Department of Social Development

Retirement Reform Project

SOUTH AFRICA'S OLD-AGE SYSTEM

EVALUATING DESIGN ALTERNATIVES

PART II: DEATH & DISABILITY BENEFITS

Rob Rusconi

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CONTENT

GLOSSARY OF TERMS

Technical terms

BSP — **Basic State Pension**, the generic term used to describe a flat pension payable to all citizens. The existing State Old-Age Grant is a form of Basic State Pension, currently means-tested. All modelling in this paper assumes that the means test falls away, generalizing the benefit to a universal pension.

Example: the state commits to pay all citizens a monthly pension of R100, starting from age 62 and growing at the rate of inflation.

DB — **Defined-Benefit** arrangement. The benefit received by participants is based on a formula related to earnings, usually late-career earnings. All modelling in this paper assumes that the defined-benefit formula is always based on inflation-adjusted career-average earnings.

The **accrual rate** is the multiple applied to earnings in each year of service to obtain the benefit.

Example: a 55-year-old joins a career-average defined-benefit arrangement with an accrual rate of 1 percent and retirement age of 65. The benefit received at the end of the 10 years of work is 10 percent of the inflation-adjusted average salary earned during that period.

DC — **Defined-Contribution** arrangement. The benefit received by participants is based on the contributions paid and the investment returns, net of costs, gained on those contributions. Benefits are not guaranteed. The accumulated saving is used to purchase an annuity at rates applicable at the time of purchase, and annuity payments are assumed to increase at the rate of inflation.

Example: a 55-year-old joins a defined-contribution arrangement with a contribution rate of 10 percent of earnings and a retirement age of 65. The benefit received is the inflation-linked annuity that can be purchased at the time of retirement with the accumulation of 10 years of contributions and investment returns.

QE — **Qualifying Earnings**, the term used to describe that part of the income of an individual that is used to set contributions and benefits under the system (though not always both of these). Different definitions can be used for, on the one hand, retirement savings and on the other, death and disability benefits, but this adds complexity.

Example: a 55-year-old earning R3 500 monthly joins a national defined-contribution arrangement with a contribution rate of 10 percent of qualifying earnings, defined as all earnings in excess of R1 000 monthly. The top R2 500 of income is used to determine the contribution rate, which is thus R250 monthly.

RR — **Replacement Ratio**, the starting level of retirement income expressed as a proportion of the highest level of earnings prior to retirement, commonly used as a measure of post-retirement prosperity. Replacement ratios vary from person to person, and are very sensitive to the assumptions underlying the modelling. Relevant to death and disability benefits, the replacement ratio concept is less tangible in this context.

Example: on retiring, an individual earning R80 000 a year receives a monthly pension of R5 000. The replacement ratio is 60 000 ÷ 80 000, which is 75 percent.

Other Acronyms

ASSA **Actuarial Society of South Africa**. The Society produces a demographic model of the population of the country, focusing on the development of the AIDS pandemic, but the model is also highly regarded for general population-projection purposes and its sensitivity to changes in the dynamics of the pandemic, at least in the short and medium term.

COIDA **The Compensation for Occupational Injuries and Diseases Act**, 1993 legislation designed to improve provisions existing at the time, through the 1941 Workmen's Compensation Act, by extending coverage to all employees and improving solidarity between participants. Some 5.3 million employees working for 287 000 companies are registered with the Compensation Fund (Garzarelli et al, 2008).

GHS2005 **General Household Survey**, an annual survey of South African households carried out by StatsSA, designed to measure various aspects of the living circumstances of South African households. There are five broad areas covered by the GHS: education, health, activities related to work and unemployment, housing and household access to services and facilities. The survey in 2005 was conducted in July 2005 and covered some 30 000 households, with the results scaled to the total population using weights derived from the 2001 Census. The database used for this study was provided by StatsSA and further variables needed for Social Security modelling were derived by EPRI and Professor Heather McLeod.

ODMWA **The Occupational Diseases in Mines and Works Act 1973** aims to cover diseases contracted specifically in risk work in mining.

SOAG **Social Old-Age Grant**, the monthly means-tested social-assistance transfer to the elderly, currently paid at a rate of R940 (from 1 April 2008) to all women aged 60 and older and all men starting from age 63. The age of eligibility for men is being lowered gradually to age 60.[1]

[1] *From 1 April 2009 it will be age 61 and from 1 April 2010, 60 (Social Assistance Amendment Bill, Government Gazette No. 30891 of 28 March 2008).*

SUMMARY

This paper forms part of the process of developing South Africa's social security arrangements. It extends the work of its predecessor[2] which covered the issue of projected retirement benefits, describing a long-term financial demographic model used to estimate the projected cost of providing a range of death and disability benefits. It sets out and discusses a number of these projections.

The paper reports on a wide variety of benefit- and parameter variations in an effort to give to readers an understanding of the subtleties involved, and to permit rough estimates of the cost of alternatives. It shows how some parameters – the age of retirement, for example – affect the cost of both retirement and survival benefits, but in opposite directions.

The analysis suggests that providing financially meaningful benefits on the death or disability of members of the system would be expensive.

- The cost of providing an **income to the surviving spouse** of a participant at a rate of half of the member's income at death, increasing appropriately over time, until the spouse reaches age 60, is expected to stabilize at around 4 percent of aggregate participant earnings.[3]
- An income payable to **surviving child dependents** until they attain age 21 is projected to cost approximately 0.75 percent of participant earnings.
- The corresponding projected costs, again relative to the total earnings of participants, of a **lump sum alternative** equal to the annual income of the participant at death amount to in excess of 1 percent.
- A benefit providing half of the income of the participant in the **event of disability** and covering the cost of the social security premium during this term is projected to cost approximately 3 percent of participant income.

The impact of complexities like contribution and benefit caps is introduced with a discussion on the tricky issue of cross-subsidies, aiming to provide a comprehensive introduction to a complex subject.

The paper discusses the trade-offs involved in benefit design and closes with a set of thoughts on how these trade-offs might be resolved towards establishing a coherent package of benefits and contributions.

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[2] Rusconi (2007), published by the Department of Social Development as part of its technical contribution to the development of the social security system.

[3] Earnings for this purpose are defined as all income. Analysis of the impact of contribution- and benefit ceilings is discussed in section 3.3 of the paper.

1 Introduction

This paper builds on an earlier effort to describe the cost of providing retirement benefits as part of a comprehensive social security system. The analysis described in this discussion covers the more complex death and disability benefits that frequently complement the accumulation of savings that provides income in retirement.

The paper provides a technical description of the financial model underlying these projections but also presents and discusses a wide range of alternatives. It is effectively both a technical paper and a discussion document and comments on both aspects would be appreciated.

The next section describes the modelling methods and the development of supporting databases and assumptions.[4]

Section 3 forms the bulk of this paper. It presents the main candidate forms of death and disability and discusses the suitability of each from a financial perspective, touching at the same time on some of the other issues that need to come into reckoning when considering the alternatives. It is intended to be written in a way that provides readers the ability to draw inferences and calculate, at least roughly, the cost of a wider set of benefits.[5]

Section 4 summarises by listing the main issues raised by the analysis, some of which present serious technical and practical hurdles. It closes by outlining a suggested approach to determining the benefit structure and complementary contribution framework for the system.

The generous and tireless assistance of Professor Heather McLeod, largely responsible for exploring and describing the subtle and complex dynamics of South Africa's families, is deeply appreciated. Her work builds on the foundational analysis of EPRI. The data contributed by an insurer towards the development of income-based mortality differentials is acknowledged with thanks. It has been invaluable. Many others have contributed to this paper, directly or indirectly, through their involvement or interest in this very important process of development. I am very grateful for all of these contributions. The responsibility for errors is nevertheless mine.

This is a discussion document. Modelling assumptions and supporting data are set out in the appendices and the recommendations are cast in general terms. On both issues, comments are much needed in support of the development of a sustainable social security system.

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[4] This is complemented by two of the appendices, discussing the assumptions in more detail and listing the parameters that form the parameter inputs to the model.

