ISBN 0 7325 0589 5

THE UNIVERSITY OF MELBOURNE

Some Financial Consequences of the Size of Australia's Superannuation Industry in the Next Three Decades

by

David M Knox
The University of Melburne

RESEARCH PAPER NUMBER 20

June 1995

Centre for Actuarial Studies
Department of Economics
The University of Melbourne
Parkville, Victoria, 3052
Australia.

SOME FINANCIAL CONSEQUENCES OF THE SIZE OF AUSTRALIA'S SUPERANNUATION INDUSTRY IN THE NEXT THREE DECADES

David M Knox

The University of Melbourne

Acknowledgments: I am very grateful to the financial assistance received from an Australian Research Council Small Grant No. SG7935484 which made this research possible. I also wish to express my sincere thanks to Mr Roger Milne who worked over many months in the development and continual updating of the model.

SOME FINANCIAL CONSEQUENCES OF THE SIZE OF AUSTRALIA'S SUPERANNUATION INDUSTRY IN THE NEXT THREE DECADES

David M Knox
The University of Melbourne

1 Introduction

The size of the assets held by Australian superannuation funds will become increasingly important in the years and decades ahead as the development of funded superannuation continues through the increasing Superannuation Guarantee contribution rates and the recently announced plan to introduce a minimum level of employee contributions.

There have been various estimates of the projected size of superannuation assets for the year 2000 and beyond. The initial public estimate for the size of the industry at the turn of the century was the often quoted $600 billion figure in Keating (1989). However, this estimate was made in a period of much higher inflation and therefore assumed a higher level of nominal investment earnings than has occurred in the first half of the 1990s or is reasonable to assume for the future.

In mid 1994 two further estimates were published, based on very different methodology and models. Sarjeant and Solomon (1994) estimated that the combined size of superannuation funds and rollover funds at June 2000, based on their "medium" reconstruction and projections would be $336 billion whilst Rothman and Bacon (1994) projected the aggregate assets held by superannuation funds in the year 2000 to be in range of $320 billion to $380 billion. Given that these figures exclude rollover funds, Rothman and Bacon were more optimistic than Sarjeant and Solomon, although it must be acknowledged that the figures are of the same order. These two recent estimates were also completed before allowance could be made for the poor investment returns achieved in 1994. Hence, they may now be considered to be slightly optimistic.

The projection of the size of Australia's superannuation industry is an extremely complex task as the market value of the total assets will depend on a number of factors including:

- the rates of return achieved, including realised and unrealised capital gains/losses,
- the level of contributions by employers, employees and the self-employed,
- the labor force participation rate, allowing for the rate of retirement at various ages,
- the proportion of the labor force covered by superannuation,
- the availability of benefits to members at ages prior to retirement age,
- the form of benefits paid (lump sum or pension),
- the tax rates payable on contributions and investment income, and
- expense and insurance charges.

Nevertheless it is important that these estimates are undertaken as the assets of Australian superannuation funds now play a very important role in the capital markets. The objectives of this paper are not restricted to obtaining an estimate of the size of the superannuation industry for a particular year in the future. Its focus is broader than this and the paper will therefore:

- project the size of Australian superannuation funds for the next three decades;
- then estimate the supply of new funds which are available for investment purposes; and
- finally identify the most significant assumptions in these projections and show the implications of changing these assumptions within reasonable bounds.

These projections will initially allow for the continuing increase in the minimum contribution rates under the Superannuation Guarantee and maintaining the existing level of employee and self-employed contributions. The final section of the paper will also analyse the impact of introducing minimum employee contributions as announced in the 1995-96 Federal Budget and variations in a number of underlying assumptions.

2 The basic model

The projection of any fund can be identified by the following simple equation:

$$F_t = F_{t-1}(1 + I_t) + CI_t - CO_t \qquad (1)$$

where F_t represents the size of the fund at the end of year t;
I_t represents the rate of investment earnings on the fund's assets in year t;
CI_t represents the cash inflow into the fund in year t; and
CO_t represents the cash outflow from the fund in year t.

In terms of superannuation funds, the investment income will include both income actually received from realised capital gains or losses, interest payments, dividends, rent etc as well as unrealised capital gains or losses. The cash inflow represents contributions from employers, employees and the self employed while the cash outflow will include benefit payments, taxes, insurance premiums and expenses. For simplicity, investment income has not been credited in respect of the cash flows during the year. Indeed, for most years, the net cash flows are relatively small.

The following sections indicate how each of these variables have been projected so that estimates of the future size of Australia's superannuation industry can be made.

It should be noted that the starting point (namely F_t) has been taken as the value of the assets of superannuation funds (but excluding approved deposit funds) as shown in ABS Cat No 5656.0 Assets of Superannuation Funds and Approved Deposit Funds. Approved Deposit Funds have been excluded as they represent only one of many rollover vehicles available to individuals who receive eligible termination payments. Other alternatives include deferred annuities and allocated pensions. Hence, in view of the options available to beneficiaries, it has been decided that this study will be restricted to superannuation funds. (It is noted that whilst the distinction between superannuation funds and approved deposit funds has now been removed, the vast majority of approved deposit funds would represent past benefit payments.)

3 Projecting the cash inflows

3.1 The measurement of investment earnings

The investment earnings of a particular superannuation fund depend, in the long term, on the asset allocation of each individual fund. However, when viewed in aggregate, the investment earnings of all superannuation fund assets can be estimated by considering the total asset allocation of Australian superannuation funds. This asset allocation can be estimated from the breakdown of assets shown in ABS Cat No 5656.0 and it will be assumed that the allocation shown in Table 1 represents the long term situation. These percentages are broadly consistent with the asset allocation shown for December 1993 and December 1994.

Table 1: The assumed long asset allocation of Australian superannuation funds

Asset class	**Percentage**
Australian equities	40%
Australian fixed interest	21%
Overseas equity	13%
Cash and short term securities	16%
Direct property	7%
Overseas fixed interest	3%
Total	100%

Of course, each asset class does not have the same rate of investment earnings and it is therefore necessary to make assumptions about the future level of investment earnings (in terms of both income and capital gains) for each asset class. Table 2 sets out the assumed after tax rates of return for each asset class, as used in Humphreys and Newman (1993).

Table 2: The assumed net rates of investment earnings for each asset class

Asset class	**Rate of annual income**	**Rate of annual capital gain**
Australian equities	4%	6%
Australian fixed interest	7.5%	-
Overseas equity	4%	5.5%
Cash and short term	6%	-
Property	6%	3%
Overseas fixed interest	7%	-

These figures produce a projected weighted net (of tax, but not expenses) rate of annual return of 8.675% per annum, or when allowing for an annual inflation rate of 3%, a real rate of return of 5.5% per annum. This assumption is broadly consistent with the real rates of return experienced by a typical superannuation for the 5 years or 20 years to 30 June 1994 of 6.5% or 6.3% pa respectively (as reported in ASFA (1995)). The impact of changing the assumed investment yield can be considerable

and will be illustrated in Section 8. By comparison, Rothman and Bacon (1994) assumed an earnings rate of 7% pa (after costs but before tax) and an inflation rate of 3% pa and Sarjeant and Solomon (1994) assumed net fund earning rates rising from 7% pa to 8% pa and inflation rising from 2.5 pa to 4% pa.

3.2 The measurement of contributions

The contributions being paid into Australian superannuation funds are paid by three distinct categories of contributors: namely employers, employees and the self employed (including additional contributions for employed individuals). For each category, the total contributions for a particular period can be estimated as the product of the following four items:

1. the number of individuals in the category;
2. the proportion of the individuals in that particular category who are covered by a superannuation plan;
3. the average rate of contribution by the contributor; and
4. the average salary for those individuals covered.

Hence, the total contributions for each group can be expressed as follows:

Contributions = No. in category * % covered * Average rate * Average salary

Appendix 1 outlines how these contributions have been estimated for employers, employees and the self employed.

Using these assumptions, an estimate of the total level of superannuation contributions can be made. Table 3 shows the level of contributions for the years 1990-95 and for every three years until 2010 for employers, employees and the self employed. The level of total contributions is also expressed as a percentage of the Gross Domestic Product, assuming that the GDP will grow at a real rate of 3% per annum from December 1994. (A different rate of GDP growth will affect the denominator and hence, in turn, the percentages shown.)

