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# LIFETIME INCOME, TAXATION, EXPENDITURE AND SUPERANNUATION (LITES): A LIFE-CYCLE SIMULATION MODEL

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# A LIFE-CYCLE SIMULATION MODEL

This document describes the scope and execution of the program LITES, which models the economic progress of individuals from entry into the workforce until death in retirement. The model is highly flexible in terms of the economic or behavioural conditions which may be imposed. A general description of the model is given in section 1. The procedure followed for each individual in the simulation run is described in the subsequent sections. This description follows the logical sequence of the program and an individual's life cycle. Section 2 describes the individual's earnings stream and age of death. Each year of working life is then examined in section 3. Decisions which must be made at retirement are described in section 4, while each year of retirement is examined in section 5. The available choices which must be made at each stage are also described. Section 6 describes the information obtained for each individual. The various input and output files are described in the appendices. The final appendix contains a glossary of terms.

## 1. A DESCRIPTION OF THE MODEL

### 1.1. Population Characteristics

Within this model, populations are composed of unique individuals, all of whom are of the same sex, have the same age of entry into the workforce, and the same retirement age. These entry and retirement ages are specified by the user. Individuals in a population are required to follow the same decision procedures, though their behaviour depends on their own particular circumstances. Individuals are uniquely characterised by their earnings stream during their working life and the number of years they survive in retirement. The minimum entry age is 20, and retirement occurs between ages 55 and 75, as the user specifies. Retirement is the only means of leaving the workforce.

Annual earnings figures are constructed for each individual independently, reflecting the assumed salary progression rate, and an assumed population income distribution. The user has extensive control over these assumptions. This enables the user to study the experience of cohorts whose income characteristics may follow a wide range of assumptions. The 'earnings' figure may represent either gross salary or the effective remuneration cost to the employer. This effective cost comprises gross salary plus employer superannuation contributions. It is possible to compare the effects of employer costs which are distributed in different ways between salary and superannuation contributions.

The age at death of each individual is calculated with regard to their effective earnings experience. The individual experience is compared to that of a large population, and a relative mortality, linked to the individual's earnings profile, is calculated. All individuals are assumed to survive until retirement, and none survives beyond the age of 100.

The income thresholds in the income tax table are increased at an annual rate specified by the user, this rate being constant throughout the cohort run. Other input data, relating to superannuation tax thresholds, income thresholds used in decision procedures, levels of age pension and associated rebates and thresholds, are all increased at a distinct rate representative of increases in AWOTE, (i.e. Average Weekly Ordinary Time Earnings).

1.2. Working Life

Individuals make superannuation contributions of a specified proportion of gross earnings. Individual contributions may be classed as either deducted or undeducted, where deducted contributions attract immediate income tax concessions, while undeducted contributions do not. All individuals in a cohort make contributions of the same type as specified by the user.

Superannuation contributions by the employer are specified as a proportion of either the gross salary or in addition to the gross salary. The rates of contribution are constant during the working life, and are common to the whole cohort. Contributions are accumulated in a superannuation fund subject to the specified constant rate of earnings and after deduction of the appropriate level of contribution tax. The flat rate of taxation on the fund's investment earnings is specified by the user. 'Deducted' and 'undeducted' contributions are distinguishable within this superannuation fund, to enable different taxation treatment at and during retirement.

Income is taxed according to the specified table of income tax rates and thresholds. There is the capacity to store 10 different tables, any one of which may be used for a particular run. Medicare is applied at a specified rate to incomes which are over a given threshold. Appropriate allowance is made for any rebate arising from superannuation contributions made.

After the gross income has been reduced by the amount of superannuation contributions made by an individual, and by the appropriate amount of income tax, savings of other kinds are made. These are made by the simple application of a percentage rate to the amount available in excess of a specified threshold. Consideration is thereby made for the relative wealth of the individual. The savings made in this way are accumulated in a distinct savings fund at a constant rate of interest. It is possible to have this interest taxed at a flat rate or at the individual's marginal income tax rate. Having allowed for all other disbursements, (i.e. superannuation, taxation and savings), the balance of the annual income is put to immediate consumption. This may be taxed at a specified tax-inclusive rate to allow for a general consumption tax.

1.3. Retirement Decisions

Upon reaching retirement age each individual is presented with the same sequence of choices regarding the use of the accumulated savings and superannuation funds. It is possible to use the available funds to provide a defined level of income, or to use a specified proportion of the available funds to purchase retirement income. The superannuation benefit may be commuted to a lump sum before purchasing an annuity by one of the following two methods.

The required level of income is defined as a proportion of the salary averaged over a number of years leading up to retirement. In this case it is possible to choose to draw the necessary monies from the savings fund first, or from the superannuation fund first, with any balance of the superannuation fund unused by the purchase being taken as a lump sum. A measure of the adequacy of the retirement provision is made, being the ratio of the total disposable funds at retirement to the cost of the target level of income. Individuals for whom this ratio is less than one are unable to fund the desired benefit, and are identified in the output.

Alternatively, it is possible to specify a proportion for each of the superannuation and savings funds which defines the fraction of each fund applied to the purchase of retirement income. This method of purchase may also be used if the entire superannuation benefit has been taken as a lump sum.

Once the commutation decision has been made, and any retirement annuities purchased, the appropriate level of lump sum tax is calculated. Concessionary taxation amounts relating to the purchase of the annuities, and punitive rates applying because of any 'excessive' lump sum taken, will be applied during the period of retirement on an annual basis.

Some of the cash remaining after the purchase of retirement income and the payment of lump sum tax due may be put to immediate consumption. The amount spent immediately may be linked to the individual's circumstances, where the circumstances are described either by earnings in the year preceding retirement, or the amount of cash now available. It is possible to apply up to three different proportions to the amount of cash available depending on how the individual's circumstances compare with average weekly earnings.

The last action at retirement involves investment. The amount of cash remaining, after the previous disbursements, is invested in a notional 'investment account', attracting a specified rate of interest. The interest is treated as income for tax purposes.

1.4. Retirement Years

Income in retirement comes from four possible sources. These are: retirement annuity purchased by savings or superannuation funds; age pension; and investment account interest. The age pension payable, and any associated income tax rebate, is calculated subject to the specified income means test. No asset test is applied.

The income is taxed having regard to any rebates, exemptions or punitive rates arising from the purchase of annuities, superannuation contributions tax, age pension in payment, and lump sum amounts taken.

No net savings are made in retirement. The amount spent in each year is equal to the post-tax income plus a proportion of the capital in the 'investment account'. It is assumed that the capital in the investment account is 'wasted' over a number of years, (up to a maximum of 25), till there is a nil balance at a specified age. The balance in each year is divided by the number of years of life remaining until this specified age, and this amount is spent, in addition to the disposable income. Those who die before the specified age will thus leave an estate equal to the balance outstanding in their account, and those who survive beyond it will reduce their capital to nil during their lifetime. Amounts spent are subject to the specified rate of consumption tax.

## 1.5. Results

LITES constructs files of output at four different levels of detail. All amounts are discounted at the specified rate to the age at entry into the workforce. Where simulations of cohorts of more than 20 people are run, the user may specify which output files are required, in order to save run time. The most detailed file of results provides lists of annual values, for each year the individual survives, valued at the entry age, for each individual in the cohort for each of fifteen different items. These include amounts of income, taxation, saving, spending and superannuation contributions. The output is in a form suitable for use in plotting routines or statistical analysis.

Another output file gives a table of nineteen values for each individual in the cohort. These include the values as at entry to the workforce of lifetime income, taxation, superannuation, consumption, and a measure of mortality profit and any residual estate. The table is such that all items of income to the individual and all sources of outgo are represented. In addition, certain statistical information is given which shows whether the individual was able to purchase the target income in a defined retirement benefit scenario, and the ratio of the available to required funds (the 'proportion funded'). Also a 'benefit:cost' ratio is given, defined as the value of total net consumption divided by the sum of income, superannuation, and investment income tax.

One output file contains lists of the above data for each individual in the cohort in a form suitable for use by another program. The briefest output file contains a table of the above data totalled for the entire cohort. It varies in detail in that it gives the number of individuals who have been underfunded, and the average proportion funded only for those who are underfunded. The benefit:cost ratio given is the average of individual values for the cohort.

## 2. STOCHASTIC COMPONENTS

2.1. Earnings over the working life

A salary stream X(t) is constructed to represent the working life of the individual, using a stochastic model. Earnings in the first year are obtained by taking a random drawing from a lognormal earnings distribution with mean and variance of logarithms of $\mu_1$ and $\sigma_1^2$. Mean log-earnings at time t, $\mu(t)$, are a quadratic function of age and are given by

$$\mu(t) = \mu_1 + (\theta + g_r)t - \delta t^2$$

where $g_r$ is the nominal growth rate of earnings.The simulation process used to produce the profile X(t) can allow for various types of process of relative income change.There may be 'regression towards the mean' where the relatively richer people experience, on average, relatively lower percentage increases (when $\beta<1$). Furthermore, there may be dependence on the past, where each individual's relative change depends on previous changes (depending on the paramater $\rho$). The process is described by the following equations:

$$X(t) = \left\{\frac{X(t-1)}{m(t-1)}\right\}^{\beta} \exp\{\mu(t) + u(t)\}$$

$$u(t) = \rho u(t-1) + e(t)$$

where e(t) is a random normal variable with mean 0 and variance $\sigma_u^2$, $m(t) = e^{\mu(t)}$. The parameters of the model can be estimated using income distributions data where $g_r$ is the nominal growth rate of earnings.

