings, direct and indirect levels of taxation, savings and superannuation, under a variety of conditions. It enables examination of selected individuals or simulated cohorts, and produces alternative measures of inequality and progressivity. For a full description see Atkinson, Creedy and Knox (1994).

Earnings profiles

Gross earnings in each year of working life are generated using a model of age-earnings profiles in which earnings in age group t are lognormally distributed as $\Lambda(\mu_t,\sigma_t^2)$, where μ_t and σ_t^2 are respectively the mean and variance of the logarithms of earnings. These two parameters are assumed to be quadratic and linear functions of t respectively, so that :

$$\mu_t = \mu_1 + (\theta + g)t - \delta t^2 \qquad \text{(A1.1)}$$

$$\sigma_t^2 = \sigma_1^2 + t\sigma_u^2 \qquad \text{(A1.2)}$$

where g is the nominal growth rate of earnings which affects all age groups equally. The five parameters μ_1, σ_1^2, θ, δ and σ_u^2 were estimated using data for Australian males; see Creedy (1992), are $\mu_1 = 9.98064$, $\theta = 0.0385$, $\delta = 0.00086$, $\sigma_1^2 = 0.1817$, $\sigma_u^2 = 0.00575$, $g = 0.06$.

Suppose that v_q represents the qth percentile of the standard normal distribution N(0,1); for example, a value of $v_q = -.6745$ represents the 25 th percentile, while $v_q = 0$ represents the median or 50 th percentile. The corresponding value of earnings, y_q, from the lognormal distribution $\Lambda(\mu_t,\sigma_t^2)$ is therefore:

$$y_q = \exp(\mu_t + \sigma_t v_q) \qquad \text{(A1.3)}$$

The earnings profiles in Figure 2 were obtained using equations (A1.1) to (A1.3) for t ranging from 1 to 45.

Age at Death

Where differential mortality is assumed, the number of years the individual survives after retirement, d, is obtained using the following formula:

$$d = \bar{d} + B \log\frac{\bar{X}}{M} \qquad \text{(A1.4)}$$

where $\bar{X}$ is the individual's annual average real earnings, M is the geometric mean value of the $\bar{X}$s, $\bar{d}$ is the average number of years individuals in the general population survive after retirement. The values used are: $\bar{d}$ = 14.6, B = 8, M = 35966.82, where the value of M was obtained by simulating the experience of a cohort of individuals.

The major economic assumptions used are shown in Table A1.

Table A1. Economic Assumptions used

Annual inflation rate	5%
Annual increase in AWOTE	6%
Annual increase in income tax thresholds	5.5%
Gross annual investment rate of return on Super accumulation	9%
Gross annual investment rate of return on Savings accumulation	7%
Gross annual rate of return on Bank account during retirement	5%
Tax on super fund investment income	7.5%
Tax on savings fund investment income	25%
The cost of a unit retirement annuity, indexed to inflation	$12.5

Appendix 2: Taxation during the working life

This appendix describes the tax structure that applies during the working life. It is used to generate the series of superannuation contributions and other savings made by each of the hypothetical individuals, in order to produce the amounts available at retirement. The thresholds and limits are those that apply at July 1994, and are indexed in line with AWOTE, unless otherwise stated.

The calculations assume annual superannuation contribution rates of 3% of gross earnings, X, for the employee, and 9% of gross earnings for the employer. This rate of employer contribution is the target level set out by the government in the Superannuation Guarantee Charge legislation. The rate of employee contribution is chosen to reflect the combined rate of 12%, which is the level considered to be adequate and desirable in the government's strategy for national savings (Dawkins, 1992).

The employees' contributions are all of the undeducted type, and for this reason an income tax rebate, R, may arise from them. The rebate calculation requires several steps. First:

$$\begin{aligned} R &= 100 && \text{if } X < 27{,}000 \\ &= 100 - 0.025\,(X - 27{,}000) && \text{if } 27{,}000 \le X \le 31{,}000 \\ &= 0 && \text{if } X > 31{,}000 \end{aligned} \qquad \text{(A2.1)}$$

where X, gross earnings, is also taxable income, since it is assumed there are no allowable deductions against income. However, the value of R is restricted to a maximum of 10% of undeducted employee contributions. Hence if X is $20,000, 10% of the undeducted contributions (3% of $20,000) is equal to $60, so the rebate is in fact $60 rather than the $100 indicated by equation (A2.1). Indeed, assuming an employee contribution rate of 3%, the maximum rebate is $81, when X = $27,000. The maximum rebate of $100 is therefore applicable only to those who contribute more than 3% at lower earnings levels.

The rebate is subject to a further eligibility test. The total of the deducted superannuation contributions, normally made by the employer or a self-employed person, is tested against a scale of age linked maxima, R_M, where the relevant age is that of the individual in the year the contributions are made. This scale is given by:

$$\begin{aligned} R_M &= \$9{,}000 && \text{if age} < 35 \\ R_M &= \$25{,}000 && \text{if } 35 \leq \text{age} < 50 \\ R_M &= \$62{,}000 && \text{if } 50 \leq \text{age} \end{aligned} \qquad \text{(A2.2)}$$

When deducted contributions are 0.09X, as assumed in the calculations reported below, these limits will not be exceeded. They are designed to discourage excessive use of the tax advantages of superannuation.