The table shows that for the calendar year 2001 the total level of superannuation contributions is estimated to be $32.1 billion which compares with an estimate of $29.6 billion for 2001 in Sarjeant and Solomon (1994) and $31.3 billion in Rothman and Bacon (1994) for the financial year 2000-2001. Hence, the three projections, which adopt very different methodologies, produce similar outcomes in terms of the level of superannuation contributions in the future.

Table 3: Estimated Superannuation contributions for 1990-2010 in $mill

Year	Employer contributions	Employee contributions	Self-employed contributions	**Total contributions**	**Total as % of GDP (3% real growth)**
1990	8059	5151	682	13893	3.68
1991	9141	5014	706	14861	3.81
1992	9620	4587	725	14932	3.67
1993	10743	4267	731	15740	3.69
1994	12508	4387	776	17671	3.98
1995	14182	4732	815	19729	4.19
1998	18524	5557	946	25027	4.45
2001	24506	6507	1097	32110	4.78
2004	31168	7560	1273	40000	4.99
2007	36009	8734	1476	46219	4.83
2010	41411	10045	1712	53168	4.65

The methodology outlined in Appendix 1 estimates the level of employer contributions by using the actual costs of superannuation for the employer in that year for current employees. Hence, contributions paid by many public sector schemes to current pensioners on a pay as you go basis have been excluded. As these contributions merely "pass through" the superannuation fund, they make no contribution to the funds' assets. A similar approach will be taken in respect of benefit payments.

As a result of this methodology, the level of contributions shown for recent years is below that shown in ISC (1995). For instance, this publication shows that for 1992-93, total superannuation contributions (excluding transfers) into non-life insurance policies were $15.4 billion and that there was an additional $11.4 billion paid into life office superannuation funds giving a total of $26.8 billion, which is considerably in excess of the above figures. However, this total includes $7.3 billion of public sector contributions, which would represent mainly pay-as you go funding, and an unknown amount of transfers into life office superannuation funds. Hence, although the ISC statistics suggest that Table 3 represent an underestimation of contributions, it is likely that the figures in Table 3 are a reasonable estimate of new contributions for funded benefits. It is also worth noting that the rate of growth in the level of contributions from 1990 to 1994 in Table 3 is the same as for the corresponding period in the ISC statistics.

It is also apparent, and not surprising given the planned increases in the Superannuation Guarantee, that the level of contributions, when expressed as a percentage of the Gross Domestic Product, steadily increases until about 2004. However after that date, the level of contributions, when expressed in terms of the total economy, starts to decline due to the demographic factors and the stable contributions rates.

4 Projecting the cash outflows

4.1 Benefit payments

The most important cash outflow from superannuation funds is the benefit payments on the retirement, death, disablement or resignation of a member. These payments are difficult to predict as they are influenced by a number of parameters including:

- economic conditions which affect retirement and resignation rates;
- labour force participation rates for males and females;
- the design of benefits (eg the vesting scale used for resignation benefits);
- preservation requirements; and
- the size of the benefits which are affected by investment returns.

For this model the aggregate benefit payments were estimated for each age group, for both for males and females. For each grouping the following calculation was made:

$$\text{Benefits paid} = LF * \%Cov * [q_x(ret) + q_x(w) * take\%] * avben \qquad (2)$$

where LF represents the projected labour force for the particular age group and gender;

%Cov represents the proportion of the group with superannuation coverage;

$q_x(ret)$ represents the proportion of the age group retiring from the workforce;

$q_x(w)$ represents the proportion of the age group resigning from one employer but staying in the workforce;

take% represents the proportion of the accrued superannuation benefit that the resigning members at this age withdraws (or takes) from the system at that time. At retirement, it is assumed that 100% is withdrawn;

avben represents the average accrued benefit for an individual of that age and gender.

The labour force figures for each age group and gender are based on Series A in ABS 6260.0 Labour Force Projections. It has been assumed that all those aged 65 and over in the labour force will be entitled to receive their accrued superannuation benefit at age 65. The proportion covered by superannuation for each age grouping has been based on the results in ABS 6319.0 Superannuation Australia.

The rates of retirement were calculated from the change in the labour force for each quinquennial age group whilst also allowing for new entrants to the labour force as shown in ABS 6264.0 Persons who have Re-entered the Labour Force Australia and some migration effects. The projected rates for retirement varied marginally from year to year in line with the labour force and population projections but were generally in the order of 3% (aged 45-54) to 10% (aged 60-64) for males and varied from 6% (aged 45-54) to 22% (aged 55-59) and then to 13% (aged 60-64) for females. The consequences of varying some of these rates will be shown in Section 8. These assumed long term rates are broadly similar to the experience of the 1990-93 period.

The assumed base rates of resignation (or withdrawal) range from 18.5% for ages 15-24 to 0.1% for ages 45-54. These rates are consistent with those used in Britt (1991)

and reflect the fact that there are much higher withdrawal rates at younger ages. As noted above, resignation rates vary with economic circumstances with much lower rates experienced during the recession. For this reason, these rates have been increased for 1990 and 1991, decreased for 1992 and increased by 10% for 1993 and beyond. The adjustments used were based on ABS 6245.0 Successful and Unsuccessful Job Search Experience.

The take up percentage rates used represent the proportion of the accrued entitlement that the member withdraws from the superannuation fund when leaving the employer. In some cases, a proportion of this benefit is preserved and is unavailable until age 55. However the preserved benefit may still be withdrawn from the superannuation fund and transferred to an approved deposit fund, deferred annuity or allocated pension, which are excluded from this data. The percentages used prior to 1994 ranged form 80% prior to age 34 to 50% for ages from 35-44 and then 20% for ages 45-54. One rationale for these percentages is that younger members are inclined to withdraw their benefits (if possible) and not transfer them to another superannuation fund. Furthermore, many of these members will have amounts of under $500 which, under current rules, do not have to be preserved. As the impact of the preservation legislation increases, these take up percentages are likely to decrease as a higher proportion of the benefits will stay within the original superannuation fund or be transferred to another superannuation fund. Hence, it is assumed that between 1994 and 1999, the take up percentages prior to age 45 will decrease gradually from 80% and 50% to 20% at all ages.

The most significant figure in equation (2) is the average benefit available at the date of retirement or resignation. Brown (1994) estimated average superannuation entitlements at various ages for both males and females. He assumed that all individuals will have, on average, 2.15 superannuation accounts. However, it is highly likely that younger members will have fewer accounts whilst older members will, on average, have more accounts. Hence, Brown's figures have been recalculated assuming that 15-25 year olds will have, on average, 1.2 superannuation accounts and that this number will steadily increase to 3.2 superannuation accounts for those over age 55.

In addition, Brown's estimates were based on a survey of superannuation accounts held in the private sector. The average accrued superannuation benefits in the public sector are much greater than the average accrued superannuation benefits in the private sector, notwithstanding recent changes in the NSW and Victoria public sector superannuation arrangements. Assuming that the average public sector benefit is 50% larger than the corresponding private sector benefit (as supported by several ASFA surveys of benefit payments) and that the public sector represents about 30% of the total workforce (ABS 6248.0 Employed Wage and Salary Earners), then the estimate in Brown should be increased by 15% to provide a more accurate estimate for the average superannuation benefit paid in the total superannuation system.

4.1.1 A consistency check on the model

The total accrued superannuation benefits in the total system at any date can be checked, in broad terms, with the total assets of Australian superannuation funds at that date as shown in the relevant ABS publication. That is, the accrued benefits that could be paid out at any one time should not be greater than the value of the assets available. Indeed, it is reasonable to suggest that the aggregated benefits available to all fund members should be less than the assets available due to the presence of undistributed surplus in some defined benefit funds and reserves in some defined contribution funds. The total is difficult to estimate accurately but the following assumptions have been used:

Years	Level of surplus or reserves
1990-92	10% of all assets
1993-94	7% of all assets
1995 and beyond	5% of all assets

The reasons for the declining level include recent legislation which has encouraged funds to decrease their level of surplus, the poor investment performance in 1994, the growing importance of defined contribution funds and the increasing importance of preserved benefits.