The values of X may represent salary only, and any employer superannuation contributions are calculated in addition to this,(IES=0). Alteratively, the values X may be taken to represent a level of employer subsidy, (IES=1), which include salary *plus* any superannuation contribution. The earnings stream values are replaced by:

$$= \frac{X(t)}{1 + (ER)\ (IES)}$$

It is thus possible to compare the advantages of salary 'packages' which have different structures, but which have the same cost to the employer, or compare packages which have the same level of 'earned income' for the employee, but different cost to the employer. For further details refer to Appendix 3.

2.2. Age at Death

The number of years the individual survives after retirement, DIE, is obtained using the following formula:

$$DIE = AVD + B \log \frac{\overline{X}}{RM} + v$$

where $\overline{X}$ is the individual's annual average real earnings, RM is the geometric mean value of the $\overline{X}$s, AVD is the average number of years individuals in the general population survive after retirement, and v is random normal variable with mean 0 and variance SUU.

## 3. WORKING LIFE

The individual begins working life of W years at age ENTRY, and survives to age ENTRY + W+ DIE . The limits on these parameters are such that

$$\begin{aligned} 20 \leq\ & ENTRY \leq 54 \\ 55 \leq\ & ENTRY + W \leq 75 \\ & ENTRY + W + DIE \leq 100 \end{aligned}$$

For each year of working life, the following steps are taken:

3.1 Superannuation Contributions

Superannuation contributions each year are calculated using:

Employee undeducted = EEU = (SU) X
" deducted = EED = (SD) X
Employer = EER = (ER) X

where SU, SD, ER, are specified rates of contribution. Vectors EEU, EED and EER are constructed. The rebate arising from these, RSD, is calculated using:

$$RSD = \min(SCREB, SCREB - SCR\ (X - SCRTHR))$$

where SCREB is the maximum rebate level, SCRTHR is the related income threshold. The maximum rebate is reduced by a proportion, SCR, of incomes in excess of this threshold. The rebate and threshold are adjusted each year using the the rate of increase of Average Weekly Ordinary Time Earnings, AWOTE. The values in year i are SCREB and SCRTHR multiplied

by $(1+AWOTE)^{(i-1)}$. RSD is then subject to a sequence of tests, and the value adjusted accordingly.

RSD= max(RSD,0) Since RSD must be non-negative

RSD= min(RSD, (RSDP) EEU) Since RSD must be not more than a proportion, RSDP, of undeducted employee contributions.

To bypass the income test, set SCRTHR to a value significantly higher than any possible initial years earnings. This approach to the rebate on employee contributions is to allow for the current Australian arrangements where there is an income tested rebate, which phases out at an income of $31,000 and is limited to a maximum annual rebate of $100.
The total of deducted super contributions, Z, is set equal to EED+EER , and is tested against the statutory age linked maxima:

| | |
|---|---|
| if age < IAGE1 | Z < CONTH1 |
| if IAGE1≤ age <IAGE2 | Z < CONTH2 |
| if IAGE2 ≤ age | Z < CONTH3 |

where age is the age of the individual in the year the contributions are made. If Z exceeds the appropriate limit then RSD = 0. As from 1 July 1994, maximum superannuation contributions subject to a deduction or rebate will be linked to the contributor's age.

To bypass this test, set IAGE1 and IAGE2 to a value less than the specified ENTRY age. (eg. 19 will exclude the effects of the test)

Values of CONTH in year i are multiplied by $(1 + AWOTE)^{(i-1)}$.

3.2 Income taxation

The same tax table, contained in one of the TXRAT- files, is used throughout each run of LITES, and for the pre- and post- retirement periods. Income tax is calculated on the integral value of X using the tax table referred to by the data flag ITABLE. (For further detail refer to Appendix 4. )
Medicare levy is added at rate RMED of taxable income AT, if AT> THMED.
Tax and medicare threshold values in year i are increased by a factor of $(1 + ET)^{(i - 1)}$.

Tax payable = TAX = max(tax + medicare - RSD, 0)

This amount is stored in vector EIT, which holds the annual amount of income tax due in each year of the individual's life.

3.3 Spending and Saving

The disposable income, A, is defined as earnings less employee superannuation contributions, less income tax payable:

$$A = X - EEU - EED - TAX$$

This amount is distributed between savings and consumption, according to the criteria specified. First, the amount saved is calculated subject to the following two tests.

if flag L = 0 amount saved =0

if flag L = 1 amount saved = (A - THSAV1) RATE1

where THSAV1 is the threshold of disposable income above which savings are made at rate RATE1. This threshold value is increased in year i by a factor of $(1 + AWOTE)^{(i-1)}$. The amount saved each year of working life is stored in vector SAI.

The amount spent, SP, is set equal to residual income A less the amount saved. The amount of general consumption tax payable, GST, is calculated.

If flag G=1

the specified rate of GST = GR1

consumption tax paid = $\frac{(SP)(GR1)}{(1 + GR1)}$

otherwise tax = 0

A vector GST is incremented by the amount of tax incurred. A vector S is incremented by the amount of net spending, where this equals (SP - consumption tax).

Savings which are made are accumulated each year in a fund, FW, in the following way. The amount of interest earned by the fund, C, is calculated, where the gross annual rate of interest is IR.

$$C = IR\ (FW_{i-1} + SA/2)$$

where $FW_{i-1}$ is the fund value at the start of a year and SA is the amount saved during the year.

The present value, at entry, of investment income during working life, WIN, is incremented by

$$\frac{C}{(1 + DISC)^i}$$

Tax on the interest, NET, is calculated according to the method indicated by the value of SAVE. That is, in one of two ways:

if SAVE = 1 then investment income is taxed at a flat rate IIT, and NET = (IIT) C

if SAVE = 2 then tax is calculated at marginal personal income tax rates, such that:

NET = income tax due on earnings increased by C
- tax due on earnings as calculated

The value of FW at the end of year i is calculated as follows:

$$FW_i = FW_{i-1} + C - NET + SA$$

3.4 The Superannuation Fund

Superannuation contributions are accumulated in a fund, VW, each year, subject to the specified contribution tax, and net investment income. Within the current Australian environment, there is a 15% tax on deductible contributions (from the employer or member) paid by the superannuation fund and a tax on the funds investment income. These amounts are calculated as follows:

Contribution tax = SCTAX = SCTR (EER + EED) where SCTR is the specified rate of contributions tax. This tax does not apply to undeducted contributions. A vector SCTAX is incremented by this amount each year of working life. Thus the net annual contribution to the super fund, CONTN, is:

CONTN = EER + EED + EEU - SCTAX

The amount of annual investment income to the super fund, REWARD, which is earned at a flat annual rate, SR, is then calculated.

$$REWARD = SR\ (VW_{i-1} + CONTN\ /2)$$

The present value, at entry, of the total investment income earned by the super fund, SIN, is incremented by:

$$\frac{\text{REWARD}}{(1 + \text{DISC})^i}$$

Tax on super investment income, exacted at a flat rate, SIT, is then calculated.

$$\text{SITAX} = (\text{SIT})\ (\text{REWARD})$$

A vector SITAX is incremented by this amount each year of working life.
Finally, all items of income and outgo having been calculated, the accumulated value of the super fund at year end, is:

$$VW_i = VW_{i-1} + \text{REWARD} + \text{CONTN} - \text{SITAX}$$

## 4. RETIREMENT DECISIONS

Retirement is assumed to occur on the $(\text{ENTRY} + W)^{th}$ birthday, at the end of the tax year. Individuals are assumed to enter a tax year immediately after attaining a birthday, and enter the workforce immediately after attaining age ENTRY. Retirement decisions are made at retirement at the end of the W th tax year. Related taxes are assumed to be payable immediately, and one-off cash distributions, either to savings or to consumption, are assumed to occur immediately. The decisions which must be made at retirement are shown in the flow diagram shown in Chart 1. Further details of each stage are given below.