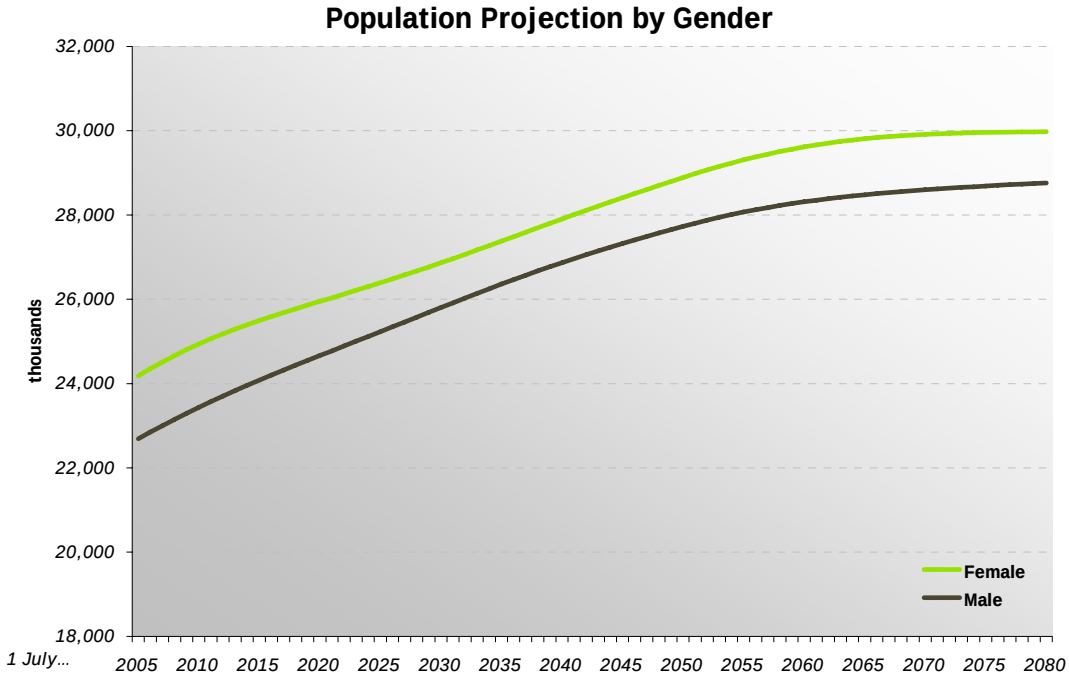
[5] Supporting information is provided in appendix 2.

2 METHODOLOGY

The computer model described in this paper has been developed to inform the thoughts and decisions of South Africa's policymakers as they put into place a comprehensive social security and old age retirement system.

An earlier version of this model is described in the first paper on the subject (Rusconi, 2007). The focus of that exercise was the projected cost of providing retirement benefits from a social assistance program and alternative complementary DB and DC arrangements. Version 2 takes the analysis a significant step further by considering the implications of adding provisions that provide for payments in the event of the death or disability of participants.

Chart 1



The model provides a 75-year financial projection of a very wide range of benefit options, together with variations to the parameters that specify these benefits more precisely.[6] As a large volume of supporting

[6] *A 'form of benefit' refers to its primary function, say an amount payable on attaining retirement or a benefit paid on death of the participant. Variations to the form include, for example, payment of a lump sum or a stream of income, subject to a number of conditions. The 'parameters' refer more precisely to the rules governing the payment of benefits. Retirement age is a parameter, for example, that determines the commencement of a retirement benefit, but may also mark the end of a disability income. Parameters can become quite intricate. Increases to income need to be expressed as an annual percentage, for example, usually relative to the corresponding rate of inflation.*

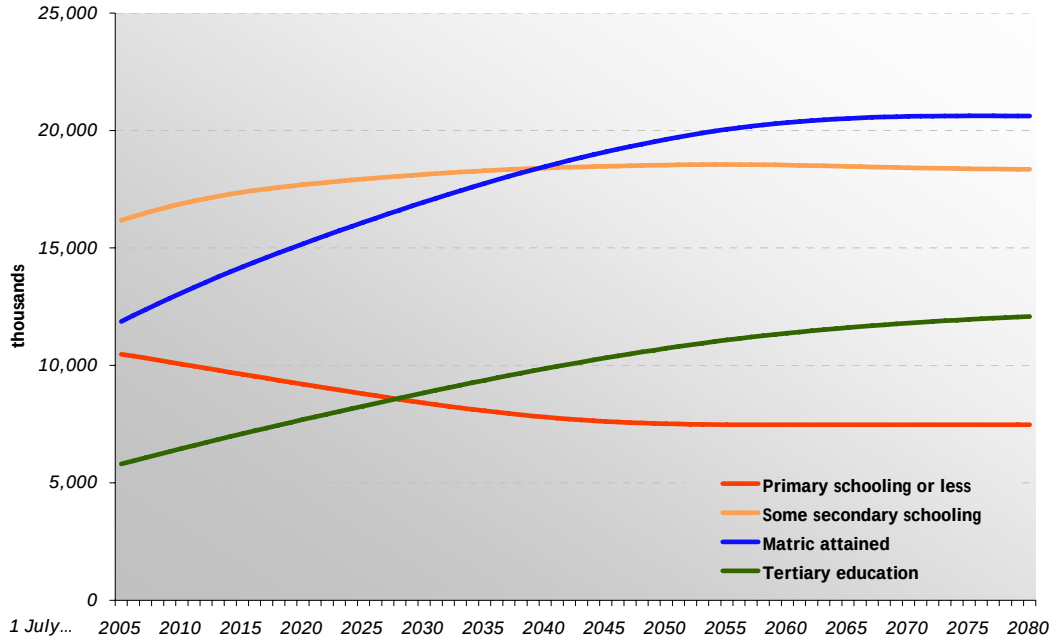
information must be used to calculate these benefits, the model may also be interrogated to gain insights into these assumptions and interim results.

Chart 1 illustrates this with a simple presentation of the projected total population of the country, starting at 46.9 million in mid-2005 and expected to grow to 50.6 million by 2020, 54.8 million by 2040 and 58.7 million by 2080.[7] The chart shows this projection, separately for males and females.[8]

Chart 2 builds on this by illustrating a consequence of one of the most important aspects of the modelling rationale, the development of education over time. Reasonably predicting the educational status of today's children and those yet to be born is crucial to the success of the model, because education can be expected to go some way to establishing the income potential of tomorrow's South Africans.[9]

Chart 2

Population Projection by Attained Education



[7] The assumptions underlying this projection are slightly at variance with the corresponding assumptions of the Actuarial Society of South Africa. This variation is discussed in the appendix.

[8] Note that this projection is slightly different to the corresponding projection in the first report. This results from the introduction of mortality rates that vary by education group. These rates are calibrated to bring overall mortality into line with the expected number of deaths for the country as a whole, but small variations in this balance are difficult to avoid and result in a slightly different overall projection with a somewhat larger population in the very long term. The projected total population is regarded as realistic considering the very long time span involved.

[9] The model uses the highest attained education status as a categorisation factor. For technical reasons, income itself cannot be used as a rating factor. Highest education status is increasingly being used by researchers around the world as a sensible proxy for socio-economic status. It is a much more useful factor than ethnicity, for example, particularly as South African society changes.

Details are set out in the appendix, but it is important to note the fundamental assumptions concerning educational status.

- The relative earning pattern over a working lifetime is expected to remain stable for a given level of education, in relative terms not in absolute terms.[10]
- Tomorrow's workers are expected to attain an educational level, across the population, that reflects the average for today's young workers – those who have completed their education – and will thus show better average education than for the population as a whole, as rates of schooling have risen.[11]

This combination of assumptions results in a gradual decrease to the numbers of South Africans with only primary schooling or less and a significant increase to the corresponding numbers with matric or better. The size of the group in the middle, with some secondary schooling, increases initially, but at a growth rate lagging that of the population as a whole, and then it declines very slightly as future generations attain better education levels, and it is overtaken in size by the corresponding group with a matric education.