After allowing for these assumed levels of unallocated surpluses and reserves, the average accrued benefits for each age group was increased so that the total accrued benefits plus the levels of surplus and reserve equalled the value of the total assets. This final adjustment factor varies from 1.12 in 1990 to 1.16 in 1994 and an assumed level of between 1.13 and 1.17 for 1995 and beyond.

Equation (2) and the above assumptions enabled the level of benefits paid out of the superannuation system each year to be estimated as shown in Table 4.

4.1.2 The size of the benefits

Table 4 highlights that most of the benefits are paid to those retiring after age 54 suggesting that the age of retirement is critical in determining the actual level of benefit payments from the superannuation system. It also highlights that about three-quarters of the benefits are paid to males due to their longer period in the workforce, their higher salaries (on average) and their past higher levels of superannuation coverage. The above figures ignore any insurance benefits paid in respect of death or disablement claims as these are not paid directly from the assets of superannuation funds.

It should be stressed that these are estimates of the benefits paid from superannuation funds and do not allow for rollovers. In some cases, where the benefits are transferred to rollover or annuity products they would remain as part of the total stock of savings whereas in other instances they would be immediately dissipated.

Table 4: Estimated Superannuation benefits for 1990-2010 in $mill

Year	Age and gender of beneficiaries						Total benefits	Total as % of GDP (3% real growth)
	males			females				
	15-44	*45-54*	*≥55*	*15-44*	*45-54*	*≥55*	**$mill**	
1990	2767	706	4148	940	352	792	9706	2.57
1991	2289	795	4847	778	329	1160	10199	2.62
1992	1655	9	6703	566	177	1258	10368	2.55
1993	2268	1285	5853	772	670	1511	12359	2.89
1994	2155	822	6594	745	310	1564	12190	2.75
1995	2014	665	7533	706	398	1723	13039	2.77
1998	1408	1364	9275	497	623	2303	15469	2.75
2001	1310	2705	11172	468	1111	2943	19709	2.93
2004	1651	2073	15853	604	1116	4271	25568	3.19
2007	2029	2505	21176	757	1453	5957	33875	3.54
2010	2456	4891	28023	931	2345	7922	46569	4.07

The total benefit payouts for 2001 is estimated at $19.7 billion compared to an estimate in Sarjeant and Solomon of $23.3 billion for 2001 (excluding public sector pensions) and a payout figure of $14 billion in for 2000-2001 in Rothman and Bacon. The latter figure may be low due to their assumption that 20% of the benefits are taken as a non-indexed annuity.

As with the level of contributions, the figures in Table 4 are lower than the statistics shown in ISC (1995). One reason for this discrepancy is that the unfunded benefits have been excluded form Table 4 as they are paid directly from Government revenue in the year of payment.

4.2 Expenses

Superannuation funds pay premiums, expenses and management fees for group life insurance, general administration, investment management and other professional services.

In terms of administration, it is assumed that these costs approximate 0.83% per annum of the funds' assets in 1993 gradually decreasing to 0.68% of the funds' assets by 2009 indicating increasing efficiency as the funds grow in total size. This figure was based on the administration costs per member shown in Hely (1994) allowing for the average amounts per member discussed above.

For insurance costs, it will be assumed that the average cost per member is $1 per week (or $52 per annum) indexed by the assumed inflation level. The total group life annual premium in the Australian market is in the order of $330 million per annum (see ISC, Quarterly Statistical Bulletin, September, 1994) which is of the same order as 6.5 million covered members times $52 per annum. Furthermore, the total of administration and insurance costs are consistent with the ISC (1995).

The investment management expenses have been assumed to equal 0.5% per annum of the assets under management. This figure is in line with general industry fees for wholesale investment management funds. However, with increasing funds under management and continued competition in the industry, it is reasonable to assume that this expense rate will decrease over time. It is therefore assumed that this expense rate will decrease gradually to 0.35% per annum of the assets under management in 2009.

Table 5 provides a summary of the expenses expected to be paid from the superannuation system from 1990 to 2010.

The expense figure of $3.75 billion for 2001 compares with an estimate of $2.55 billion for 2001 in Sarjeant and Solomon (1994). Rothman and Bacon (1994) did not show any expense costs which suggests that their projected size of the future assets may be too high. Expressed as a proportion of GDP, the expense estimates show a very small increase over time although they tend to stabilise in the order of 0.6% of GDP.

Table 5: Estimated expenses incurred by the superannuation industry ($mill)

Year	Administration and insurance expenses	Investment expenses	**Total expenses**	**Total as % of GDP (3% real growth)**
1990	932	561	1493	0.39
1991	968	583	1551	0.40
1992	1165	702	1867	0.46
1993	1224	737	1961	0.46
1994	1503	905	2408	0.54
1995	1446	864	2310	0.49
1998	1853	1079	2932	0.52
2001	2396	1356	3751	0.56
2004	3068	1681	4749	0.59
2007	3849	2034	5883	0.61
2010	4673	2371	7044	0.62

4.3 Taxation

Superannuation funds pay taxation at the rate of 15% in respect of deductible contributions paid by employers and the self employed and in respect of investment income, net of any imputation and other credits. For this model, the 15% tax has been assumed to apply in respect of all employer and self employed contributions, although this will slightly overstate the tax paid in respect of the self employed contributions. The tax rate does not apply in respect of undeducted member contributions.

Taxation is also payable in respect of investment income and benefits paid. However, the taxation payable in respect of investment income has been incorporated into the investment earning rates shown earlier which are net of tax. The taxation paid on benefits is calculated according to the size of the benefit and is paid from the benefit received by the individual. As a result, the taxation figure shown in the following tables does not include the taxation paid in respect investment income or benefits.

The projected taxation figure allows for 15% tax on the assumed level of deductible contributions less an allowance for the assumed level of administrative expenses. Group life premiums and claims have been excluded from this estimate as they tend to cancel each other out. The model shows a level of taxation from deductible contributions of $1124 million for 1992 compared to the Taxation Statistics figures of $1401 million for 1991-92 and $1213 million for 1992-93. These official figures also include investment income although much of is offset by dividend imputation and other credits. In terms of the projections, the estimate for 2001 is $2.97 billion compared to a projected figure of $3.45 billion in Sarjeant and Solomon (1994) and $3.6 billion for the year 2000 in Rothman and Bacon (1994). These comparisons confirm that the estimates in the model are of the right order although slightly lower than the other models.

5 An historical check on the results

Before proceeding to the projection of the size of Australia's superannuation industry, it is helpful to check this model against recent history.

The data discussed above has a commencing date of 31 December 1989. As we have data on the size of the industry until 31 December 1994, it is possible to check the validity of the model and the size and direction of any error that may be implicit in the model by comparing the projections within the model with past experience. Table 6 sets out the projected size of the industry and the actual size as shown in the relevant ABS publication. Two estimates are shown. The initial one operates on a cumulative process with a 31 December 1989 starting date whilst the second one represents an annual estimate using the known size 12 months before the date shown.

These results suggest that the model is working reasonably well. Indeed, over a 5 year period (1989-94) the cumulative error is plus 0.71% or 0.14% per annum. The largest error occurred in 1994 where the model suggests a smaller answer than the ABS statistics. This result could be brought about by the large unrealised capital loss that was assumed to occur in 1994 as shown in Table 7. In view of these retrospective results, there is some confidence to use the model for future projections.

Table 6: Comparison of the model results with the actual data

Date for projection	Actual fund size[1] ($bill)	Projection from 1989 base ($bill)	Percentage error (cumulative)	Projection for 12 months ($bill)	Percentage error (annual)
31.12.1990	115.8	116.6	0.65	116.6	+0.65
31.12.1991	139.2	140.4	0.79	139.6	+0.25
31.12.1992	146.1	147.5	0.93	146.4	+0.18
31.12.1993	179.5	181.1	0.91	179.7	+0.16
31.12.1994	176.4	175.1	-0.71	173.5	-1.63

Notes

1 As shown in ABS Cat No 5656.0

6 The projected size of Australian superannuation funds

The above sections have described a model that can be used to project the size of the Australian superannuation system. Using the above assumptions, and a starting point of 31 December 1994, Table 7 sets out a summary of the inflows and outflows for Australia's superannuation funds for the next 15 years in terms of both dollars and as a percentage of GDP allowing for real growth of 3% pa.