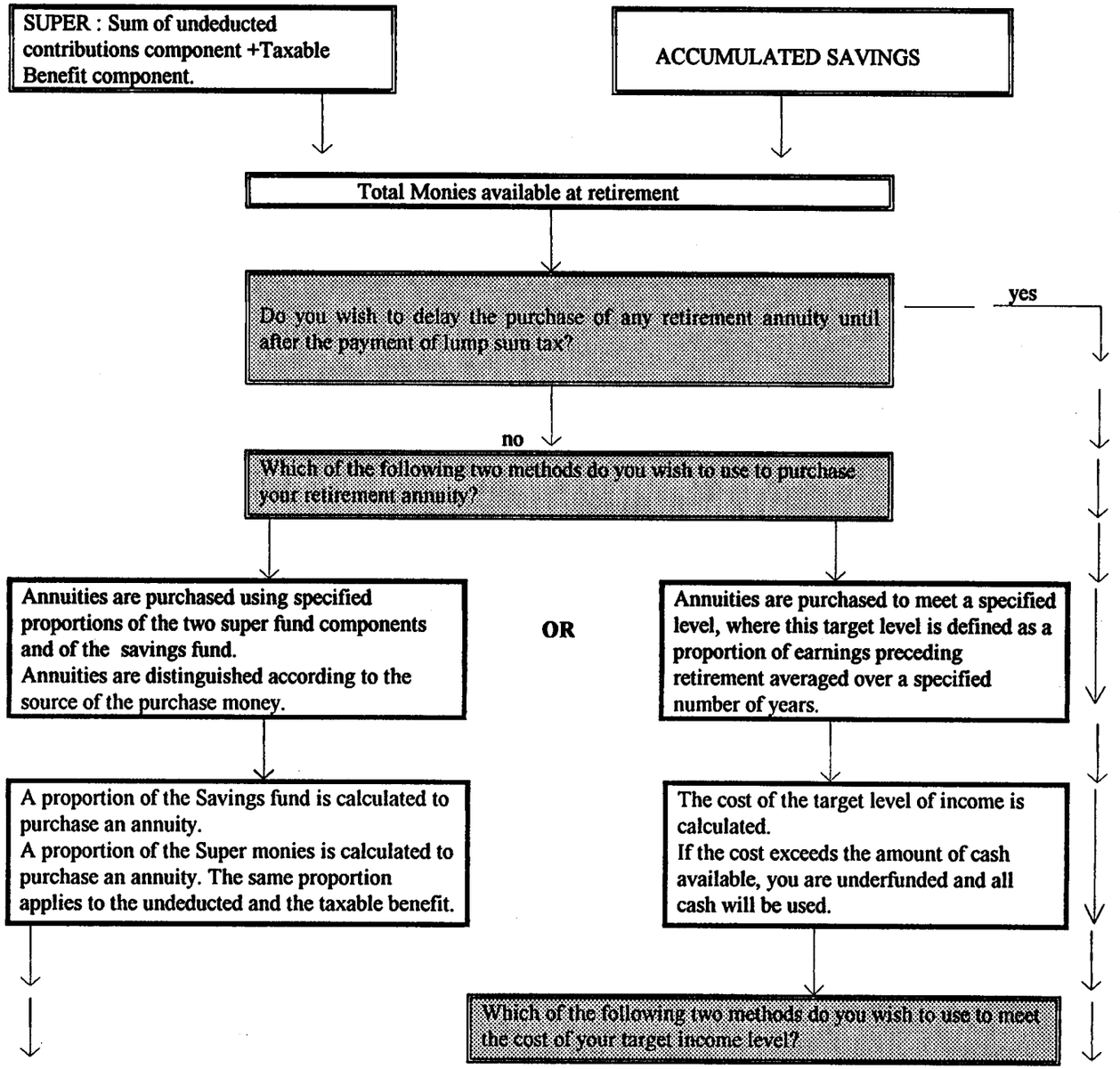
### 4.1 Commutation of Superannuation

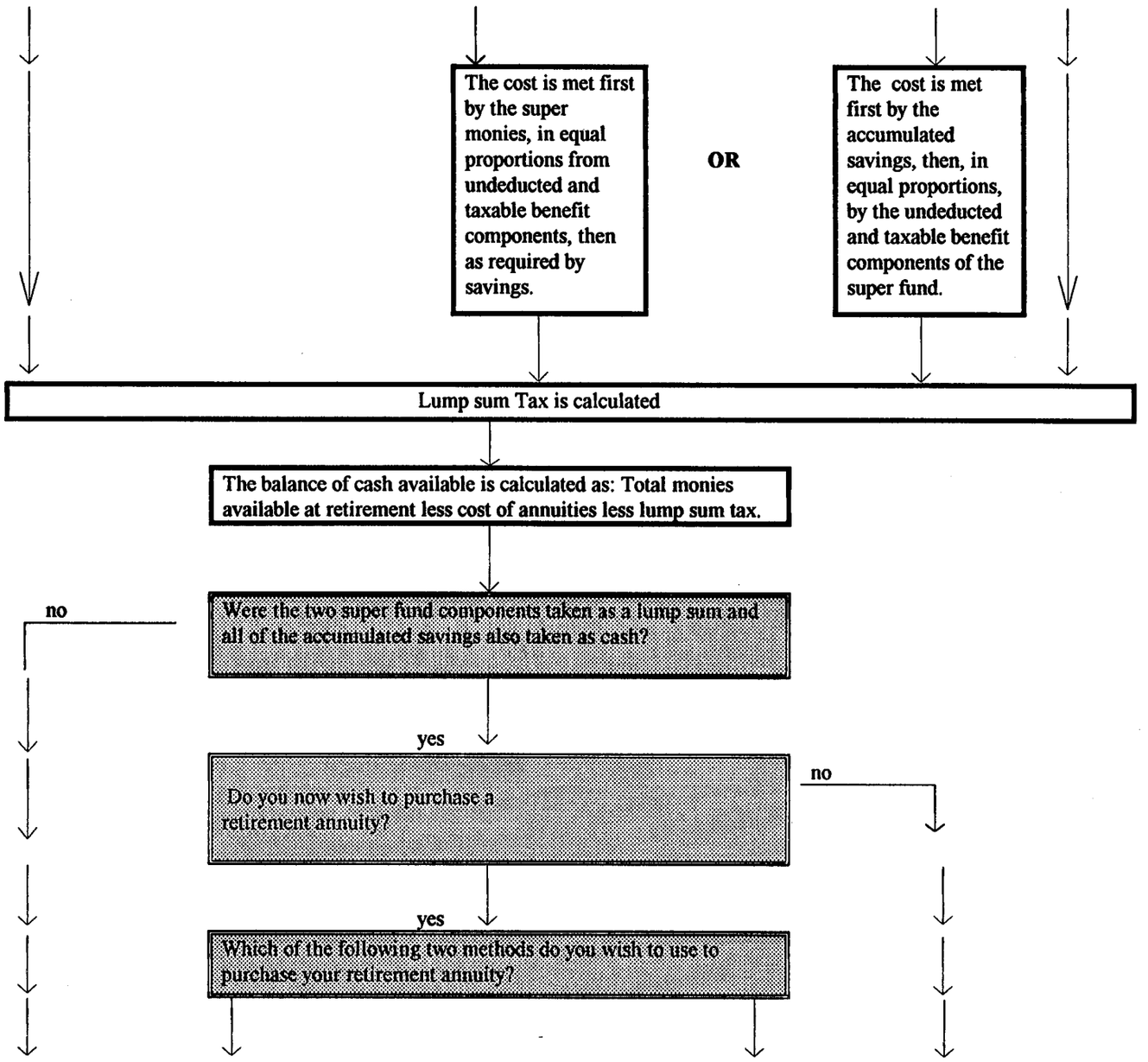
At retirement, options exist to commute a specified part of the superannuation accumulation to a lump sum, and the balance, if any, is used to purchase an annuity. The same options exist for the accumulated savings. The specified value of the item ICOMM indicates the criteria defining the level of income to be purchased. The item PRIOR may have three different values, which indicate either that all the superannuation fund is to be taken as a lump sum, (PRIOR = 2), or which of the savings or superannuation fund monies is to be used first to purchase the required level of income. The procedure is as follows:
The sum of the undeducted contributions, UNSUM, is separated from VW, the accumulated super fund,

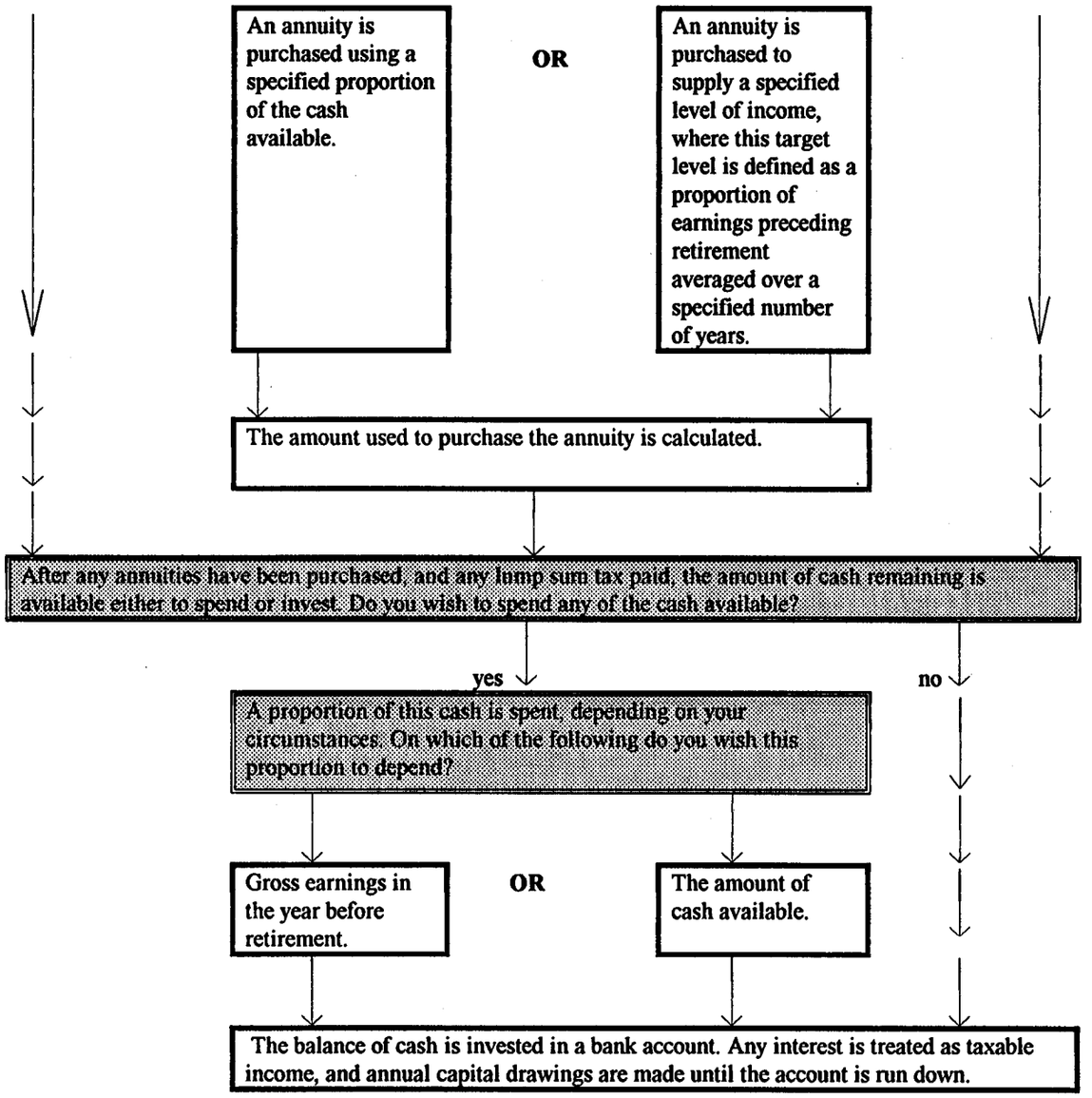
$$\text{UNSUM} = \sum_i \text{EEU}_i$$

and so VW - UNSUM = accumulated value of other (deducted) super contributions
plus investment earnings on the undeducted contributions
= the taxable benefit

## CHART 1. DECISIONS AT RETIREMENT




The cost is met first by the super monies, 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 super fund.
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.
no
Were the two super fund components taken as a lump sum and all of the accumulated savings also taken as cash?
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.