Chart 3 combines a number of factors to illustrate the projected contribution of different groups to aggregate national wealth. Intuitive interpretation of a chart like this is complex because it reflects a wide range of assumptions, including:

- general demographic assumptions like mortality and fertility,
- the development of average educational achievement over time,
- the distribution of worker numbers by age,
- the expected pattern of earnings over the lifetime of workers, and
- the rates of employment at each age and for each educational status.

All of these assumptions apply separately to females and males, complicating results yet further.

The chart shows the combined impact of all these assumptions.[12]

- All groups are expected to contribute to rising levels of real income over time, despite the falling absolute numbers for the groups with poorer levels of education. This results from the assumption

[10] The model thus allows for the better prospects for income growth associated with higher levels of education, particularly in the early years of the working life. Skills acquisition is expected to grow the income of an individual over their working years, but the pattern of growth is determined by their gender and education status (refer to appendix 1 for more detail).

[11] The implications of this are important. Average education status is thus expected to rise but not to a level exceeding that which currently characterises South Africa's young workers.

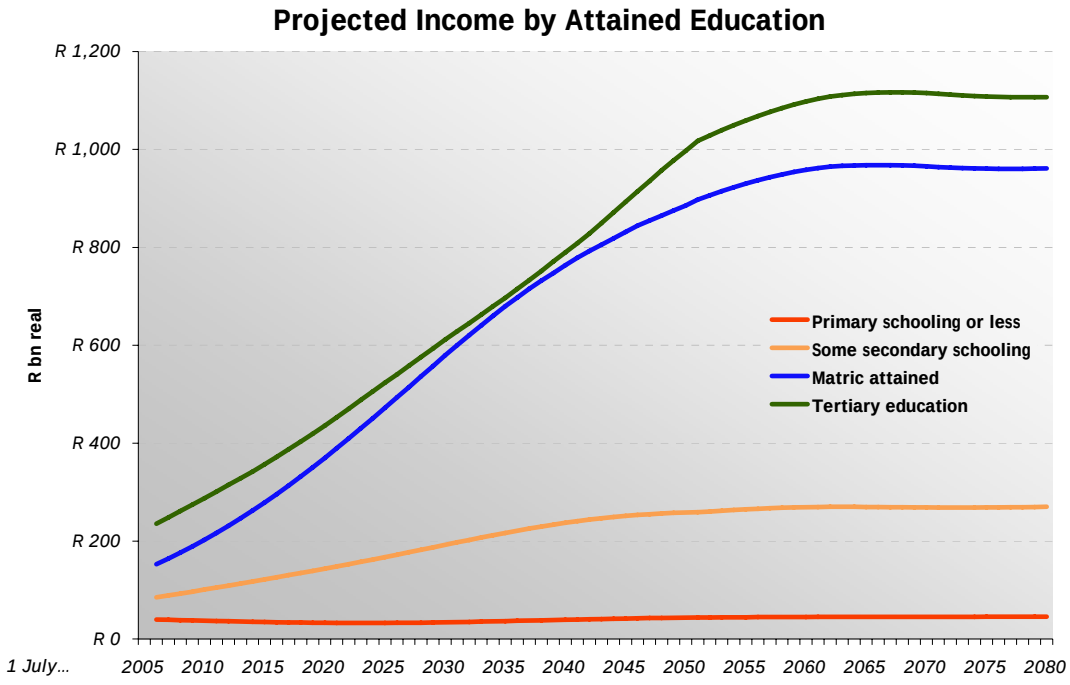
[12] Interested readers should consider this chart together with charts A2 and A3 in appendix 1, which show the assumed income distributions for each combination of age, gender and education status.

of rising real income and from the slowly growing average age of workers as fertility and worker mortality rates fall.[13]

- The relative contribution of those with a matric or higher is expected to increase over time.[14]

The slight fall in the numbers towards the end of the projection is probably due to a gradual increase in the proportion of workers approaching retirement, a period in which real incomes often fall.

Chart 3



Standard outputs

The focus of outputs in this document is on total income and total outflow from the system, across the population as a whole. The model permits more detailed analysis of a number of the system components and allows drilling down by gender and educational group and any combination of these. It also gives the option to monitor the progress of any age or age group.

The standard forms of outputs in this paper are the rand amount of income and outgo in constant 2005 rand terms and the percentage of earned income. Alternatives, for example the percentage of gross domestic product, are very easily computed, and these should be considered by policymakers to enhance their understanding of the expected dynamics of the system.

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[13] *HIV and AIDS are explicitly modelled in the ASSA population model as part of overall mortality rates. HIV does not form an explicit part of the assumptions on mortality by education status but clearly plays a very strong implicit part in the factors used to differentiate mortality rates by education status.*

[14] *The proportion of total earnings attributed to members of the higher two education groups is projected to grow from 75.6 per cent in 2005 to 82.0 per cent in 2020 and 86.7 per cent in the very long term. This does not necessarily reflect higher levels of inequality, because they groups are expected to grow in number over time.*

Implicit liabilities

Present value calculations would permit evaluation of the implicit liability of an unfunded system such as today's BSP. These have not been built in to the model, but can be calculated from the cash flows. For example, the estimated implicit liability for the Social Old-Age Grant (SOAG) is between R1 800bn and R1 850bn, around 125 percent of GDP.[15]

Similar techniques may be used to determine the cumulative surplus or deficit of the system, as contribution inflow and benefit outflow are seldom perfectly aligned. Calculations like these should become a standard part of assessing any social security or social-assistance programme.

Personal simulation

The corresponding discussion paper covering the modelling of retirement alternatives also provided an illustration of the impact of the proposed benefit structure and parameters on individuals participating in the system. This is much more difficult to do in the context of death and disability benefits because the relationship between these benefits and the income at the time of the claim-causing incident are strongly dependent on the timing of an incident that does not affect all participants equally.[16]

Replacement ratio calculations do not easily convey the sense of uncertainty associated with a risk or survivor benefit. Other ways must be found to establish the appropriateness of a proposed level of benefit. These are discussed with each of the benefit types considered.

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[15] A number of assumptions are required for a calculation like this. In this case it is based on a 2005 calculation date to be consistent with the rest of the model. It assumes that payments increase annually at a rate of 1 percent above the inflation rate, consistent with the corresponding projection of BSP cash flows. It discounts future payments to the present at a rate of 3 percent above inflation. It takes into consideration only the next 75 years of payments, in line with the convention in the United States for measuring social security liability.

[16] The corresponding problem does not arise in the calculation of projected replacement ratios for retirement benefits, because retirement may be assumed to apply at the same age in all cases. Death and disability not only occur at an unknown station in life, but they do not affect all participants, bringing into play an additional level of uncertainty.

3 BUILDING BLOCKS

The previous paper provided alternative forms of retirement benefit as a series of building blocks. This paper extends that thinking into death and disability benefits, touching on the range of considerations applying to each of these. Section 4 then brings these together by discussing some of the issues that need to be taken into account when assessing potential combinations.

The purpose of this section is to introduce the candidate components of the system. Each has distinct qualities that are rarely sufficient, taken alone, to meet a broad range of objectives, but each could form a useful component of a system that dovetails the qualities of many parts. The section describes the respective characteristics of each component in the context of the system as a whole and from the point of view of individual members.

The discussion starts with brief consideration of the modelling hurdles unique to an assessment of possible death and disability benefits.

The challenges to system design and cost assessment

Death and disability schemes provide unique obstacles that are primarily concerned with the two-part relationship that the administrator has with the member, first over the life of that participant and then in its interaction with the dependent. This complexity presents itself in three ways:

- **Modelling challenge.** The relationship between the participant and his or her beneficiaries needs to be understood and the survival pattern of both the participants and the spouse or children need to form part of the modelling.
- **Cost of benefit.** Death benefits are expensive, particularly in South Africa at present, where mortality rates due to the HIV/AIDS pandemic are extremely high. This forces policymakers into considering trade-offs between benefit types rather than having the luxury of being able to provide a comprehensive suite of benefits, as this paper shows. Disability rates are also high.
- **Administrative complexity.** The nature of the contingent benefit[17] considerably increases the complexity of administration. In the case of death, the beneficiaries need to be identified and, if the benefit is payable for some time, their status needs to be confirmed periodically during that period until the required terminating conditions are met. Disability benefits require confirmation of the

[17] *A contingent benefit starts only when a specified event, like the death of the participant, takes place, and then only if certain conditions are met. The spouse and children must be registered as dependents on the records of that member, for example, and must be below the age at which they are eligible to receive benefits, if an age limit forms part of the benefit specifications.*

disablement both at commencement of benefit and periodically throughout the time of benefit payment.[18]

These challenges force a different view on the provision of risk benefits to the corresponding approach to retirement benefits, but also compel consideration of the trade-offs between the two types of benefit. A number of difficult questions need to be asked. A few examples follow.