The tables are based on the earlier figures with one exception. The investment returns and the size of the Gross Domestic Product are known for the years 1990-1994. Hence, it is appropriate to use the exact figures rather than estimates. The actual investment returns used for 1990-1994 are those shown in the Towers Perrin Superannuation Pooled Funds Survey allowing for the relative importance (in terms of assets) of both market linked and capital stable funds. It is acknowledged that these surveys do not encompass the total industry but the rates of return achieved by these funds provide a very good indicator of the returns achieved by the total industry. Furthermore, their overall asset allocation is very similar to that shown in the ABS figures for the total industry.

The projected size of the assets held within the Australian superannuation industry in December 2001 is $347 billion compared to an estimate of $365 billion for June 2001 in Sarjeant and Solomon (1994) and $367 billion for June 2000 in Rothman and Bacon (1994). The lower estimate in the Table 7 is due to a number of reasons. However the most significant factor is the poor investment returns achieved in 1994 which had not occurred when the earlier projections were made. This result alone reduces the earlier estimates by about 10% such that the three figures are very similar.

These tables show that the market value of the assets held in Australia's superannuation funds will continue to grow at a significant rate during the next 15 years. This is not surprising with the continuing implementation of the Superannuation Guarantee Charge. It is also likely that the value of the assets will increase when expressed as a percentage of the nation's Gross Domestic Product. However, it is worth noting that the rate of growth is slower in the first decade of the next century than in the 1990s.

With this suggestion of a changing trend, it is appropriate to extend our projections to 2030 so that we obtain a better understanding of the impact of the effects of the ageing population and other factors that may impinge on the long term level of funds available from superannuation funds.

Table 7: Projected Size of Australia's superannuation funds in $bill

Year	Fund at start of calendar year	Contributions	Investment Income	Investment Cap Gain[1]	Benefits Paid	Expenses	Taxation	Fund at end of year[2]	**Funds as % of GDP[4] (3% real growth)**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1990	112.260	13.893	5.526	-2.929	9.706	1.493	0.969	116.581	30.84
1991	116.581	14.861	6.107	15.676	10.199	1.551	1.122	140.354	35.99
1992	140.354	14.932	6.655	-1.108	10.368	1.867	1.124	147.474	36.23
1993	147.474	15.740	7.193	26.266	12.359	1.961	1.272	181.081	42.41
1994	181.081	17.671	7.655	-15.262	12.190	2.408	1.441	175.104	39.44
1995	176.365[3]	19.729	8.743	5.975	13.039	2.310	1.720	193.743	41.13
1998	234.527	25.027	11.642	7.957	15.469	2.932	2.246	258.507	45.96
2001	315.244	32.110	15.638	10.688	19.709	3.751	2.975	347.245	51.70
2004	420.234	40.000	20.795	14.213	25.568	4.749	3.766	461.160	57.51
2007	549.831	46.219	27.050	18.487	33.875	5.883	4.253	597.575	62.41
2010	697.435	53.168	34.091	23.299	46.569	7.044	4.821	749.559	65.56

Notes

1 The investment return from capital gains (Column (5)) has been adjusted for 1990-1994 to reflect the actual experience of the funds as shown in the regular Towers Perrin surveys.

2 Column (9) = Columns [(2) + (3) + (4) + (5)] - Columns [(6) + (7) + (8)]

3 The figure for 1 January 1995 has been adjusted to reflect the actual size for future projections.

4 The GDP figures used for 1990-1994 are based on the expenditure measure (Reserve Bank Bulletin).

Sources

Column (3) is from Table 3; Columns (4) and (5) are based on the asset allocation shown in Table 1 and the rates shown in Table 2: Column (6) is from Table 4; Column (7) is from Table 5 and Column (8) is 15% of (employer's and self employed contributions minus administration expenses).

Table 8 projects the size of Australia's superannuation funds until 2030 using as a starting base, the size of the Australian superannuation funds as at 31 December 1994.

Table 8: The projected size of Australian superannuation from 1995 to 2030

End of year	Projected Size ($bill)	Projected Size in 1995 dollars ($bill)	Projected Size as a % of GDP (3% pa growth)
1995	193.7	193.7	40.3
2000	315.2	271.9	49.8
2005	504.7	375.5	59.3
2010	749.6	481.1	65.6
2015	1046.9	579.6	68.1
2020	1424.2	680.2	68.9
2025	1863.9	767.9	67.1
2030	2408.5	855.9	64.6

As suggested earlier, the rate of growth of Australian superannuation funds will slow in the second and third decades of next century due to the effects of ageing population and the associated payment of retirement benefits from these funds. Indeed, assuming real GDP growth of 3% per annum over this long term, the relative size of superannuation funds within the economy starts to decline after about 2020. The flattening of the curve, due to the retirement benefits paid to those born after World War II, is very apparent and must have significant effects for the economy and the capital markets in the future. It is therefore appropriate that we now turn to estimate the amount of new capital available for investment from superannuation funds.

7 The capital available for investments from superannuation funds

One of the major advantages of a mandatory funded national retirement income system is the generation of capital for investment purposes (see World Bank (1994) and FitzGerald (1994)). However, it is important to realise that the growth in the relative size of Australia's superannuation funds, by themselves, do **not** generate new funds for capital investment. For example, if a fund of $100 invests in a marketable security that increases in value by 10% during the year, the fund's value has increased to $110 but there is no extra capital available for investment from that fund, even though the fund's value may have grown at a faster rate than the economy. Of course, it may be that the company (whose value has grown by 10%) may be in a better position to raise new capital due to its higher share price but it is important to realise that the superannuation fund has no additional funds available for investment.

This distinction between the growth of the assets of Australia's superannuation funds and the capital that may be available for new investments is often overlooked. Foster and Knox (1994) and Knox (1994) both show that the significant increase in the value of superannuation fund assets during the last 5 years has been predominantly caused by the underlying investment performance and not by a net increase in the cash flow to superannuation. Of course, it is recognised that during this period, the SGC was being introduced gradually and benefit payments were higher due to the impact of the recession. Nevertheless, it needs to be recognised that growth in the market value of the funds' assets does not guarantee the available of capital for new investment projects.

The model described above is able to project the amount of new funds that would be available for investment by Australia's superannuation funds. In general terms, the assumption is that all funds actually received by the superannuation system will be available for investment opportunities. Hence the amount of funds available for new investments can be considered to be the following:

Funds available for new investment in any one period =
+ contributions received + investment income received
- benefits paid - administration and insurance expenses - taxation (3)

It should be noted that capital gains from investments have been excluded from Equation (3). The reason for this assumption is that unrealised capital gains do not generate any additional income for a superannuation fund to increase its investments. On the other hand, it could be argued that a realised capital gain does generate additional funds for a particular superannuation fund. However, in many cases, the purchaser of the security will be another superannuation fund such that the total superannuation system has not received any additional funds for investment.

Table 9 estimates the amount of new funds available for investment opportunities, expressed in 1995 dollars and as a percentage of GDP from 1995 to 2030.

Table 9: Capital available for new investments from superannuation funds

Year	New funds for investment ($bill)	New funds in 1995 dollars ($bill)	New funds as a % of GDP (3% pa real growth)
1995	11.403	11.403	2.42
2000	19.867	17.137	3.14
2005	27.924	20.778	3.28
2010	28.825	18.502	2.52
2015	33.034	18.290	2.15
2020	38.638	18.454	1.87
2025	36.851	15.182	1.33
2030	43.160	15.338	1.16

Table 9 shows that the level of funds available for new investments will increase until 2030 when expressed in nominal dollars. However, when expressed in 1995 dollars or as a percentage of GDP, there is a decline in the capital available after 2005. That is, the amount of new funds available for investment purposes, when expressed as a percentage of the total economy starts to reduce shortly after the SGC reaches its maximum level of 9% in 2002-03. These figures are very significant for the future growth of the Australian economy and highlight the important effect that the ageing population will have on the Australian economy and the need for a continued priority to raise the level of national savings.