There are three initial options for the commutation of the funds available, PRIOR =2, ICOMM = 1, ICOMM = 2:

(i) PRIOR = 2

This indicates that all superannuation monies are taken as a lump sum, and the next step is as for ICOMM = 2 The option occurs later to purchase an annuity.

(ii) ICOMM = 1

This indicates that commutation is made on a specified proportional basis.

PSUP = proportion of VW applied to purchase annuity
PSAV = proportion of FW applied to purchase annuity
CAU = cash applied to annuity from undeducted contributions
= (PSUP) (UNSUM)
CAD = cash applied to annuity from taxable benefit sources
= (PSUP) ( VW - UNSUM)
CLSU = cash taken as lump sum from undeducted contributions
= UNSUM - CAU = (1-PSUP) (UNSUM)
CLSD = cash taken as lump sum from taxable benefits
= VW - UNSUM - CAD
FWANN = amount of savings fund applied to purchase annuity
= (PSAV) (FW)
FWCASH = amount of savings fund taken as cash
= FW - FWANN

(iii) ICOMM = 2

This indicates that commutation is made with reference to a target level of income.The level of income required is FAST, a proportion of some final average salary, where

$$FAST = \frac{(RIP)\ (SUMX)}{FAP}$$

and RIP is the specified retirement income proportion of SUMX, the sum of salaries X over FAP years preceeding retiral.

The amount of cash required to satisfy this income requirement is COST where:

$$COST = (FAST)\ (MAS)$$

and MAS is a market rate to purchase a whole life annuity for an individual aged ENTRY + W, escalating at rate ES. The proportion funded, FB, is set as:

$$FB = \frac{(FW + VW)}{COST}$$

The cash required is drawn from the super and savings funds according to one of three possible priorities as specified by PRIOR.

(i) PRIOR = 1

The cost of the annuity is drawn first from VW, the super fund, in equal proportion from taxable benefit and undeducted contributions.

CAU = (COST) (UNSUM)/VW
CAD = (COST) (VW - UNSUM)/VW

Cash is then drawn from the savings accumulation FW if and as necessary.

(ii) PRIOR = 2

All the super fund is taken as a lump sum. All savings are taken as cash. No annuity is purchased at this stage. The option to purchase an annuity is given later, according to ICOMM, but at this point the distinction between money saved as super and as private savings is lost.

(iii) PRIOR = 3

As for PRIOR =1, an annuity is purchased on a proportional income basis, except that the required monies are taken from savings first. Money drawn from the super fund is taken in equal proportions from the taxable benefit and undeducted contributions. Any super fund not required for the purchase is taken as a lump sum.

If COST > CAU + CAD + FWANN (i.e. if the total of monies available is less than the cost of providing the specified level of income) then the item POOR is set equal to 1. At the end of the cohort run, the sum of the individual items POOR will indicate the number of individuals who could not fund their defined benefit level. Each of these individuals is identified by the value of POOR=1 in their individual record. Others have POOR=0.

Cash values are thus calculated for:

| item | source | destination |
|---|---|---|
| CLSU | VW, undeducted contributions | lump sum |
| CLSD | VW, taxable benefit | lump sum |
| CAU | VW, undeducted contributions | annuity |
| CAD | VW, taxable benefit | annuity |
| FWCASH | FW | cash |
| FWANN | FW | annuity |

4.2 Taxation of the Lump Sum

Lump sum tax and any associated 'excessive proportion' for the annuity are calculated. A value for E is calculated, indicating which of the statutory lump sum limits applies:

if (CAU + CAD ) ≥ VW -(CAU + CAD) then E=1, otherwise E=0

If E=1 then the higher of the reasonable benefit limits, RBLU, applies to the lump sum, because less than 50% of the super fund, VW, is taken as a lump sum. Otherwise RBLL applies in the calculation of the 'excessive proportion', EC.

$$EC = \frac{(CLSD + CAD)-(RBLL + E(RBLU-RBLL))}{(CLSD + CAD)}$$

where EC is ensured ≥ 0, and adjusted to 4 significant figures, and the values of RBLL and RBLU are increased by $(1+AWOTE)^{(W-1)}$.

Now the lump sum tax, TAXLS, is calculated:

= R1 ( CLSU)
+ R21 (CLSD(1-EC) -TH1)
+ (R22 - R21) (CLSD (1-EC) - TH2) if positive
+ (R23 - R22) (CLSD (1-EC) - TH3) if positive
+ R3 ( CLSD )EC

where THi are the lump sum tax thresholds, and R1, R2i and R3 are specified rates of taxation. The THi values are increased by a factor of $(1 + ET)^{(W-1)}$ at the date of retirement. There is provision for a three tier tax table to apply to the non-excessive part of the lump sum drawn from the taxable benefit, (i.e. on the amount CLSD (1-EC) ), as follows:

| | | | |
|---|---|---|---|
| in excess of | TH1 | R21 | applies |
| " | TH2 | R22 | " |
| " | TH3 | R23 | " |

4.3 Allocation of Disposable Wealth

The total cash available at retirement, after purchase of retirement income and payment of tax, is now given by:

FREE = CLSU + CLSD + FWCASH - TAXLS

This amount may be put to the purchase of income if the super fund was taken entirely as a lump sum, invested in a bank account, or put to immediate consumption, according to the individual's circumstances. The decisions are made in the following way:

If PRIOR =2 and all super has been taken as a lump sum, and no annuity purchased thus far, (i.e. FREE = VW + FW), then there are two possibilities:

(i) If ICOMM = 1 a retirement annuity is purchased using a proportion, PSAV, of the available funds, FREE.

(PSAV)(FREE) = amount applied to purchase annuity
(FREE)(1-PSAV) = balance retained as cash

(ii) If ICOMM = 2 an annuity is purchased relating required income in retirement to a proportion of some final average salary. The amount applied to purchase the annuity = min(FREE,COST)
where COST is, as before, the cash required to provide the specified level of income.
The proportion funded, FB, is calculated FB = FREE/COST
If COST > FREE, indicating the individual is underfunded, then POOR is incremented by 1.

Disposable cash is (FREE - COST) ≥ 0

Decisions regarding the purchase of annuites are now complete, and the calculation of income from annuities and the associated Undeducted Purchase Price, UPP and SUP, can now be made. Income in the first year of retirement is calculated and stored in the vectors BA and BS as appropriate, and each undeducted purchase price, thus:

| | |
|---|---|
| BA(1) = FWANN / AS | Annuity purchased by savings fund |
| SUP = FWANN / E0 | Associated undeducted purchase price |
| BS(1) = (CAU + CAD ) / MAS | Annuity purchased by super fund |
| UPP = CAU /E0 | Associated undeducted purchase price |

where SUP and UPP are constant non-taxable amounts, and BA and BS are vectors of retirement income, associated with savings fund and super fund respectively. E0 is the life expectancy according to the approriate sex specific mortality table, at age ENTRY + W. AS and MAS are market annuity rates, allowing for escalation at rates ES and ESC respectively. Note that these rates should be identical if ICOMM = 2, but need not be if ICOMM = 1.

The present values at ENTRY of the purchase price of the annuities are calculated as follows:

$$COSTA = \frac{FWANN}{(1 + DISC)^W}$$ present value of the savings annuity

$$COSTS = \frac{(CAU + CAD)}{(1 + DISC)^W}$$ present value of the super annuity

These values are used in the calculation of the mortality profit, a figure included in the output data. Mortality profit is here defined to be the present value of the cost of the purchased retirement annuities, less the present value of the payments which the individual actually receives.

Decisions regarding the disposal of any remaining cash are now made. Any amount which is to be put to immediate consumption is calculated according to the specified criteria, and any balance is then used to establish a bank account.

FREE is now the amount of cash remaining from the retirement funds. A figure TEST is constructed, depending on the value of TESTF, which is used to assess the individual's circumstances, and identify the immediate spending behaviour.

If TESTF = 1 then TEST is set equal to $X_W$, final years earnings.

If TESTF = 2 TEST is set equal to FREE, the amount of cash available.

Thus individual behaviour may be linked either to accustomed standard of living, ( as represented by pre-retirement earnings), or to the amount of cash available.