- Why have death benefits at all? What is the primary rationale for such benefits?
- What is the purpose of disability benefits and at what level should they be pitched?
- How are fundamental choices made between retirement benefits and risk benefits?[19]
- How is this then extended to consideration of different types of benefits?

These questions concern not only the difficult trade-offs between death and disability options, and their retirement savings counterpart, but across all the available variations between these.

- Should death benefits be aimed at children or spouses?
- Should they be in the form of a lump sum or an income?
- Are disability benefits intended to replace lost income or provide no more than a survival package, motivating the recipient to return to work – any kind of work – as soon as possible?

At heart of this discussion is the philosophical question of whether the system aims to provide social protection or social provision, translated into the more tangible decision of income protection or a social safety net. The first is much more ambitious and requires greater resources. The second is not only cheaper but permits a different approach to be taken to the provision of benefits, aiming to meet basic needs rather than protect comprehensively against unforeseen events like death or disability.

3.1 Death Benefits

This section starts by setting out the main design options. This is followed by a summary of the costs of these alternatives and then a more detailed assessment of a number of variations on each of these.

Summary of options

The primary options in the design of death benefits are set out below.

- **Simple lump sum.** A lump sum, fixed in rand terms though increasing over time to match inflation of living costs, is designed primarily to cover the immediate costs associated with a death, the burial

[18] Neither this paper nor its retirement modelling counterpart take a view on the quantum of costs of administering a comprehensive social security system, or the question of who should bear these costs. Even at its most efficient, the system could be expected to cost in the region of 1 per cent of the earnings of participants, though more in the early years and hopefully less as maturity develops.

[19] This needs to recognize that broad groups of participants have a preference for one over the other that forces these choices to acknowledge winners and losers.

principally, and perhaps to meet emergency needs in the period shortly thereafter. It does not aim to replace income.

It can be limited only to working age participants or it could also be paid on the death of registered elderly members or children, perhaps at a different level. It is easier to administer than its alternatives because it is a once-off payment, but runs the risk of over-provision in the face of anecdotal evidence that incrementally added funeral benefits tend not to crowd out existing arrangements in this country.

- **Earnings-related lump sum.** A lump sum that is linked to the income of the participant at death aims to provide earnings-related protection during which dependents can make alternative arrangements.[20] This benefit could be structured either as a generous lump sum, twice annual salary, for example, or as income over a short period to provide a benefit of roughly equivalent value, for example, 50 percent of salary for a four-year period.[21]

  In the sense that it does not aim to provide permanent income replacement, this is not strictly an income protection mechanism. If it is spread over a number of periods, it is more complex to administer than a pure lump sum but less intensive than the permanent income benefit that with time would result in a higher number of income recipients. It is of course cheaper than a permanent income benefit paying out at the same level.

- **Earnings-related income.** The most expensive option is a permanent or near-permanent income benefit that is related to the income of the participant and is designed to sustain the standard of living of the beneficiaries indefinitely or at least up to a specified age, perhaps the age of eligibility for the BSP. It is the most generous approach and it is expensive, as illustrated shortly, but it does satisfy the definition of pure income replacement, as long as the benefit level is sufficiently high.[22]

Each of these provides advantages and disadvantages. In an ideal world, an appropriate combination might be sought. In practice, this may not be possible, particularly in an environment characterised by high rates of mortality.

Broad costs

Chart 4 gives a first look at the cost of the main types of benefit. It also provides the opportunity to discuss each of these from a system perspective. Like all of the charts of projected benefits, it provides estimated costs from mid-2005, the modelled launch date of the system which corresponds to the most recent date at which demographic data is available. This chart show the expected cost in constant 2005 rands.

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[20] Participant income needs to be very carefully defined. To protect dependents against the possibility of receiving no benefit where the participant died following protracted illness, income may need to be defined by reference to the earnings prior to stopping work, though proving that the illness caused the absence from work may be difficult. The likely complexity of administering such a system is hard to overstate.

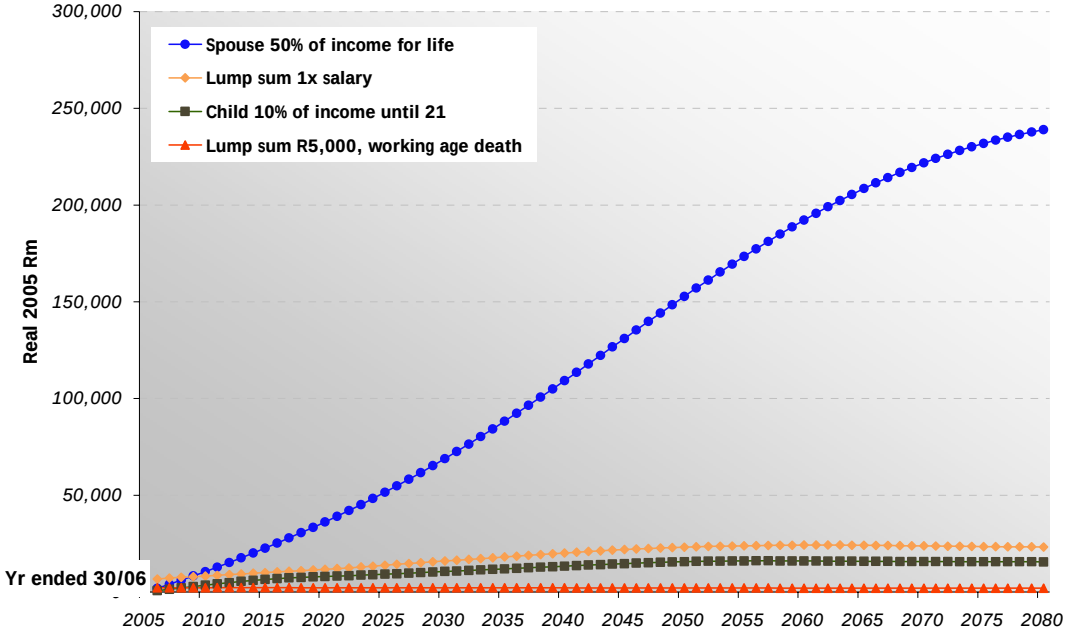
[21] These are only approximately equivalent in value. The latter is cheaper due to the time value of money and cheaper still if the benefit ceases on the death of the beneficiary.

[22] A typical benefit level is half of the income of the participant, broadly providing the means to sustain a similar standard of living after the death of the participant as was permitted by the income of the participant before his or her death.