One method of reversing the trend shown in Table 9 is to slow down the rate of benefit payments from the Australian superannuation system. This could be done by requiring or strongly encouraging individuals to take their superannuation benefits in a life annuity or allocated pension form. In essence, this would reduce the rate of benefit payments from the overall superannuation system. However, it must be stressed that such a move, which may have many advantages, does not remove the problem. It merely defers it for a decade or so. The Australian community must realise that with an ageing population, there will be a limited level of savings available for new investments after the first decade of the next century. This finding is not new and supports FitzGerald (1994) which notes that the contribution to national saving of the Superannuation Guarantee is initially due to the increasing accumulation in superannuation funds and then as a reduction in the assumed level of future age pension outlays. Indeed Table 9 suggests that superannuation funds will be providing less funds for new investment purposes in terms of GDP from 2015 than will occur in 1995.

Another possibility to counter this declining level of investible funds is to raise the level of superannuation contributions, either from employers or employees. The effects of introducing a minimum employee contribution of 3% of earnings, as announced in the 1995-96 Federal Budget, and an increase in the SGC will be assessed in the next section.

8 Changing the underlying assumptions

As with any model projecting future values, the assumptions used are critical in determining the final outcome. Table 10 indicates the differences in the projected size of the superannuation funds (expressed as a percentage of GDP) and the capital available for investment in 10 and 25 years time for various changes in the underlying assumptions. Figures 1 and 2 graph the results from 1990 until 2030 for the base run and four alternatives.

The table and graphs confirm a number of expected results. These include:

- an increase in inflation, without a corresponding increase in investment returns, causes a decline in the relative importance of superannuation (when expressed as a proportion of the GDP) due to the impact of lower real rates of return although there is a small increase in the amount of capital available due to higher contributions;
- an increase in the real investment returns causes a rise in the relative importance of superannuation funds as the increase is not matched by a similar growth in the economy. However this increase does not fully flow through into new funds available for investment as some of it is assumed to be unrealised capital gains;
- an increase in both the inflation rate and investment returns causes only a minor change in the relative importance of superannuation but increases the capital available due to the higher investment returns;
- the introduction of compulsory employee contributions (in line with the Budget announcement but excluding the Government contributions as these do not represent additional national savings) causes a significant increase in both the importance of superannuation funds in the economy and the level of funds available for new investments, particularly in the next decade;
- an increase in the level of the minimum level of SGC from 9% of earnings in 2002-03 to 11% of earnings in 2006-07 and beyond has very little impact in the next decade but, as expected, causes an increase in the importance of superannuation and the amount of capital available for investments in later years;
- decreasing the rates of retirement from age 55 by 4% pa (for example, for males aged 60-64 it reduces from 10% pa to 6% pa) increases the importance of superannuation and the availability of capital due to the deferred payment of retirement benefits; and
- an increase in expenses or taxation reduces the size of superannuation and the amount of capital available for investment purposes.

However, it is important to stress that the overall shapes of Figures 1 and 2 are not fundamentally altered by any of these changes. The impact of the ageing population remains dominant and hence policies must be developed which take full account of this fundamental change within Australia's population and the corresponding effects within the economy.

Table 10: Projected size of Australian superannuation funds in 2005 and 2020 under different scenarios

Scenario	Projections for 10 years time (2005)				Projections for 25 years time (2020)			
	Projection as % of GDP (with 3% pa real growth)	Difference from base as a % of GDP	Capital available $ bill	Difference from base $ bill	Projection as % of GDP (with 3% pa real growth)	Difference from base as a % of GDP	Capital available $ bill	Difference from base $ bill
Base	59.3	-	3.28	-	69.0	-	1.87	-
Inflation +2% pa	51.5	-7.8	3.36	+0.08	54.0	-14.9	2.17	+0.30
Investment returns +2% pa	67.7	+8.3	3.95	+0.67	88.0	+19.0	2.49	+0.62
Inflation and investment returns both +2% pa	58.5	-0.8	3.93	+0.65	67.2	-1.8	2.66	+0.79
Minimum employee contributions at 3%	63.0	+3.7	3.80	+0.52	76.0	+7.0	2.15	+0.28
SGC +2% to 11% over 4 years	59.9	+0.6	3.62	+0.33	75.1	+6.1	2.24	+0.37
Retirement rates +4% each year	56.6	-2.7	3.09	-0.19	64.7	-4.3	1.69	-0.18
Retirement rates -4% each year	63.0	+3.7	3.56	+0.28	74.5	+5.5	2.12	+0.25
Expenses +0.5% of assets	58.0	-1.3	3.14	-0.14	66.1	-2.9	1.72	-0.15
Taxation on deductible contributions +5% to 20%	58.1	-1.2	3.16	-0.13	67.1	-1.9	1.80	-0.07