The amount TEST is compared to AWEW increased by a factor CFACi, where AWEW is annual average earnings multiplied by $(1 + AWOTE)^W$. The comparison is applied according to the following table.

| | | | |
|---|---|---|---|
| if: | TEST> (CFAC2)AWEW | then | AMOUNT =(1-CONP3)FREE |
| if: | (CFAC2)AWEW≥TEST>(CFAC1)AWEW | then | AMOUNT =(1-CONP2)FREE |
| if: | (CFAC1)AWEW≥TEST | then | AMOUNT =(1-CONP1)FREE |

where CONPi are the proportions of FREE put to immediate consumption, SPEND, and AMOUNT is put into the bank account.

$$FREE = SPEND + AMOUNT$$

Goods and Services Tax, GST, is calculated on SPEND, and vectors GST and S (net spending) are incremented in year W, as previously described.

## 5. THE RETIREMENT YEARS

### 5.1 The Savings Account

A vector BAL is constructed using subroutine BANK to represent a notional savings account. No subsequent investment is made to this account, and capital drawings are made from the account as described below. The opening balance is AMOUNT as previously calculated.

$$BAL(1) = AMOUNT$$

At each year end the bank account attracts annual interest at constant rate IRR, and is subject to withdrawals of capital for a maximum of 25 years, such that:

Opening balance in year i of retirement = BAL(i)

$$= (1 + IRR)\,(1 - 1/z)\,BAL(i-1)$$

where IRR is some specified interest rate in retirement, and

$$z = AGEX - (ENTRY + W) - i + 2$$

since it is assumed that the amount in bank is wasted over the years to age AGEX, by an amount at age x equal to 1/(AGEX-x). The maximum value of AGEX is ENTRY + W + 25. Those who die before age AGEX will thus leave an estate equal to their amount in bank in the year they die. Those who survive beyond AGEX reduce their capital to nil at that age.

### 5.2 The Income Flow in Retirement

Vectors describing the flow of income from the savings annuity, BA, and the super annuity, BS, are constructed. For each year, k, of the DIE years survived in retirement:

$$BA(k) = (1+ES)^{(k-1)}\,BA(1)$$
$$BS(k) = (1+ESC)^{(k-1)}\,BS(1)$$

where ES and ESC are the annual rates of escalation applying to the purchased annuities. The initial year's income is as calculated in section 4.3.

The total income, T, before any age pension is payable, in year k of retirement is then calculated:

T = Total income in year k

= BA(k) + BS(k) if age >AGEX

= BA(k) + BS(k) + IRR BAL(k) if age≤AGEX

Taxable income excludes those parts of the purchased annuities deemed to be a return of capital, that is, the allowances for undeducted purchase price, UPP and SUP, calculated in section 4.3. So assessable income, AT, is:

$$AT = T - UPP - SUP$$

Vectors of means-tested age pension payable in each year, BP(k), and the associated rebate, BR(k), are constructed using:

$$BP(k) = AP - RPENS\ (AT - THP)$$

where AP is the maximum level of age pension payable, THP is the associated income threshold, and $AP \geq BP(k) \geq 0$ . RPENS is the rate at which the pension reduces for incomes in excess of THP. No asset test is applied in relation to the age pension.

Now for each year total taxable income, TT, and associated age pension rebate, BR, are calculated using:

$$TT = AT + BP$$

and

age pension rebate = BR = REB - RPENR (TT-THR)

where REB is the maximum rebate allowable, THR is the associated income threshold, and $REB \geq BR \geq 0$ . RPENR is the rate at which the rebate reduces for incomes in excess of the threshold THR.

AP, THP, REB and THR are assumed to increase each year after ENTRY by a factor of (1 + AWOTE). In year k of retirement this factor is $(1 + AWOTE)^{(W+k-1)}$.

5.3 Income Taxation

Annual amounts of income tax payable in retirement are stored in the vector EIT and calculated in subroutine EITRET. For each of the DIE years the individual survives in

retirement, calculate TASS, the taxable superannuation annuity, and ASS, the assessable income using:

$$TASS = BS(k) - UPP$$

$$ASS = BA(k) - SUP + (1 - EC)TASS + BP(k)$$

where UPP and SUP are purchase price allowances calculated at retirement, and EC is the excessive proportion calculated on realisation of the lump sum. If there is any investment income, ADD, this must be added to ASS, and the following steps completed:

If $k < AGEX - (ENTRY + W)$, i. e. if age is less than AGEX then:

$$ADD = (IRR)\, BAL(k)$$ interest earned on bank account

and:

increment RIN by $\dfrac{ADD}{(1 + DISC)^{(W + K)}}$

where RIN is the present value of interest income in retirement.

and:

Set $ASS = ASS + ADD$

If age is greater than AGEX, then the bank balance has been reduced to zero and there is no investment income, ADD.

Income tax is calculated on the integral value of ASS in the usual way and increased by TAXEX, the punitive tax payable on the excessive proportion, EC, of TASS.

$$TAXEX = (\text{Top marginal rate})\,(EC)\,(TASS)$$

Medicare levy is calculated subject to the following tests:

If no age pension rebate is due, i.e. $BR(k) = 0$, and the assessable income is above the specified threshold value, THMED, i.e. $ASS + (EC)\,(TASS) > THMED$
where THMED is increased in year k of retirement by a factor of $(1 + ET)^{(W+k-1)}$
then add medicare = RMED (ASS + (EC) (TASS)) where RMED is the specified rate of medicare levy. Otherwise no medicare levy is payable.

Tax payable, TAX, is calculated, adjusting for rebates due as follows:

TAX = Tax before rebates - BR(k) -STR (1 - EC) TASS

where TAX is ensured to be non-negative, BR is the age pension rebate due, STR is the rate of super contribution tax rebate and (1-EC) TASS is the non-excessive proportion of TASS.

The vector of income tax paid, EIT, is incremented by this amount.

5.4 Consumption

No savings are made in retirement, so that all income after taxation is spent. The following calculations are made for each of DIE years, k, survived in retirement.

(i) BENE is incremented by $(BA(k) + BS(k))\ (1+DISC)^{-(w+k-0.5)}$. BENE is the total present value of annuity income actually received, and is used in the calculation of mortality profit.

(ii) Figures for gross income and net disposable income are constructed using:

A = BA(k) + BS(k) + BP(k) is gross income (excluding interest)

GRIN(k) = A where GRIN is a vector of gross income in retirement.

A is adjusted = A - EIT (W+k)to represent income after tax.

The age of the individual is ENTRY + W + k in year k of retirement.

If age is less than AGEX, there is investment income in the year and GRIN is incremented by interest on BAL(k), the balance in the bank account at the beginning of the year.

GRIN:= GRIN + BAL(k) IRR

If age is less than AGEX net disposable income A is incremented by the amount of capital realised, ( i. e. the amount which is withdrawn from the bank account).

A:= A + (1 + IRR)BAL(k) – BAL(k+1)

A now represents the amount spent in the year. The vector S, net spending, and the vector GST, consumption tax, are incremented.

(iii) If the individual dies before age AGEX, ( i.e. ENTRY + W + DIE <AGEX), then at death the notional bank balance is non-zero, and represents the residual estate, ESTATE.

If age at death <AGEX then ESTATE = BAL(DIE+1)

This completes the calculations for an individual. A cohort simulation repeats this procedure for each of the specified number of individuals and aggregates the results. The following section lists the items which are constructed for each individual during a simulation. Appendix 5 describes the results which are available in the various output files.

## 6. FORMAT OF RESULTS GENERATED

These are the items for which values are calculated and stored during the simulation run for each individual. The maximum number of values for each item is shown in brackets after the item name. In general this number is the maximum number of years for which a value may exist, and describes the dimension of the vector in which the values are stored.

Income for each year of working life or retirement:

| | |
|---|---|
| X(55) | Annual salary during working life |
| GRIN(45) | Gross Retirement Income (includes annuities, interest, pension) |
| BA(45) | Annual income from retirement annuity purchased by savings |
| BS(45) | Annual income from retirement annuity purchased by superannuation fund |
| BP(45) | Annual amount of age pension payable |

Taxation

| | |
|---|---|
| EIT(80) | Income tax paid |
| GST(80) | Consumption tax paid |
| IITAX(55) | Tax paid on savings investment income |
| SITAX(55) | Tax paid on superannuation fund investment income |
| SCTAX(55) | Superannuation contribution tax paid |
| BR(45) | Age pension tax rebate due |

Other disbursements

| | |
|---|---|
| EEU(55) | Employee annual undeducted super contributions |
| EED(55) | Employee annual deducted super contributions |
| EER(55) | Employer annual super contributions |
| S(80) | Spending (net of GST) |
| SAI(55) | Savings made in working years |

Sundry items

| | |
|---|---|
| BAL(26) | The balance in the savings account at the beginning of each year in retirement up to AGEX |
| ESTATE | The balance in the savings account (if any) at death |

| | |
|---|---|
| POOR | Binary flag which indicates an individual who has been unable to afford a specifed level of income in retirement |
| FB | If ICOMM=2, a defined level of retirement benefit is required, FB is the ratio of the amount of funds available at retirement , to the cost of the specified benefit level. If ICOMM=1, FB=1 |
| COSTA | Present value at age ENTRY of the cost of annuity purchased with savings |
| COSTS | Present value at age ENTRY of the cost of annuity purchased with super fund |
| BENE | Present value at age ENTRY of the amount of annuity income actually paid in retirement |
| WIN | Present value at age ENTRY of gross savings investment income (in working life) |
| RIN | Present value at age ENTRY of gross investment income earned in retirement (on bank BAL ) |
| SIN | Present value at age ENTRY of gross investment income earned on superannuation fund (during working life) |
| EFFI | The 'cost:benefit' ratio for an individual $= \frac{\text{net consumption}}{\text{income tax + lump sum tax + tax on investment income}}$ |

## APPENDIX 1. INPUT FILE: GIVEN

GIVEN contains values for parameters which are used in the LITES suite of programs. These are items which are not discretionary, and are 'given' values in tax law and superannuation legislation. They should be set to those values current during the initial tax year for which the simulation is run. The annual rate of increase of any item is specified in file CHOSEN, and is constant throughout each simulation.