- The **spouse's income benefit** is characterised by a very long development phase – costs take an extremely long time to reach a form of stability. This is due to the nature of the benefit. It starts on the death of a participant and is then payable until the death of the widow or widower of that member. If today's participants only are taken into account, it will be many decades before the last of these benefits is paid.[23]
- A **lump sum benefit related to salary** can be quite expensive[24] but does not increase as dramatically as the corresponding lifetime income payment, because the payment on notification of death is made once only.[25]

Chart 4

Death Benefit Options



- A **child's income benefit** is relatively affordable. Though it increases over time, the extent of this increase is lower than for the spouse's income, because it is assumed to cease at a fixed age, in this case 21.[26]

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[23] *Of crucial importance to the long run sustainability of such a benefit, of course, is its assumed rate of increase in payment. The results illustrated in this paper assume that payment slightly exceeds the rate of inflation but does not aim to keep up with national wages – the modelling assumes a 1 percent real increase of benefits in payment. This is probably slightly generous but is not as expensive as a wage-linked benefit.*

[24] *This base line – and admittedly completely unrealistic – analysis assumes that there is no upper limit to the level of salary that is taken into account for benefit. It provides a useful starting point, a comparison with the corresponding costs in the private sector, and, if salary is limited for both contribution- and benefit definitions, provides an answer that is not that far from the corresponding outcome in the capped environment. An indication of this modified cost is provided later in this paper.*

[25] *Its profile therefore depends only on the pattern of deaths of participants, not the contingent survival probability of their spouses.*

[26] *A small inconsistency in the treatment of accumulated savings should be noted. The cost of the spouse's income-related benefit is reduced by the amount of the accumulated fund; in other words, the fund itself is used to contribute*

- A **simple lump sum** is not only inexpensive, if pitched at a level as low as R5,000, but it is also relatively stable, more so than the salary-related lump sum that increases over time at the rate of salary growth – this benefit increases at the rate of inflation.[27]

Rand values are not a particularly helpful way of assessing the cost of benefits, except to show that some forms of benefit, over time, are expected to be much greater than others. Chart 5 shows that, relative to the size of the economy, even the daunting spouse's benefit is not expected to continue increasing indefinitely. This is because the economy is expected to grow more rapidly than the earnings that establish the starting level of benefits at the time of death, and more rapidly than the assumed rate of growth of the income in the course of payment.

Chart 5

Spouses' Income by Gender vs GDP

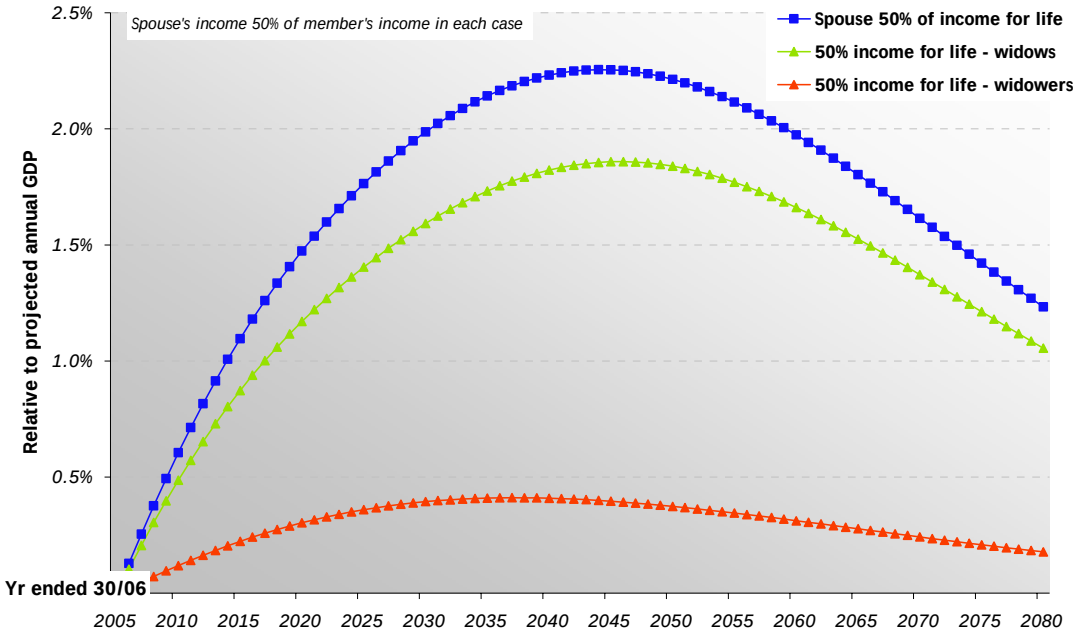


Chart 5 also shows that, of men and women recipients, widows are expected to be strongly dominant as beneficiaries. Similar dynamics are evident in the profile of SOAG recipients, but the effect is stronger in this case, because the same mortality feature doubles up:

- male participants experience a higher rate of mortality, creating a higher number of widows than widowers, and
- widows live longer on average than their male counterparts, increasing the longevity of the benefit.

to the cost of providing this benefit. This results in a small reduction in the cost of the benefit, particularly in later years. The same is not true of the child's benefit. This result in a very small overstatement of the cost of this benefit, but it should be noted that the offset is available only once in the instance of a member's death, so would only be available to reduce the cost of the child's benefit if there were no spouse.

[27] *Different increase rates can be assessed, of course, though all of them should be considered in real money terms so that the benefit at least keeps up with the increasing cost of living.*

Only the second of these attributes affects the profile of beneficiaries of the SOAG. The discussion in box 1 raises the issue of the cross-subsidy and asks whether it is appropriate. The train of thought is extended to boxes 2 and 3 later in this section.

The cost of benefits charted against GDP might be interesting, but it is not as relevant as the same cost relative to the income of participants. Contributions from participants are required to meet the cost of benefits. While the inflow of contributions need not match precisely the corresponding outflow of benefits, we need to understand how the cost of these benefits matches up to the income of the participants.

Chart 6 shows this relationship for each of the broad benefit types considered in chart 4.

The chart provides the opportunity to consider the cost of each of these options more usefully than before.

Box 1. The practice and philosophy of cross-subsidies

Chart 5 raises the important issue of cross-subsidies, in this case between male members and their female counterparts. Based on the value of benefits received – expressed in the case of the chart relative to the corresponding income of participants – males receive considerably greater benefits,[1] than their female counterparts. On the assumption that males and females, in other respects the same, pay the same percentage premium for these death benefits, female members cross-subsidise males.

Is the cross-subsidy a problem? In the case of a death benefit, it might not be regarded as an issue, as the widows of male members in receipt of a pension may be seen to 'balance' the continued contributions of female members, and the widowers of female members are much less likely to benefit.[1] For other forms of benefit, disability for example, cross-subsidies are more significant and could be addressed more explicitly. This is discussed in more detail later in this paper.

- The cost of the **spouse's income benefit** again takes a long time to develop but is very expensive in the long run.[28] A benefit this generous is not sustainable except at very high contribution rates or a significant sacrifice to the contributions allocated to retirement savings. There are a number of ways to reduce this benefit – and the corresponding cost – and these are considered further on in this discussion.
- The cost of a **lump sum benefit equal to the annual salary** of the participant starts out at around 1.3 percent of salary. This falls gradually over time, stabilising at a level fractionally below 1 percent of the earnings of participants.[29] The fall is attributable to two factors, the expected overall decline

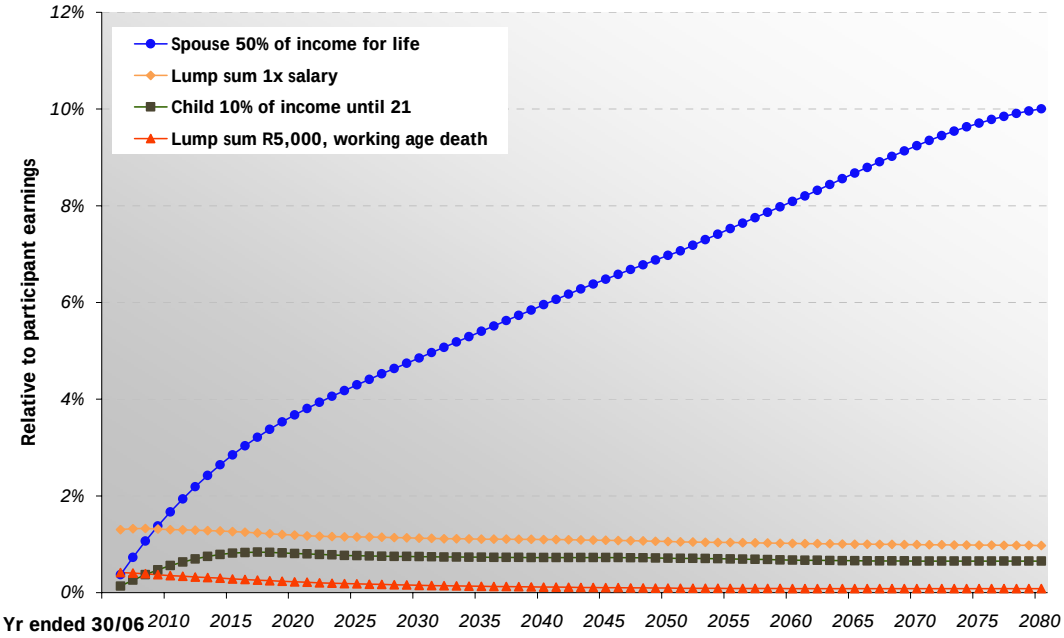
[28] The long term matters. A flat contribution rate always sufficient to meet the corresponding cost of benefits in that year would result in a large overpayment in the first few years. It is tempting to suggest that this overpayment should be used to cover the costs of benefits in later years, reducing the required level of the contribution. This is true, but only for a limited period. A system that is stable in the long-term needs to charge contributions that, in most foreseeable scenarios, would be sufficient to cover the cost of benefits at the time. The spouse's income benefit shown in Chart 6 levels off after the projection period at a rate of between 11 and 12 percent of income.