Figure 1: Super funds as a % of GDP

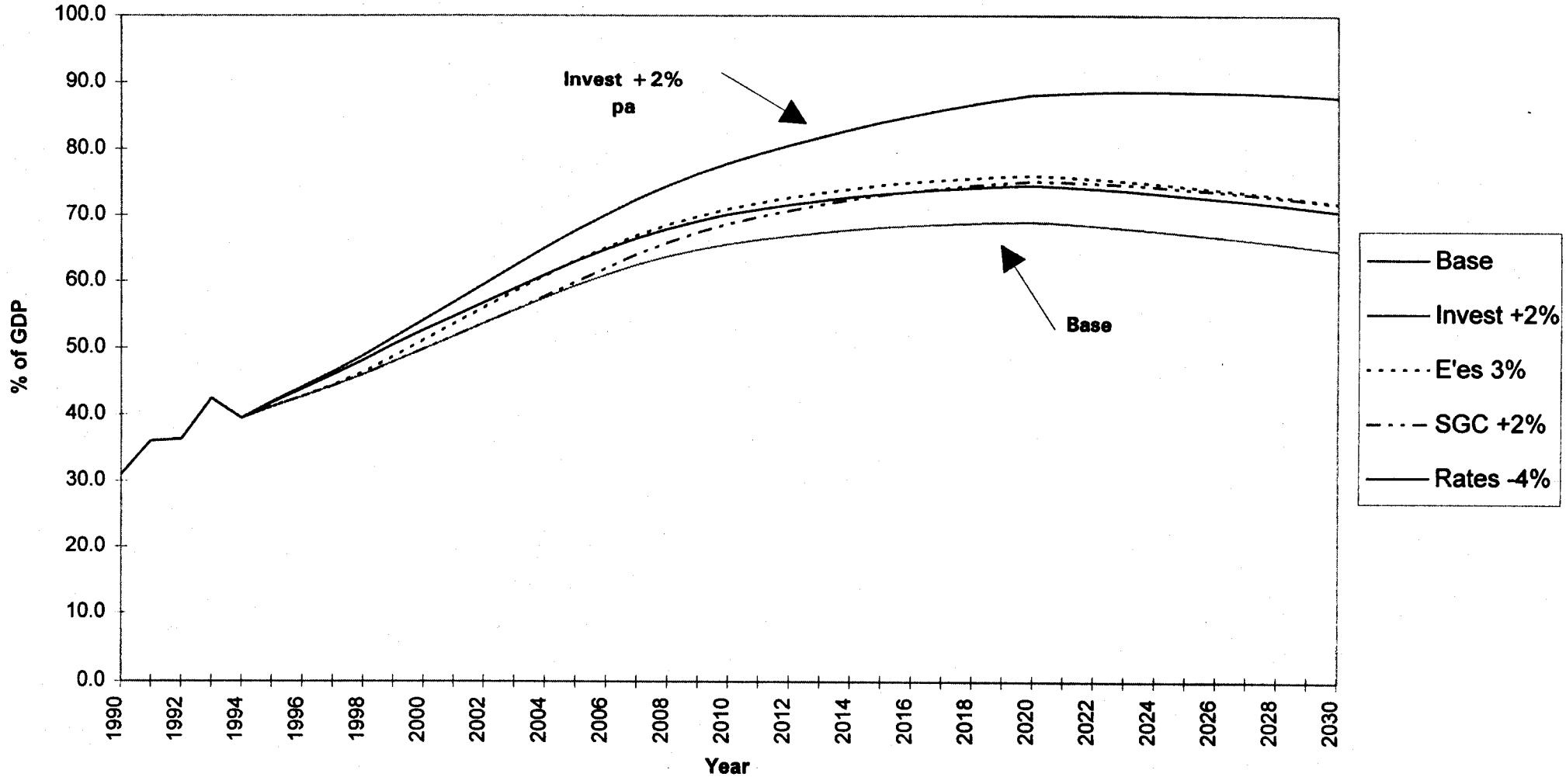
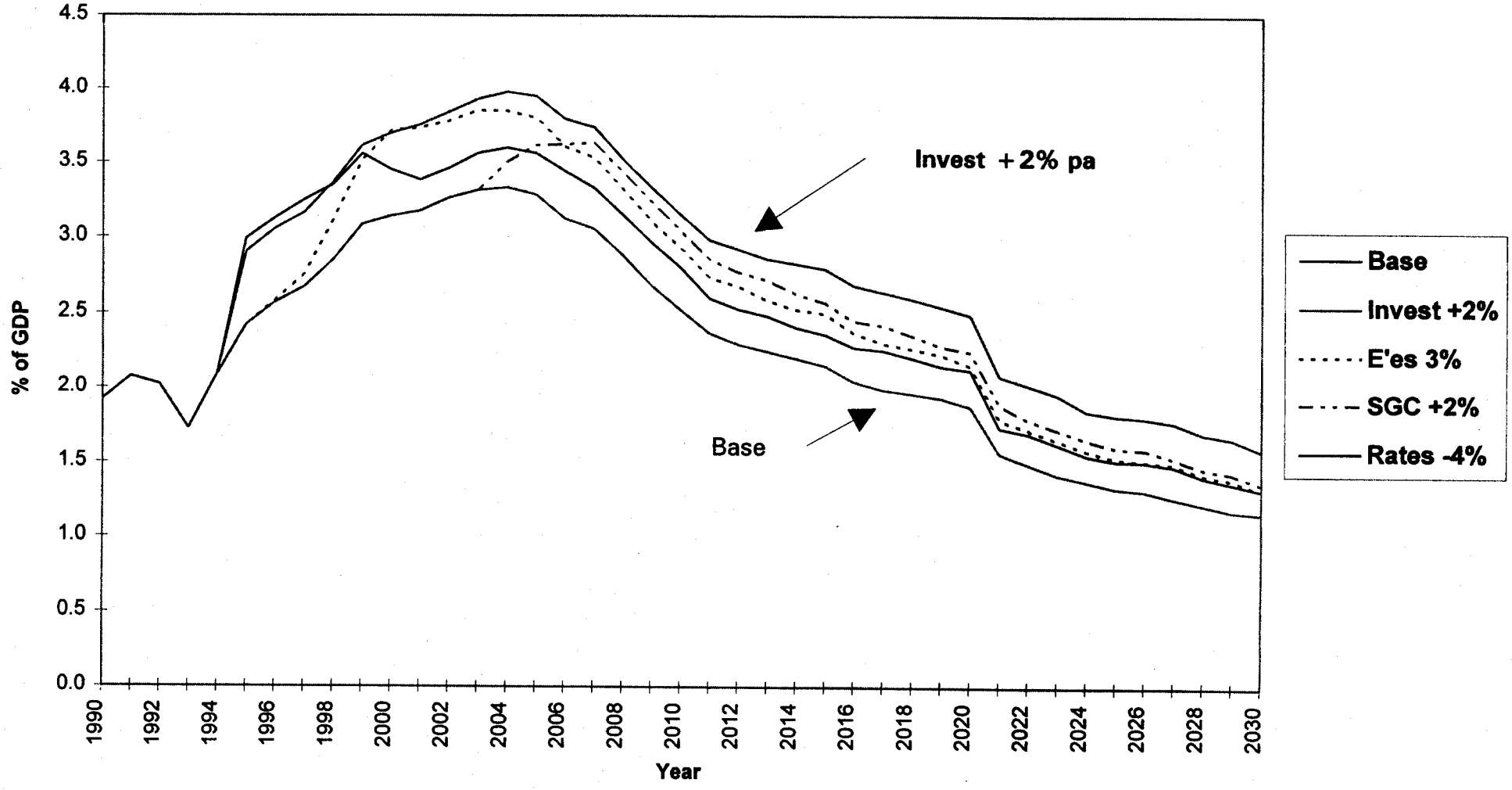


Figure 2: New funds available for investment as a % of GDP



9 Conclusions

This paper has projected the size of assets held by Australia's superannuation funds and the amount of funds available for new investments until 2030. As noted earlier, Approved Deposit funds and post retirement funds (eg allocated pensions) have been excluded from the study. Notwithstanding the dramatic changes in Australian superannuation policy during the last decade, the underlying trends are clear. Superannuation funds (that is, funds holding benefits prior to payment) will continue to grow in importance within the economy until the end of the second decade of the next century and will then tend to gradually decline from their peak. However, the availability of funds for new investments will have peaked in the first decade and will then reduce as benefits are withdrawn.

In terms of the overall need for saving and the need for available funds for investment within the economy, these results confirm the benefits of the introduction of the Superannuation Guarantee and employee contributions. However, in the longer term, it is essential that the Government provide additional structures and incentives to encourage individuals to stay in the work force for longer periods, to increase their contribution rates and to preserve part of their superannuation benefits after their retirement. That is, the issue of national savings must be tackled on several fronts within Australia's overall retirement income strategy.

In overall policy terms, the recent trend towards earlier retirement needs to be reversed and an incentive or requirement for superannuation benefits to be primarily taken as annuities is required, thereby helping to maintain the accumulated capital stock for a longer period. In addition, it must be noted that the investment policies of retirees will become increasingly critical as they will control a much larger proportion of Australia's investible capital in the future than ever before.

Without these significant social changes, many of the important foundations that have been laid in the past decade will be wasted. Such an outcome will not be to the benefit of the future generations of Australians.

References

ABS Cat No 5656.0 Assets of Superannuation Funds and Approved Deposit Funds

ABS Cat No 6245.0 Successful and Unsuccessful Job Search Experience

ABS Cat No 6248.0 Self Employed and Employers

ABS Cat No 6260.0 Labour Force Projections

ABS Cat No 6264.0 Persons who have Re-entered the Labour Force Australia

ABS Cat No 6302.0 Average Weekly Earnings

ABS Cat No 6319.0 Superannuation Australia

ABS Cat No 6334.0 Employment Benefits

ASFA, Surveys of Retirement Benefits, various years

ASFA (1995), Yield up, Price down, Superfunds, February, 59.

Australian Taxation Office, Taxation Statistics

Britt S (1991), Greater of Benefits - Member Options in Defined Benefit Superannuation Plans, Transactions of the Institute of Actuaries of Australia, 77-139.

Brown C L (1994), The Distribution of Private Sector Superannuation Assets by Gender, Age and Salary of Members, Second Annual Colloquium of Superannuation researchers, The University of Melbourne.

FitzGerald V W (1994), National Saving: A Report to the Treasurer, AGPS, Canberra.

Foster R and Knox D M (1994), Funded Retirement Incomes for Australians and the Growth of the Superannuation Sector, Second Annual Colloquium of Superannuation researchers, The University of Melbourne

Hely S (1994), Administration costs jump by 31%, Superfunds, 63-67, November.

Humphreys J and Newman C A (1993), Crediting Rates for Superannuation Plans, Transactions of the Institute of Actuaries of Australia, 229-304.

Insurance and Superannuation Commission (1994), Quarterly Statistical Bulletin, September.

Insurance and Superannuation Commission (1995), Superannuation Bulletin 1992-93 AGPS.

Keating P. J., (1989), Address to the Life Insurance Federation of Australia, NSW Branch, 9 November.