Definitions

Each item is followed by an illustrative value.

**line1:**

| | | |
|---|---|---|
| SCREB | 100 | This is the maximum tax rebate payable in respect of employee undeducted superannuation contributions made during a year of working life. |
| SCRTHR | 27000 | This is the taxable income threshold in excess of which the above rebate begins to phase out. |
| SCR | .025 | This is the rate at which the rebate phases out, expressed as a proportion of income in excess of SCRTHR. |
| RSDP | .10 | This is the proportion of income which the above rebate must not exceed. |

**line 2:**

| | | |
|---|---|---|
| IAGE1 | 35 | {These values describe a table used to test the |
| CONTH1 | 9000 | {total of undeducted superannuation contributions |
| IAGE2 | 50 | {made in a tax year on behalf of an employee. |
| CONTH2 | 25000 | { No tax rebate is allowable if the applicable |
| CONTH3 | 62000 | {age related maximum is exceeded. |

| age | allowable max. |
|---|---|
| <35 | 9000 |
| 35 -50 | 25000 |
| 50< | 62000 |

**line 3:**

| | | |
|---|---|---|
| RBLL | 400000 | The Reasonable benefit limit applying where more than 50% of super monies are taken as a lump sum, as opposed to an annuity. |
| RBLU | 800000 | The limit applying where at least 50% of super monies are applied to purchase an annuity. These limits determine the tax treatment of the lump sum, and are used in the calculation of the 'excessive proportion'. |
| THLS1 | 77796 | The threshold below which deducted super monies taken as a lump sum are tax free. Amounts in excess of this taxed at R21LS. |
| THLS2 | 0.0 | The second threshold in the deducted, non-excessive lump sum tax table. Amounts in excess of this taxed at R22LS. If there is no 2nd tier, set =0.0 |
| THLS3 | 0.0 | The third threshold, in excess of which tax applied at R23LS. If there is no 3rd tier, set=0.0 |

**line 4:**

| | | |
|---|---|---|
| R1LS | 0.0 | Lump sum tax rate applying to undeducted amounts. |
| R21LS | 0.164 | Lump sum tax rate (here illustrated 15% + medicare) applying to non-excessive deducted super contributions which are taken as a lump sum, and which are in excess of THLS1 (see above). This is the first rate of tax applying in this table. |
| R22LS | 0.0 | As above, second rate of tax in table. If there is no 2nd tier, set=0.0 |
| R23LS | 0.0 | As above, third rate of tax in this table. If there is no 3rd tier, set=0.0 |
| R3LS | 0.484 | Lump sum tax rate applying to the excessive proportion of deducted super contns taken as a lump sum. (Here the illustrative value is top marginal rate of tax + medicare,47%+1.4%) |

**line 5:**

| | | |
|---|---|---|
| PENS | 8115 | Annual rate of age pension payable to subject of the simulation run. |
| THPENS | 10351 | Annual income threshold at which age pension begins to phase out. |
| RPENS | .5 | Rate at which the pension phases out, as a proportion of income in excess of THPENS |
| PENR | 972 | Maximum income tax rebate associated with an age pension. |
| THPENR | 10260 | Annual income threshold at which PENR begins to phase out. |
| RPENR | .125 | Rate at which PENR phases out, as proportion of income in excess of THPENR. |

**line 6:**

| | | |
|---|---|---|
| AWE | 32500 | Annual expression of average weekly ordinary time earnings. |

**line 7:**

| | | |
|---|---|---|
| RMED | .014 | Medicare levy rate. |
| THMED | 12000 | Medicare levy is not exacted from individuals whose taxable income falls below this threshold. |

## APPENDIX 2. INPUT FILE: CHOSEN

CHOSEN contains values for parameters which are used in the simulation. These items are those which are discretionary: they describe economic conditions and the priorities which govern decision making during the simulation.

Definitions

Each item is followed by a value which illustrates the required form, and, where appropriate, the range of permissable values of that item.

**line 1:**

ENTRY 20 The age at entry to the workforce.

W 45 Years in the workforce.

These two items thus define the retiral age for the simulation, (ENTRY + W), and are limited such that retirement is between ages 55 and 75, where ENTRY has a minimum value of 20. The age at death, determined by the program, is not greater than 100.

AGEX 80 The age by which any bank balance held in retirement is fully expended. AGEX has a maximum value of (ENTRY+W+25). Individuals dying before AGEX will leave a residual estate.

**line 2:**

G Describes calculation method and amount of consumption tax, GST, applying.

0 No GST.

1 GST applies at rate GR1, calculated in this way:

$$GST = \frac{\text{amount spent x GR1}}{1 + GR1}$$

L Describes method of saving during working life.

0 No saving.

1 Applies RATE1 to disposable income in excess of specified amount THSAV1.

SAVE Indicates method of taxation applying to interest earned on savings.

1 Interest on savings taxed at flat rate IIT.

2 Interest on savings taxed at marginal personal income tax rates.

**line 3:**

ICOMM Indicates whether commutation at retiral is made by reference to the cash available at retirement or the level of income required in retirement.

1 Commutation is made by proportion of funds available:
PSUP is proportion of super fund applied to purchase an annuity.
PSAV is the proportion of the savings applied to purchase an annuity.

2 Commutation is made according to PRIOR (see below)
If ICOMM =2, then AS and MAS in GIVEN should be set equal.

**line 4:**

PSAV .5 The proportion of savings fund applied to the purchase of annuity.(Used if ICOMM=1)

PSUP .5 The proportion of super fund applied to purchase annuity.(Used if ICOMM=1)

**line 5:**

FAP 3 {These items are used to calculate a required
RIP 0.6 {level of income with reference to a personal
{average salary, and are used if ICOMM=2 .
{ FAP is the number of years preceeding
{retirement over which salary is averaged.
{RIP is the Retirement Income as a Proportion
{ of this final average salary.

PRIOR 1 Money required to purchase the required level of income, as indicated by FAP and RIP, is taken first from super funds, and then if and as required from savings.

2 All super is taken as a lump sum. Option to purchase an annuity is available later as indicated by ICOMM.

3 Money required to purchase required annuity is taken first from the savings fund, and then as necessary from the super fund. Balance of super is taken as a lump sum.

**line 6:**

THSAV1 0 The threshold of annual disposable income in working life above which savings are made at RATE1

RATE1 0.2 The proportion of disposable income in excess of THSAV1 which is saved during working life.

**line 7:**

CFAC1 1.5 {These items describe a table which determines
CONP1 .6 {the amount of cash put to immediate consumption
CFAC2 3 {at retirement, and run in conjunction with TESTF.
CONP2 .3 { A TEST amount is calculated according to TESTF
CONP3 .2 {and compared with the tabulated values.
{Consumption is calculated as a proportion,
{CONPi, of FREE, the cash available.
{CFACi are factors applied to AWE, the annual
{equivalent of average weekly earnings.

| | |
|---|---|
| if TEST < (CFAC1)AWE | (CONP1)FREE is spent |
| CFAC1(AWE)≤TEST≤CFAC2(AWE) | (CONP2)FREE is spent |
| CFAC2(AWE)< TEST | (CONP3)FREE is spent |

**line 8:**

TESTF This item indicates how the item TEST is calculated, and thus determines how much of the disposable lump sum is put to immediate consumption.

1 TEST is set equal to the final years earnings.

2 TEST is set equal to FREE, the available cash .

**line 9:**

DISC .065 Discount rate used for valuation.

AWOTE .06 Rate of increase in average weekly earnings, used to index super and pension rebates, values and other thresholds .

ET .055 Indexation rate for income tax thresholds.

**line 10:**

| | | |
|---|---|---|
| SU | .03 | Proportion of gross salary, employees undeducted super contributions. |
| SD | 0 | Proportion of gross salary, individuals deducted super contributions. |
| ER | .09 | Proportion of gross salary, employer super contributions. |
| IES | | Flag indicating how employer super contributions, if any,relate to earnings . |
| | 0 | Employer contributions, if any, are in addition to the earnings stream constructed by the program. The total effective employer subsidy is X (1+ER) and the salary is X. |
| | 1 | The earnings profile constructed by the program *includes* the employer super contributions. The effective employer subsidy is therefore X, and the salary is X/(1+ER). |

**line 11:**

| | | |
|---|---|---|
| IR | .1 | Annual rate of return on savings, in working years. |
| SR | .09 | Annual rate of return on super fund. |
| IRR | .06 | Annual rate of return on savings in retirement. |

**line 12:**

| | | |
|---|---|---|
| SCTR | .15 | Rate of Super contribution tax . |
| IIT | .20 | Tax on investment income to savings fund. |
| SIT | .10 | Tax on investment income to super fund. |

**line 13:**

| | | |
|---|---|---|
| STR | .15 | Rate of super contribution tax rebate payable in retirement. |

**line 14:**

| | | |
|---|---|---|
| GR1 | .10 | GST rate applied when G=1.(see line 1,item 1,'G ') |