[29] This is higher than the corresponding figure for the private sector, estimated by ASSA at significantly below 1 percent of income (ASSA, 2007). The computed figure is particularly sensitive to the mortality assumptions by income level. It is well established that mortality rates are inversely related to income level - that those with less income experience a high probability of death in any given year. What is not clear is how strong this inverse relationship is. Since the wealthy bring a larger share of contributions and take up a relatively larger share of benefits (per death), a stronger relationship reduces their assumed mortality experience and reduces the expected overall cost of income-related benefits. The ASSA figure covers formal sector workers who experience a lower rate of mortality, so we should expect a figure for the working population as a whole that is meaningfully higher. ASSA also estimates a cost

in mortality rates and the increasing proportion of the population with higher education and correspondingly lower mortality.[30]

Chart 6

Death Benefit Options vs Income



- A small **income benefit for children** – pitched at a level of 10 percent of participant income per dependent child and payable only until a maximum age, in this case 21 – is less expensive than the salary-related lump sum benefit, and much cheaper than the spouse's benefit. Relative to member income, it reaches maturity much more quickly than the spouse's benefit, gradually falling thereafter from a peak of a little under 1 percent of income.[31] Variations according to the maximum age of the dependent are explored in more detail further on.
- As suggested by the earlier chart, the **lump sum** may be provided at a relatively low cost, starting at around 0.4 percent of income and falling over the long term to a level of approximately 0.1 percent.

for the South African population of 1.9 percent of income, which overestimates the corresponding result from the model, though a smaller range of mortality differentials could explain the difference between these figures.

[30] A small overstatement of the expected improvement in overall mortality level is possible from a form of double counting of these factors. This is difficult to avoid in practice, but practitioners should be careful not to overstate the projected improvement in the cost of fixed sum of income-related death benefits over time.

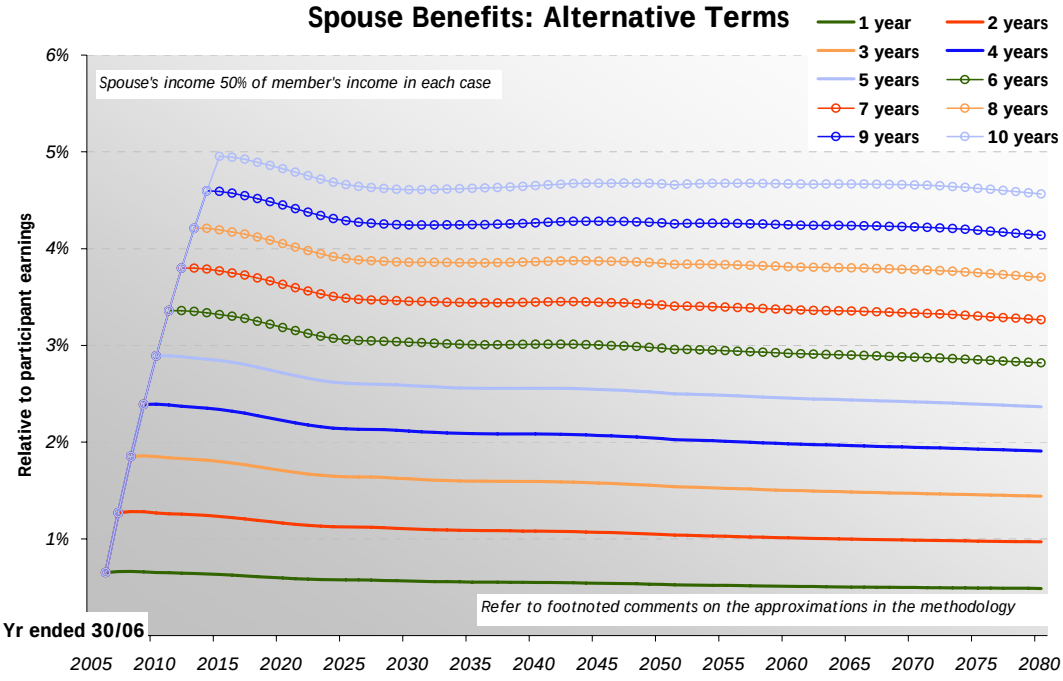
[31] Benefits are paid over a much shorter period, thanks to the age ceiling.

Reducing the cost of the spouse's income benefit

The evidence presented thus far shows how expensive a permanent – for life – income benefit to a surviving spouse can be, particularly in the present environment in South Africa with its very high rates of HIV infection and AIDS-related mortality.[32]

Chart 7 shows the effect of a term limit on the income benefit. The benefit is still payable at a rate of 50 percent of the income of the deceased at the time of death and increasing at a rate of one percent. But it is now payable only until the end of a fixed number of years, or to the death of the recipient, should this occur before the end of the fixed period.[33]

Chart 7



[32] *The cost of spouse's benefits may be somewhat overstated by the model for this very reason. The model assumes that the mortality experience of a person is not dependent on their relationship to another person. This is not true, in marriages in general and most certainly in the course of a pandemic. The mortality experience of the widowed is, in the absence of AIDS, higher than the corresponding mortality of their married counterparts. This can be expected to be strongly exacerbated by the disease, as the probability of a surviving spouse being HIV positive is much higher than the corresponding probability for an individual who was not married in the first place. Their mortality experience is thus also expected to be higher, leading to a shorter expected period of receipt of pension. Accurately modelling covariant mortality is extremely difficult in normal circumstances, let alone in the midst of a rapidly changing pandemic.*

[33] *This is an approximate calculation based on the corresponding analysis of the costs of a lump sum payable each year. It therefore assumes that the 'income' is actually paid in advance at the anniversary of the death, starting immediately after the death of the member, which gives a slightly higher value than if income were paid evenly over the course of the year. It also uses the same mortality factor for all spouses, the average of a male and female aged 40 in 2005, rather than tracking the mortality experience of the group of ageing recipients over time.*

The costs shows a strong upward trend in the early years, particularly for benefit structures with a longer term limit,[34] followed by a sudden cessation of this increase as the payments to the spouse's of those members who died in the first year come to an end. The gentle slopes of the curves thereafter reflect the small downward trend in the overall frequency of deaths of participants. This is due not only to general secular improvements in the mortality rates of participants, but, in the longer term, also due to increases in the average level of education of these participants, feeding through in turn to lower assumed mortality rates.