Knox D M (1994), Present Problems and Prospective Pressures in Australia's Superannuation System, Centre for Actuarial Studies, The University of Melbourne, Research Paper Number 15.

Rothman G P and Bacon B R (1994), The Impact of Population and Labour Force Scenarios on Superannuation, tax Expenditures and Pension Costs, Second Annual Colloquium of Superannuation researchers, The University of Melbourne.

Sarjeant H and Solomon S (1994), Estimation of Superannuation Payments - Australia, Second Annual Colloquium of Superannuation researchers, The University of Melbourne.

Towers Perrin, Superannuation Pooled Funds Survey

World Bank (1994), Averting the Old Age Crisis, Oxford University Press.

Appendix 1: The methodology used to estimated future contributions

The level of employer contributions

To estimate the level of employers' contributions, the number of individuals has been estimated as the projected labour force (ABS Cat No 6260.0 Labour Force Projections) less the unemployed persons and the number of self employed persons. It is assumed that the unemployment rate will remain at 9% and that the number of self employed persons will increase by 1% per annum.

The number of employed persons who are covered by an employer sponsored superannuation plan has been taken from ABS 6334.0 Employment Benefits which enables the relevant proportion to be calculated. The proportion has increased from 52.6% in 1990 to 85.4% in 1993. It is estimated that this will increase to 88% in 1994 and then rise steadily to 93% for 1999 and later years.

The level of the average employer contribution rate has been estimated from ABS 6348.0 Labour Costs for 1990 and 1991. The average contribution for the employers who were contributing is estimated to be 9.6% and 8.0% for 1990 and 1991 respectively. With the advent of the SGC and the increasing coverage, it is expected that the average employer contribution rate will decrease to 7.2% in 1993 but then increase gradually from 7.6% in 1994 to 10.4% for 2003 and beyond. It is noted that the current plans for the SGC is for a minimum employer contribution rate of 9% of earnings in 2002-03. The long term employer contribution assumption of 10.4% allows for some employers (albeit a decreasing percentage) to contribute at a rate in excess of the required minimum.

The average wage used to estimate the level of total employer contributions is the average wage increased by 4% per annum. This rate of increase allows for annual inflation of 3% pa and a 1% pa productivity increase.

Table 3 showed the estimated annual level of employer contributions from 1990 to 2010. The overall level of employer contributions for 1992 is confirmed by the level of employer contributions shown in Taxation Statistics for 1991-2 and 1992-3 (the most recent available). Although the financial years for each superannuation fund does not all correspond to the financial year, the average level of employer contributions and other net income for 1991-2 and 1992-3 is $9.0 billion compared to the estimate of $9.6 billion.

The level of employee contributions

As for employer contributions, the number of employees has been estimated as the labour force less the unemployed persons and the number of self employed persons.

The proportion of employees who are contributing to superannuation has been estimated from ABS 6319.0 Superannuation Australia. Using the adjusted labour force number (from above), it is estimated that 49.7% of employees contributed in 1991 and 43.3% of employees made contributions in 1993. The reduction may be explained by the

increasing use of salary sacrifice arrangements and the reduced taxation attractiveness of personal superannuation for employees. For 1994 and beyond, it is assumed that 42.5% of employees will make contributions to superannuation. This includes contributions to both their employer scheme and personal arrangements. The introduction of employee contributions will increase this percentage and the effect of this change is analysed in Section 8.

A weighted average rate of the level of employees contributions can be calculated using data from ABS 6319.0 Superannuation Australia. It was 5.37% of earnings for 1991 and 4.86% of earnings for 1993. For 1994 and beyond, it will be assumed that the contribution rate will be 4.8% of earnings for those employees who contribute. Of course, the introduction of a compulsory 3% contribution will reduce this average rate of employee contribution.

Unlike employer contributions, the average wage will not be assumed as employees who make contributions have a higher contribution rate than the average based on ABS 6319 statistics which show a 15-20% difference. For the longer term projections, it has been assumed that the average wage for employees who currently make contributions will be 15% higher than the average wage.

The level of self-employed contributions

The number of self-employed persons has been estimated from ABS 6248.0 Self Employed and Employers.

The proportion of employers and the self-employed covered by superannuation can be estimated from ABS 6319.0 Superannuation Australia. For both 1991 and 1993, the proportion covered is 41.7% and this figure will be assumed in the future. Of course, if the SGC were to be extended to the self-employed, this figure would rise.

The average rate of contribution by the self-employed who contribute to superannuation has been assumed to be 5.5% of earnings. This represents the average contribution rate in 1990 for members making their own contributions and it has been assumed for the future. In terms of the self-employed, it is likely that this contribution rate will vary significantly with economic conditions and any legislative requirement.

The average wage has been assumed for the estimates for the self employed and the total estimated contributions for 1990-2010 is shown in Table 3. The total contributions for the self employed are lower than shown in the Taxation Statistics but it is reasonable to expect that some of the tax deduction provided for contributions were received by employees.

RESEARCH PAPER SERIES

No.	Date	Subject	Author
1	MAR 93	AUSTRALIAN SUPERANNUATION : THE FACTS, THE FICTION, THE FUTURE	David M Knox
2	APR 93	AN EXPONENTIAL BOUND FOR RUIN PROBABILITIES	David C M Dickson
3	APR 93	SOME COMMENTS ON THE COMPOUND BINOMIAL MODEL	David C M Dickson
4	AUG 93	RUIN PROBLEMS AND DUAL EVENTS	David CM Dickson Alfredo D Egidio dos Reis
5	SEP 93	CONTEMPORARY ISSUES IN AUSTRALIAN SUPERANNUATION - A CONFERENCE SUMMARY	David M Knox John Piggott
6	SEP 93	AN ANALYSIS OF THE EQUITY INVESTMENTS OF AUSTRALIAN SUPERANNUATION FUNDS	David M Knox
7	OCT 93	A CRITIQUE OF DEFINED CONTRIBUTION USING A SIMULATION APPROACH	David M Knox
8	JAN 94	REINSURANCE AND RUIN	David C M Dickson Howard R Waters
9	MAR 94	LIFETIME INCOME, TAXATION, EXPENDITURE AND SUPERANNUATION (LITES): A LIFE-CYCLE SIMULATION MODEL	Margaret E Atkinson John Creedy David M Knox
10	FEB 94	SUPERANNUATION FUNDS AND THE PROVISION OF DEVELOPMENT/VENTURE CAPITAL: THE PERFECT MATCH? YES OR NO	David M Knox
11	JUNE 94	RUIN PROBLEMS: SIMULATION OR CALCULATION?	David C M Dickson Howard R Waters
12	JUNE 94	THE RELATIONSHIP BETWEEN THE AGE PENSION AND SUPERANNUATION BENEFITS, PARTICULARLY FOR WOMEN	David M Knox
13	JUNE 94	THE COST AND EQUITY IMPLICATIONS OF THE INSTITUTE OF ACTUARIES OF AUSTRALIA PROPOSED RETIREMENT INCOMES STRATEGY	Margaret E Atkinson John Creedy David M Knox Chris Haberecht
14	SEPT 94	PROBLEMS AND PROSPECTS FOR THE LIFE INSURANCE AND PENSIONS SECTOR IN INDONESIA	Catherine Prime David M Knox
15	OCT 94	PRESENT PROBLEMS AND PROSPECTIVE PRESSURES IN AUSTRALIA'S SUPERANNUATION SYSTEM	David M Knox