**line 15:**

| | | |
|---|---|---|
| ITABLE | | Index indicating which income tax table should be used, stored in files named below |
| | 0 | TXRATS Standard tax table |
| | 1-9 | TXRAT1,TXRAT2 ....TXRAT9 refer to the non-standard rates, there being facility for up to 9 alternative tax tables in addition to the standard rates. NOTE That medicare rates and structure should be adjusted independently, see file 'GIVEN'. |

**line 16:**

| | | |
|---|---|---|
| AS | 11.11 | Market rate to purchase unit whole life annuity at retiral, escalation as specified below. Purchased with non-superannuation funds. |
| ES | .05 | Rate of escalation on the above. |
| MAS | 11.11 | This is as for AS, rate applying when superannuation funds are applied to purchase. NOTE that MAS must equal AS if flag ICOMM=2 (See line 3.) |
| ESC | .05 | Rate of escalation applying to MAS. |
| E0 | 14.6 | Expectation of life, sex specific, at retiral age. The illustrative value is male, age 65, according to ALT 85/87. |

## APPENDIX 3. INEARN

This file contains information about the age-earnings profiles of the cohort and the process of differential mortality described in Section 2. It consists of the following four lines:

$\mu_1$ $\theta$ $\delta$ $\sigma_1^2$ $\sigma_u^2$
$\beta$ $\rho$ $g_r$
AVD SUU B RM
PRATE

where PRATE is the rate of increase in the retail price index. An example of INEARN is:

9.98064 .0385 .00086 .1817 .00575
1 0 .065
14 50 8 40634.79
0.05

The value of RM must be obtained separately by running the program: SURVIVE.FOR. This program requires the input file: INSURV which takes the form:

$\mu_1$ $\theta$ $\delta$ $\sigma_1^2$ $\sigma_u^2$
$\beta$ $\rho$ $g_r$
DISC PRATE
AVD SUU B

These are the same as in INEARN, and DISC is the nominal interest rate.

An example of INSURV is:

9.98064 .0385 .00086 .1817 .00575
1 0 .065
.065 .05
14 50 8

Care must be taken to ensure that the values used in INSURV are the same as those used in the rest of the simulations. If any variables contained in INSURV and used in the lifetime simulations are changed, then INSURV must be changed and SURVIVE re-run. The new value of RM must then be used for INEARN.

## APPENDIX 4. 'TXRATS', 'TXRAT1',...'TXRAT9'

The 'TXRAT-' files contain income tax tables. The last character in the file name identifies the table. TXRATS is the standard table, and there is facility for up to 9 alternative tables. The item 'ITABLE' in file 'CHOSEN' identifies the tax table /input file which is to be used in any simulation.

Format:

| | | |
|---|---|---|
| LOWER INCOME LIMIT | UPPER INCOME LIMIT | TAX RATE |
| " | " | " |

and so on for up to a maximum of 8 tax bands.

| | | |
|---|---|---|
| LOWER INCOME LIMIT | 0 | TOP TAX RATE |

Note: The upper income limit in the top tax band is set equal to zero. This marker identifies it as the last of the tax bands in the table.

Construction: The program TAXBAND can be used to construct the 'TXRAT-' files.

# APPENDIX 5. OUTPUT FILES

## 1. DETAIL

The file DETAIL contains a report of totals of various items for each individual included in a simulation run, and takes the following form:

Number in cohort 1
Present values at 6.50 % of:

| | |
|---|---|
| Earnings | 1569739.00 |
| Employer contributions (gross) | 94184.35 |
| Net consumption | 1060751.00 |
| Age pension | 32948.89 |
| Income tax (working years) | 491448.60 |
| " (in retirement) | 23281.30 |
| G S T | 106075.10 |
| Investment income (working years) | 1221768.70 |
| Investment income tax (working years) | 24353.74 |
| Investment income (in retirement) | 28624.57 |
| Super contribution tax | 13689.74 |
| Super investment income | 369350.40 |
| Super investment income tax | 36935.04 |
| Lump sum tax | 27479.87 |
| Residual Estate | 9220.53 |
| Risk profit | 8618.98 |
| Number of'Poor' | 0 |
| Proportion Funded | 1.4589 |
| Cost/Benefit Ratio | 1.7577 |

' Number in cohort' is the ordinal number associated with the individual and provides a unique identifier for this individual. It is thus possible to isolate and examine individual experience in a simulation which deals with a large cohort.
' Present values' are discounted values as at age ENTRY, the beginning of the first tax year of the simulation.

' Earnings' $=\sum_{i=1,w} X_i\ (1 + DISC)^{-(i-0.5)}$

Employer contributions' $=\sum_{i=1,w} EER_i\ (1 + DISC)^{-(i-0.5)}$

' Net Consumption' $=\sum_{i=1,w+die} S_i\ (1+ DISC)^{-(1-0.5)}$

' Age Pension' $=\sum_{i=1,die} BP_i\ (1 +DISC)^{-(w+i-0.5)}$

' Income Tax(working years)' $=\sum_{i=1,w} EIT_i\ (1 + DISC)^{-i}$

' " (in retirement)' $=\sum_{i=1,die} EIT_i\ (1 + DISC)^{-(w+i)}$

' G S T' $=\sum_{i=1,w+die} GST_i\ (1 + DISC)^{-(i-0.5)}$

' Investment Income (working years)' = WIN

' Investment income tax (working years) ' $=\sum_{i=1,w} IITAX_i\ (1 + DISC)^{-i}$

' Investment Income (in retirement)' =RIN

' Super Contribution Tax' $=\sum_{i=1,w} SCTAX_i \ (1 + DISC)^{-i}$

' Super investment income' = SIN

' Super investment income tax' $=\sum_{i=1,w} SITAX_i \ (1 + DISC)^{-i}$

' Lump sum tax' $=TAXLS \ (1 + DISC)^{-w}$

' Residual Estate' = 0 if w+die>80

$= (1 + DISC)^{-(w+die)} BAL(die)$

' Risk Profit' = BENE - (COSTA+COSTS)

' Number of 'Poor" = POOR (value=0,this individual not poor)
(value=1,this individual 'poor')

' Proportion funded' =1 if ICOMM=1, that is, not a defined benefit simulation

$= \frac{FW + VW}{COST}$ if ICOMM=2,that is, if retiral benefits are defined,

$= \frac{\text{total funds available}}{\text{cost of defined benefit}}$

Note: if POOR=1, proportion funded must be<1
if POOR=0, " >1

' Cost:Benefit Ratio'=

$$\frac{\text{Net Consumption}}{\text{Income tax(working+retirement years)+Investment Income tax(pre-retirement)+Lump Sum tax}}$$

## 2. SHORTS

This file contains substantially the same information as DETAIL, in an abbreviated form. The items listed are these:
Earnings, Employerer contns, Net consumption, Age pension, Income tax(working life), Inc.tax (in retirement), GST, Investment Income(working life), Investment Income Tax(working life), Investment Income(in retirement), Super contribution Tax, Super Investment Income, Super Investment Income Tax, Lump Sum Tax, Residual Estate, Risk Profit, 'Poor', Proportion funded. The entry for each individual takes this form:

```
1569739.00    94184.35    1060751.00    32948.89    491448.60
23281.30    106075.10    121768.70    24353.74    28624.57
13689.74    369350.40    36935.04    27479.87    9220.53
 8618.98    0    1.4589    1.7577
```

This file can be used as a data input file for further statistical analysis.

## 3. RESULT

This file gives results of a cohort, and presents the totals for the whole cohort in the form:.

Number in cohort 15

Present values at 6.50 % of:

| | |
|---|---|
| Earnings | 13608430.00 |
| Employer contributions (gross) | 816505.50 |
| Net consumption | 10144030.00 |
| Age pension | 609468.30 |
| Income tax (working years) | 3085910.00 |
| " (in retirement) | 163481.20 |
| G S T | 1014403.00 |
| Investment income (working years) | 1314357.00 |
| Investment income tax (working years) | 262871.30 |
| Investment income (in retirement) | 289150.10 |
| Super contribution tax | 118679.50 |
| Super investment income | 3668556.00 |
| Super investment income tax | 366855.60 |
| Lump sum tax | 216241.70 |
| Residual Estate | 474569.40 |
| Risk profit | -107320.70 |
| Number of'Poor' | 0 |
| Proportion Funded | 1.0000 |
| Cost:Benefit Ratio | 2.7801 |

' Number in cohort' = the number of individuals in the run, the size of the cohort. Generally, other items are the sum of all the individual items (as described and reported in DETAIL) for each individual in the cohort. Thus, for a cohort run of 1, RESULT and DETAIL output files will be identical.

These are the other exceptions:

The number of 'Poor' indicates *how many* in the run were unable to fund a defined retirement benefit level. The individuals may be identified by referring to their output in DETAIL.

The item 'Proportion funded' relates only to those who were 'Poor'. It is the average value of the proportion funded *only* for those who were designated 'Poor'. In a run where the value of Poor is zero (either because there is no defined benefit level, or because no one failed to achieve the required level of funding), the proportion funded is given as 1.

The item 'Cost:Benefit Ratio' is the average of the individual cost:benefit ratios. That is, equals the sum of each individual ratio, divided by the number of individuals in the cohort.