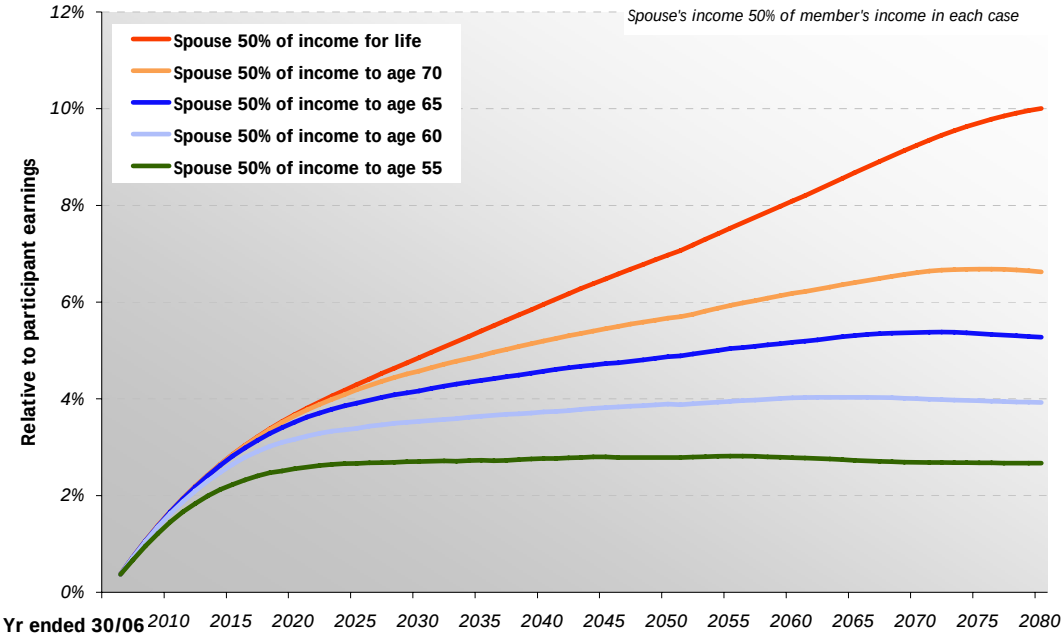
The chart shows that the expected cost of this type of benefit can be restricted to just about any desired maximum through the technique of a maximum term of payment. A useful rule of thumb is that, in the long-term at least, the expected cost of paying a spouse's income equal to half of the members' earnings at death payable for a specified number of years is equal roughly to 0.5 percent of the members' income for each year of payment.

On pure income-replacement grounds, limiting the payment to a fixed number of years is harsh. The limit changes the philosophy underlying the benefit from a permanent income replacement to a temporary measure designed to assist the surviving spouse with the adjustment required to find work and adapt to the lifestyle changes required of employment.

Another way to reduce the cost of the spouse's benefit is to pay it only until a specified maximum age. This avoids double-payment to widows or widowers who become eligible for state pension benefits in their own right and should ideally be co-ordinated with such a benefit.

Chart 8

Spouse Benefits: Alternative Maximum Ages



[34] *This curve corresponds approximately to the corresponding curve for the early years of the lifetime spouses'*

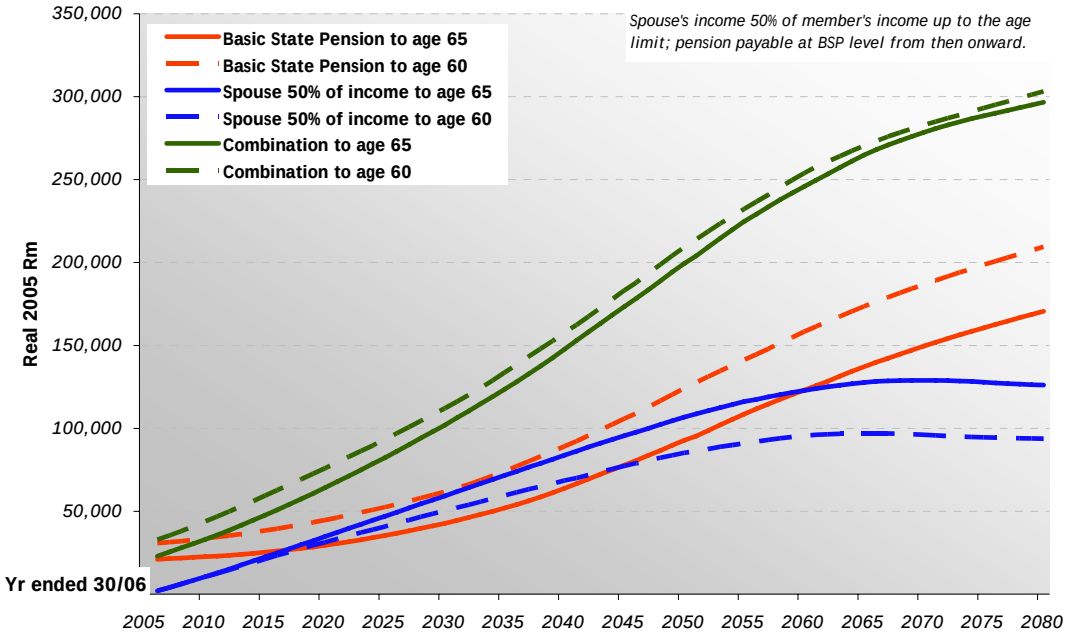
Chart 8 illustrates the expected impact of this age limit, demonstrating its significance. The red curve shows the cost of the benefit without age cap, corresponding to the spouse's benefit in chart 6. The other curves show the impact of successively lower age limits. The two blue curves are most valuable in this context, showing that, with a limit of 65, though the cost of the benefit is initially roughly the same, in the long-term it is expected to be just over half of the corresponding cost without age limit. At an age limit of 60, a peak of around 4 percent of income is expected, a substantial improvement.

This modification could not be considered in isolation of other changes. Lowering the age of eligibility for retirement benefits increases the cost of these benefits, all else being equal. But using the same age as an upper limit for income-related death benefits and lowering this age reduces the corresponding costs. The two of these in combination produce interesting results, as demonstrated in charts 9 and 10.

The red curves in chart 9 show the projected cost of a BSP benefit starting at age 65 (solid line) and at age 60 (dashed). The blue curves demonstrate the corresponding projected costs for the death benefit, the solid line for a benefit terminating at age 65 and its dashed counterpart for the benefit ending at age 60. These are the same as the pair of curves in the middle of chart 8, but expressed in real rand terms rather than as a percentage of income. The green curves at the top of the chart show the combination of these costs.

Chart 9

Spouse Benefits: Alternative Maximum Ages



Not surprisingly, a lower retirement age results in a higher BSP cost and a lower cost of providing death benefits. What is important is the relative size of these impacts, for the set of benefit parameters assumed.

pension in chart 6. The reasons for the approximation are set out in the previous footnote.

The differences almost exactly offset one another, with the earlier retirement age only marginally more expensive, in aggregate, as there are more pension recipients than death benefit recipients in the age range 60 to 65.[35]

Chart 10 shows the corresponding picture expressed as a percentage of participant income. It illustrates the gradual closing of the gap between the two sets of benefits.

It also shows the impact of a fixed retirement age in the context of demographic change: as the population ages, the costs of the retirement benefit increase while the corresponding costs of the death benefit stabilize, falling off very slightly towards the end of the period.[36]

These charts illustrate the importance of a holistic review of all of the options together with a careful calculation of their combined impact.

Box 2. Another look at cross-subsidies

Chart 10 raises again the issue of cross-subsidies. While the overall cost from this mix of benefits is largely independent of the retirement age – and with some modifications to benefit parameters the small difference could be almost entirely removed – the choice of retirement age is not cost-neutral to members or groups of members.

Those members at higher risk of not attaining their retirement age would prefer generous death benefits and an earlier retirement age. The lower the retirement age, the greater the extent to which this group receives an implicit subsidy from the members of other groups more likely to survive until retirement. All else equal, this group is likely to consist of lower-income South Africans. Its members are also in a better position to gain from a system that promises lower retirement benefits and higher death benefits, again, all else being equal.

(Within the retirement benefits, members of this group would probably prefer fixed rand benefits to income-related benefits, because their income is likely to be lower than average.)

Alternative parameters for child income benefits

The cost of income benefits paid to dependent children can be altered in three main ways:

- the ceiling age could be altered,
- the level of the benefit, as a percentage of salary, perhaps also with a rand floor, could be adjusted, and
- the ceiling typically applied to a family group could be set at a different level or removed altogether.

[35] The picture is complicated by the differences in the level of benefit received as well. The average size of the death benefit exceeds the state pension because it is based on income. This greater size, combined with the lower number of recipients, is insufficient to outweigh the impact of the much greater number of pension recipients in that age range.