The calculations assume that there are no other sources of income such as self employment or rental income. Hence, income tax, T_X, is calculated on the value of gross earnings, X, rounded down to the nearest dollar. The income thresholds are assumed to increase by 5.5% each year, which is 0.5% lower than the assumed rate of increase in average wages. The income tax thresholds are assumed to increase at a lower rate than other thresholds in order to allow for the tendency for tax thresholds to become lower in real terms. The Medicare levy is added at a rate of 1.4% of taxable income, if the taxable income exceeds \$12,000; this limit is also increased by 5.5% each year.

In addition to the above rebate R, there is provision for a rebate to low income earners. The amount of rebate, E_r, is calculated in the following way.

$$\begin{aligned} E_r &= \$150 && \text{if taxable income} \leq \$20{,}700 \\ E_r &= \$150 - .04\,(\text{taxable income} - 20{,}700) && \$20{,}700 < \text{taxable income} \leq \$24{,}450 \\ E_r &= 0 && \$24{,}450 < \text{taxable income} \end{aligned} \qquad \text{(A2.3)}$$

The total tax payable, T, is obtained using:

$$T = \text{maximum } [T_X + \text{Medicare levy} - (R + E_r), 0] \qquad \text{(A2.4)}$$

The disposable income in each year of working life, A, is defined as earnings less employee superannuation contributions less income tax payable. Hence:

$$A = X\,(1 - 0.03) - T \qquad \text{(A2.5)}$$

This amount is distributed between long term savings and consumption. The results presented in Section 3 are based on annual saving of 5% of disposable income. The amount spent is simply equal to A less the amount saved, S.

Savings are accumulated each year in a fund of value F_t after t years. It is assumed that savings are made throughout the year, so that on average they attract half a year's interest in the year that they are made. The amount of interest earned by the fund in the t^{th} year, Y_S, where the gross annual nominal rate of interest is assumed to be 7%, representing a real return of 2% per annum, is given by:

$$Y_S = 0.07\,(F_{t-1} + S/2) \qquad \text{(A2.6)}$$

In view of the wide range of investment opportunities available and the tax treatment of investment income, it does not seem appropriate to assume that interest income is simply added to income from employment for income tax purposes. In order to simplify the calculations, it is assumed that tax on the interest, T_S, is imposed at a flat rate of 25%. The value of F at the end of year t is calculated as follows:

$$F_t = F_{t-1} + Y_S - T_S + S \qquad \text{(A2.7)}$$

Appropriate substitution gives $F_t = 1.0525F_{t-1} + 1.02625S$.

Superannuation contributions are accumulated each year in a fund, of value W_t at the end of the t^{th} year. Since July 1988 there has been a 15% tax on deducted contributions, paid by the superannuation fund, and a tax on the fund's investment income. The contribution tax does not apply to undeducted contributions. Insurance and administration costs are not allowed for in this paper. The contributions tax, T_C, is therefore obtained as:

$$T_C = 0.15\ (0.09\ X) \qquad \text{(A2.8)}$$

The net annual contribution to the superannuation fund, C_W, is therefore given by:

$$C_W = X\ (0.03 + 0.09) - T_C \qquad \text{(A2.9)}$$

Appropriate substitution gives $C_W = 0.1065X$

It is assumed that annual investment income of the superannuation fund, Y_W, is earned at a constant annual nominal rate of 9%. This rate reflects an assumption of a long term real rate of return of 4% in excess of the 5% CPI long term rate assumption. The superannuation fund is expected to earn a higher rate of interest than the savings fund, by virtue of it's greater exposure to higher risk, higher yield investments such as equities. In general other savings may be expected to reflect a lower risk portfolio of investment, such as bank cash deposits. Contributions are assumed to be made throughout the year, and therefore to attract an average of half a year's return in the year that they are made. Investment income is thus calculated using:

$$Y_W = 0.09\ (W_{t-1} + C_W/2) \qquad \text{(A2.10)}$$

Tax on this investment income, T_w, is assumed to be exacted at a flat rate of 7.5%. This rate is an approximation of the effective rate of tax paid, making an allowance for dividend imputation and other credits which might be expected to attach to the fund earnings. The statutory rate is 15%, and so it is assumed that such credits effectively reduce the nominal tax liability by half, so that:

$$T_w = 0.075\ Y_w \qquad \text{(A2.11)}$$

Finally, the accumulated value of the superannuation fund at the end of year t is given by:

$$W_t = W_{t-1} + Y_w + C_w - T_w \qquad \text{(A2.12)}$$

Appropriate substitution gives the result that $W_t = 1.08325\ W_{t-1} + 0.111\ X$.

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