## 4. LISTS

This file contains data for an individual. The data are itemised, giving each annual value in the vectors of stored information, in a form suitable for use as input to other routines. Annual values have been discounted at rate DISC to age ENTRY i.e.the date of entry to the workforce. Items included are:

| | |
|---|---|
| ' sals' | salary |
| ' grin' | gross retirement income |
| ' saving' | savings in working life |
| ' savings annuity' | amount of annuity purchased by savings |
| ' super ann.' | " super |
| ' age pension' | age pension |
| ' age pens rebate' | tax rebate associated with the above |
| ' income tax' | income tax payable throughout |
| ' GST' | Consumption tax paid |
| ' investment income tax' | tax paid on interest earned by savings in working life |
| ' super income tax' | tax paid on interest earned by super fund |
| ' super contn tax' | tax paid on contributions to super fund |
| ' net spending' | Consumption, net of GST |
| ' eee super contns' | contributions made by an individual into their super fund |
| ' eer super contns' | contributions made by the employer |

This is an extract from an individual listing as illustration:

```
sals   16888.4     19630.2     19877.4     20038.4     20379.5
  21926.1     21831.1     23760.2     25785.2     27511.3
  30329.7     31294.7     34301.2     34511.3     35297.8
  41099.1     41237.2     41610.8     40201.2     43392.3
  43282.1     46679.4     45204.4     43448.9     46428.5
  47368.4     51659.6     52649.8     48711.6     52227.5
  46638.1     50109.1     44897.3     41234.1     42555.7
  42264.0     40594.6     41722.2     40768.7     37932.5
  33963.0     33512.0     33036.7     33091.2     33041.0
grin   29473.2     29058.0     28648.8     28245.3     27847.5
  27455.2     27068.5     26687.3     26311.4     25940.8
  25575.5     25215.3     24860.1
saving   1272.92     1460.48     1476.79     1482.73
  1497.77     1573.85     1566.86     1662.30     1761.15
```

## APPENDIX 6. GLOSSARY

Terms and identifiers used

| | |
|---|---|
| AGEX | (see appendix 2)The age by which bank balance held in retirement is to be fully expended |
| AS | (see appendix 1)Market rate to purchase unit annual annuity per dollar, using non-super funds |
| AWE | (see appendix 1)Annualised figure for average weekly earnings |
| AWOTE | (see appendix 2)Index of average weekly earnings |
| BA(45) | Annual income from retirement annuity purchased by savings |
| BAL(26) | The balance in the savings account at the beginning of each year in retirement up to age AGEX |
| BENE | Present value at age ENTRY of the amount of annuity income actually paid in retirement |
| BP(45) | Annual amount of age pension payable |
| BR(45) | Age pension tax rebate due |
| BS(45) | Annual income from retirement annuity purchased by superannuation fund |
| CFAC1 | { (see appendix 2) Factor in table describing amount |
| CFAC2 | {put to immediate consumption at date of retiral |
| CHOSEN | Name of input file containing discretionary values for variables |
| CONP1 | ⌈ (see appendix 2) Proportions in table describing |
| CONP2 | { amount put to immediate consumption at date of |
| CONP3 | ⌊ retiral |
| CONTH1 | ⌈ (see appendix 1) Threshold values in table used to |
| CONTH2 | {impose tax rebate regulations in respect of super |
| CONTH3 | ⌊ contributions. See also IAGE1,2. |
| COSTA | Present value at age ENTRY of the cost of annuity purchased with savings |
| COSTS | Present value at age ENTRY of the cost of annuity purchased with super fund |
| DETAIL | (see appendix 5) Name of output file containing totals for each individual in a simulation run |
| DISC | (see appendix 2) Discount rate used to calculate present values of results. |
| E0 | (see appendix 1) Expectation of life for individual at retiral age |
| EED(55) | Employee annual deducted super contributions |
| EER(55) | Employer annual super contributions |
| EEU(55) | Employee annual undeducted super contributions |
| EFFI | (see Appendix 5)Cost:Benefit ratio=net consumption/(tax on income + tax on investment income + lump sum tax) for an individual |
| EFFN | (see Appendix 5) Sum of cost:benefit ratio for n individuals in a cohort, divided by n |
| EIT(80) | Income tax paid |
| ENTRY | (see appendix 2) Age at entry to workforce |
| ER | (see appendix 2) Rate of employer super contribution |

| | |
|---|---|
| ES | (see appendix 1)Rate of escalation on retirement annuity associated with purchase rate AS |
| ESC | (see appendix 1)Rate of escalation on retirement annuity associated with purchase rate MAS |
| ESTATE | The balance in the savings account (if any) at death |
| ET | (see appendix 2)Index rate of change for tax tables |
| FAP | (see appendix 2) Input number of years over which salary preceeding retiral is averaged |
| FB | Proportion Funded in defined benefit simulation |
| G | (see appendix 2) Input flag describing method of GST |
| GIVEN | Name of input file containing legislated (or otherwise restricted) values for variables |
| GR1 | (see appendix 2)GST rate 1 |
| GRIN(45) | Gross Retirement Income (includes annuities, interest, pension) |
| GST(80) | Consumption tax paid |
| IAGE1 | ⌈(see appendix 1)Age values in table used to impose |
| IAGE2 | ⌊tax rebate rules in respect of super contributions, maximum allowable amounts as in CONTH1,2,3 |
| ICOMM | (see appendix 2) Input flag describing commutation decisions |
| IES | (see appendix 2) Input flag defining method of calculation of effective employer support,whether any super contributions are in addition to salary, or as part of a salary 'package' |
| IITAX(55) | Tax paid on savings investment income |
| INEARN | (see appendix 3)Name of input file containing data used in construction of salary stream and age at death for each individual in a simulation |
| IR | (see appendix 2)Interest rate on savings earned during working life |
| IRR | (see appendix 2)Interest rate on savings earned in retirement |
| ITABLE | (see appendix 2)Reference number input to indicate which tax table is to be used in a simulation |
| L | (see appendix 2) Input flag describing saving behaviour |
| LISTS | (see appendix 5)Name of an output file containing listed annual values for individuals in a simulation, designed for use in plotting routines |
| MAS | (see appendix 1)Market rate to purchase unit annual annuity at retirement with super funds |
| PENR | (see appendix 1)Maximum tax rebate associated with single age pension |
| PENS | (see appendix 1)Annual rate of single age pension |
| POOR | Binary flag which indicates an individual who has been unable to afford a specifed level of income in retirement. |
| PRIOR | (see appendix 2) Input flag describing priorities in purchase of annuities |
| PSAV | (see appendix 2) Input flag describing commutation as proportion of savings |
| PSUP | (see appendix 2) Input flag describing commutation as proportion of super fund |
| R1LS | (see appendix 1)Rate of tax on undeducted lump sum |

| | |
|---|---|
| R21LS | ⎧ (see appendix 1)Rates of tax on deducted, non- |
| R22LS | ⎨ excessive amounts taken as a lump sum ,part of |
| R23LS | ⎩ three tier table. See THLSi. |
| R3LS | (see appendix 1)Rate of tax payable on excessive part of lump sum |
| RATE1 | (see appendix 2) Proportion saved in working life of prescribed disposable income |
| RBLL | (see appendix 1)Reasonable Benefit limit for lump sum on retiral with less than 50% commutation |
| RBLU | (See appendix 1)Reasonable benefit limit for lump sum on retiral with more than 50% commutation |
| RESULT | (see appendix 5) Name of an output file which contains totals for the whole cohort in a simulation run |
| RIN | Present value at age ENTRY of investment income earned in retirement (on bank BAL ) |
| RIP | (see appendix 2) Proportion of final average salary required as retirement income, in defined benefit case |
| RMED | (see appendix 1)Rate of medicare levy |
| RPENS | (see appendix 1) Rate at which age pension phases out, as proportion of income in excess of THPENS |
| RPENR | (see appendix 1)Rate at which age pension rebate PENR phases out, as proportion of income in excess of THPENR |
| RSDP | (see appendix 1) Proportion of earnings describing a maximum for rebatable super contributions. See SCREB |
| S(80) | Spending (net of GST) |
| SAI(55) | Savings made in working years |
| SAVE | (see appendix 2) input flag describing taxation on savings |
| SCR | (see appendix 1)Rate at which rebate SCREB phases out for incomes in excess of SCRTHR |
| SCREB | (see appendix 1)Maximum amount of tax rebate payable in respect of employee super contributions |
| SCRTHR | (see appendix 1)Income threshold relating to employee tax rebate in respect of super contributions |
| SCTAX(55) | Superannuation contribution tax paid |
| SCTR | (see appendix 2) Rate of super contribution tax |
| SD | (see appendix 2) rate of employee deducted super contribution |
| SHORTS | (see appendix 5) Output file containing compact version of individual results as in DETAIL |
| SITAX(55) | Tax paid on superannuation fund investment income |
| SIN | Present value at age ENTRY of investment income earned on superannuation fund (during working life) |
| SR | (see appendix 2)Interest rate earned on super fund |
| SU | (see appendix 2)rate of employee undeducted super contribution |
| TESTF | (see appendix 2) input flag used in determining amount of immediate consumption at retiral |
| THMED | (see appendix 1)Income test threshold for medicare levy |

| | |
|---|---|
| THLS1,2,3 | (see appendix 1) Thresholds in 3 tier tax table applying to non-excessive, deducted lump sum amounts See R2iLS for rates applying |
| THPENR | (see appendix 1)Threshold for income test on age pension tax rebate (PENR) |
| THPENS | (see appendix 1)Threshold for income test on age pension (PENS) |
| THSAV1 | (see appendix 2)Income threshold in savings decisions |
| TXRAT1,.9 | (see appendix 4)Names of files which contain alternative income tax tables |
| TXRATS | (see appendix 4) Name of file containing standard tax table |
| W | (see appendix 2) Number of years in working life |
| WIN | Present value at age ENTRY of savings investment income (in working life) |
| X(55) | Annual salary during working life |

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