16	DEC 94	PLANNING RETIREMENT INCOME IN AUSTRALIA: ROUTES THROUGH THE MAZE	Margaret E Atkinson John Creedy David M Knox
17	JAN 95	ON THE DISTRIBUTION OF THE DURATION OF NEGATIVE SURPLUS	David C M Dickson Alfredo D Egidio dos Reis
18	FEB 95	OUTSTANDING CLAIM LIABILITIES: ARE THEY PREDICTABLE?	Ben Zehnwirth
19	MAY 95	SOME STABLE ALGORITHMS IN RUIN THEORY AND THEIR APPLICATIONS	David C M Dickson Alfredo D Egidio dos Reis Howard R Waters
20	JUN 95	SOME FINANCIAL CONSEQUENCES OF THE SIZE OF AUSTRALIA'S SUPERANNUATION INDUSTRY IN THE NEXT THREE DECADES	David M Knox
21	JUN 95	MODELLING OPTIMAL RETIREMENT IN DECISIONS IN AUSTRALIA	Margaret E Atkinson John Creedy
22	JUN 95	AN EQUITY ANALYSIS OF SOME RADICAL SUGGESTIONS FOR AUSTRALIA'S RETIREMENT INCOME SYSTEM	Margaret E Atkinson John Creedy David M Knox
23	SEP 95	EARLY RETIREMENT AND THE OPTIMAL RETIREMENT AGE	Angela Ryan
24	OCT 95	APPROXIMATE CALCULATION OF MOMENTS OF RUIN RELATED DISTRIBUTIONS	David C M Dickson
25	DEC 95	CONTEMPORARY ISSUES IN THE ONGOING REFORM OF THE AUSTRALIAN RETIREMENT INCOME SYSTEM	David M Knox
26	FEB 96	THE CHOICE OF EARLY RETIREMENT AGE AND THE AUSTRALIAN SUPERANNUATION SYSTEM	Margaret E Atkinson John Creedy
27	FEB 96	PREDICTIVE AGGREGATE CLAIMS DISTRIBUTIONS	David C M Dickson Ben Zehnwirth
28	FEB 96	THE AUSTRALIAN GOVERNMENT SUPERANNUATION CO-CONTRIBUTIONS: ANALYSIS AND COMPARISON	Margaret E Atkinson
29	MAR 96	A SURVEY OF VALUATION ASSUMPTIONS AND FUNDING METHODS USED BY AUSTRALIAN ACTUARIES IN DEFINED BENEFIT SUPERANNUATION FUND VALUATIONS	Des Welch Shauna Ferris
30	MAR 96	THE EFFECT OF INTEREST ON NEGATIVE SURPLUS	David C M Dickson Alfred D Egídio dos Reis
31	MAR 96	RESERVING CONSECUTIVE LAYERS OF INWARDS EXCESS-OF-LOSS REINSURANCE	Greg Taylor
32	AUG 96	EFFECTIVE AND ETHICAL INSTITUTIONAL INVESTMENT	Anthony Asher

33	AUG 96	STOCHASTIC INVESTMENT MODELS: UNIT ROOTS, COINTEGRATION, STATE SPACE AND GARCH MODELS FOR AUSTRALIA	Michael Sherris Leanna Tedesco Ben Zehnwirth
34	AUG 96	THREE POWERFUL DIAGNOSTIC MODELS FOR LOSS RESERVING	Ben Zehnwirth
35	SEPT 96	KALMAN FILTERS WITH APPLICATIONS TO LOSS RESERVING	Ben Zehnwirth
36	OCT 96	RELATIVE REINSURANCE RETENTION LEVELS	David C M Dickson Howard R Waters
37	OCT 96	SMOOTHNESS CRITERIA FOR MULTI-DIMENSIONAL WHITTAKER GRADUATION	Greg Taylor
38	OCT 96	GEOGRAPHIC PREMIUM RATING BY WHITTAKER SPATIAL SMOOTHING	Greg Taylor
39	OCT 96	RISK, CAPITAL AND PROFIT IN INSURANCE	Greg Taylor
40	OCT 96	SETTING A BONUS-MALUS SCALE IN THE PRESENCE OF OTHER RATING FACTORS	Greg Taylor
41	NOV 96	CALCULATIONS AND DIAGNOSTICS FOR LINK RATION TECHNIQUES	Ben Zehnwirth Glen Barnett
42	DEC 96	VIDEO CONFERENCING IN ACTUARIAL STUDIES - A THREE YEAR CASE STUDY	David M Knox
43	DEC 96	ALTERNATIVE RETIREMENT INCOME ARRANGEMENTS AND LIFETIME INCOME INEQUALITY: LESSONS FROM AUSTRALIA	Margaret E Atkinson John Creedy David M Knox
44	JAN 97	AN ANALYSIS OF PENSIONER MORTALITY BY PRE-RETIREMENT INCOME	David M Knox Andrew Tomlin
45	JUL 97	TECHNICAL ASPECTS OF DOMESTIC LINES PRICING	Greg Taylor
46	AUG 97	RUIN PROBABLITIES WITH COMPOUNDING ASSETS	David C M Dickson Howard R Waters
47	NOV 97	ON NUMERICAL EVALUATION OF FINITE TIME RUIN PROBABILITIES	David C M Dickson
48	NOV 97	ON THE MOMENTS OF RUIN AND RECOVERY TIMES	Alfred D Egídio dos Reis
49	JAN 98	A DECOMPOSITION OF ACTUARIAL SURPLUS AND APPLICATIONS	Daniel Dufresne
50	JAN 98	PARTICIPATION PROFILES OF AUSTRALIAN WOMEN	M. E. Atkinson Roslyn Cornish
51	MARCH 98	PRICING THE STOCHASTIC VOLATILITY PUT OPTION OF BANKS' CREDIT LINE COMMITMENTS	J.P. Chateau Daniel Dufresne
52	MARCH 98	ON ROBUST ESTIMATION IN BÜHLMANN STRAUB'S CREDIBILITY MODEL	José Garrido Georgios Pitselis

064 ISBN 0 7340 1370 1	AUG 98	RUIN PROBLEMS FOR PHASE-TYPE(2) RISK PROCESSES	DCMD CH
065 ISBN 0 7340 1371 X	AUG 98	COMPARISON OF METHODS FOR EVALUATION OF THE n-FOLD CONVOLUTION OF AN ARITHMETIC DISTRIBUTION	BS DCMD
066 ISBN 0 7340 1372 8	NOV 98	COMPARISON OF METHODS FOR EVALUATION OF THE CONVOLUTION OF TWO COMPOUND R_1 DISTRIBUTIONS	DCMD BS
067 ISBN 0 7340 1373 6	NOV 98	PENSION FUNDING WITH MOVING AVERAGE RATES OF RETURN	DB Ddu
068 ISBN 0 7340 1374 4	DEC 98	MULTI-PERIOD AGGREGATE LOSS DISTRIBUTIONS FOR A LIFE PORTFOLIO	DCMD HRW
069 ISBN 0 7340 1375 2	FEB 99	LAGUERRE SERIES FOR ASIAN AND OTHER OPTIONS	Ddu
070 ISBN 0 7340 1376 0	MAR 99	THE DEVELOPMENT OF SOME CHARACTERISTICS FOR EQUITABLE NATIONAL RETIREMENT INCOME SCHEMES	DMK RC
071 ISBN 0 7340 1377 9	APR 99	A PROPOSAL FOR INTEGRATING AUSTRALIA'S RETIREMENT INCOME POLICY	DMK
072 ISBN 0 7340 1378 7	NOV 99	THE STATISTICAL DISTRIBUTION OF INCURRED LOSSES AND ITS EVOLUTION OVER TIME I: NON-PARAMETRIC MODELS	GT
073 ISBN 0 7340 1379 5	NOV 99	THE STATISTICAL DISTRIBUTION OF INCURRED LOSSES AND ITS EVOLUTION OVER TIME II: PARAMETRIC MODELS	GT
074 ISBN 0 7340 1380 9	DEC 99	ON THE VANDERMONDE MATRIX AND ITS ROLE IN MATHEMATICAL FINANCE	RN
075 ISBN 0 7340 1381 7	DEC 99	A MARKOV CHAIN FINANCIAL MARKET	RN
076 ISBN 0 7340 1382 5	MAR 00	STOCHASTIC PROCESSES: LEARNING THE LANGUAGE	AJGC DCMD ASM HRW MW
077 ISBN 0 7340 1383 3	MAR 00	ON THE TIME TO RUIN FOR ERLANG (2) RISK PROCESSES	DCMD
078 ISBN 0 7340 1384 1	JULY 00	RISK AND DISCOUNTED LOSS RESERVES	GT
079 ISBN 0 7340 1385 X	JULY 00	STOCHASTIC CONTROL OF FUNDING SYSTEMS	GT