[36] It has been suggested that, while a steadily increasing retirement age is an important requirement of a contributory system, the same is not true of a non-contributory system. This appears to be confirmed by chart 4 of the first report which shows that the costs of the BSP, relative to GDP, are expected to fall. The two red curves in chart 10 suggest that this argument holds true only in certain circumstances, at least when charted against the income of participants, which after all provides the tax base for providing social security benefits. In the early years of the projection, the increasing income of participants is sufficient to outweigh the impacts of ageing. The balance in later years swings the other way as the assumed inexorable ageing of the population pushes up the implied cost of the system relative to total income. This is exacerbated in the model used for this paper which assumes a gradual shift of the population to better educated groups which experience lower rates of mortality, increasing the implied impacts of ageing.

Chart 10

Spouse Benefits: Alternative Maximum Ages

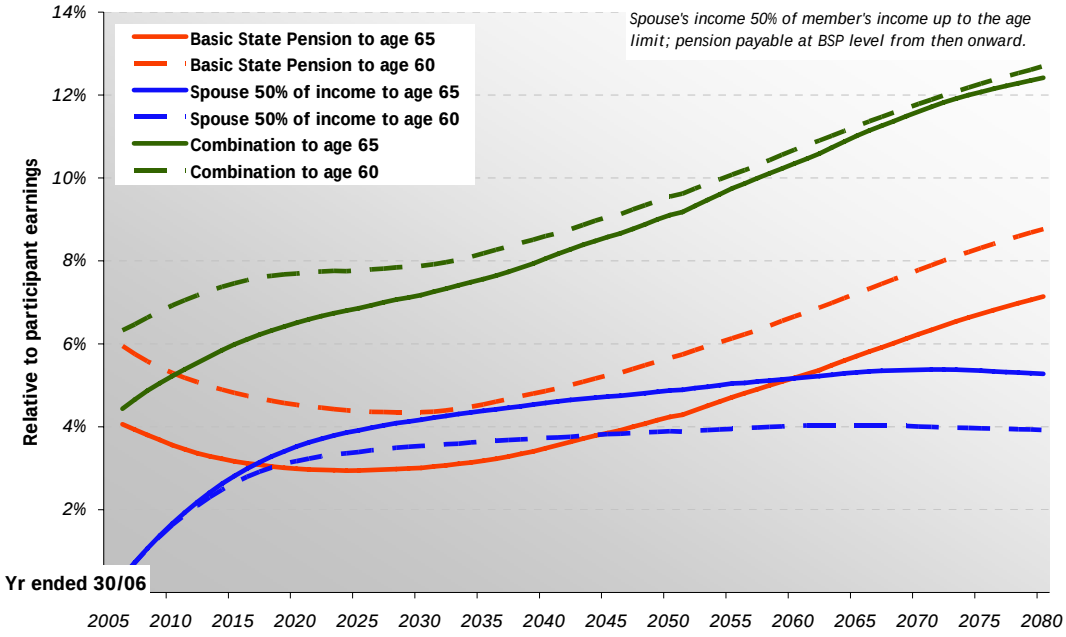


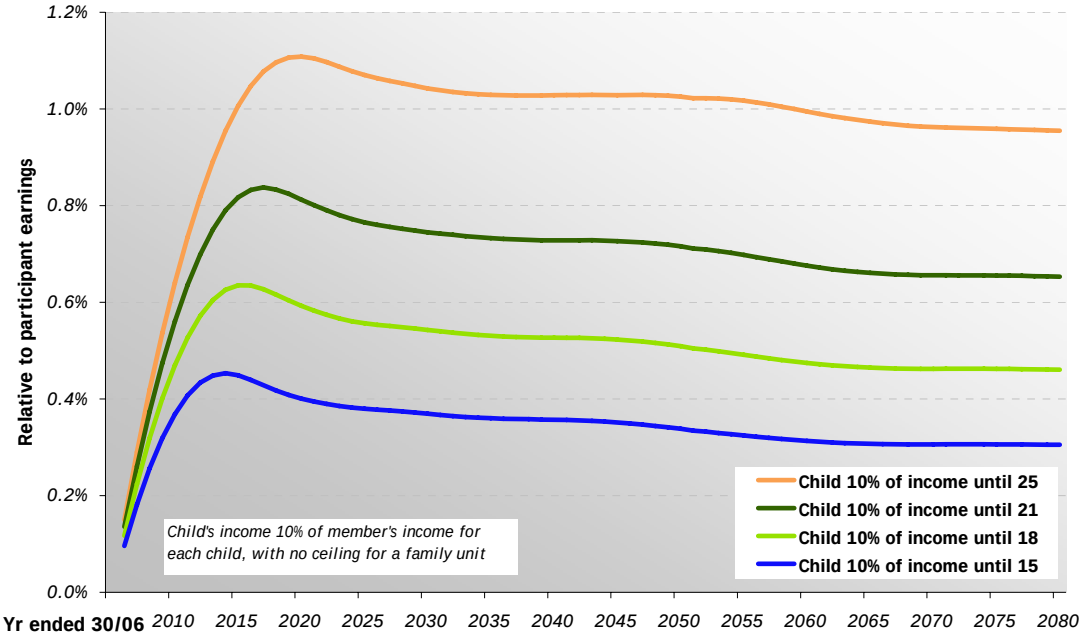
Chart 11 shows how the value of benefits, expressed as a percentage of the income of participants depends on the stipulated maximum age. As expected, the lower the maximum age the lower the cost of paying the benefits. The cost of benefits stabilizes at a level of approximately 1 percent of income if the benefit is paid at a rate of 10 percent of income up to an age of 25. The corresponding cost estimates for other age ceilings are around 0.65 percent for age 21, just under 0.5 percent for age 18 and around 0.3 percent for age 15.[37]

Income payable to children on the death of a participating parent appears to be a relatively inexpensive benefit to cover in the system. This is supported by philosophical considerations in favour of a system that aims to protect children, who after all are not in a position to earn an income themselves on the death of a parent.

[37] *Private sector arrangements commonly pay out benefits to a higher fixed age if the child dependent is studying full-time beyond the maximum age that otherwise applies. Data catering for this type of combination has been gathered, but it has not been modelled for a number of reasons. First, the contingency of full-time study makes the modelling more complex. Second, the administration involved in confirming this condition complicates the scheme and may open the possibility of moral hazard or fraudulent behaviour. Third, while in theory this may incentivise low-income South Africans to enrol in full-time study, in practice, this incentive is probably rather weak. As a result, such a condition probably benefits wealthy or middle-income South Africans more than their lower-income counterparts and is not considered further in this modelling.*

Chart 11

Child benefits: Alternative Maximum Ages



Policymakers should nevertheless consider a few issues before introducing a benefit such as this one.

- It would overlap existing benefits, notably the Child Care Grant currently payable under South Africa's social security system.
- It is administratively more complex than existing arrangements, which do not depend on the condition that the child is registered as a dependent of the participant at the time of death.
- Like all other death benefits with payments linked to the income of the participant, it risks creating the notion that the wealthy (those working at the time of the death) benefit and the poor (those unemployed on death) receive nothing. Furthermore, only the dependents of those actually complying with the requirement to pay contributions at the time of death are eligible for benefits.[38]
- This may be exacerbated by the potential for moral hazard, with possibilities of changes to the registration of dependent children and attempts to re-register children after the death.
- It requires a robust system of identification to ensure that all eligible children actually receive benefits.

These are the practical considerations, all of which could have an impact on the claims rate. Another consideration – this one related to the data – that should be taken into account is the changing nature of families. As mortality rates are expected to be higher among working age South Africans than their

[38] *This may rule out the children of many who die from AIDS or other long illnesses that render them unable to work for a long period prior to death, notwithstanding the comments made earlier (see footnote 20) that every effort should be made to protect dependents against this type of risk.*

children, except perhaps the very young, dependency rates are expected to increase.[39] The model doesn't allow for this: it determines the average number and age of children for each age and gender of working South African at present. Calibration for the future is possible but very difficult. This is because, as not all South Africans of working age are working, it stands to reason that not all South African children are covered as dependents.[40]

The rather attractive numbers shown illustrated in chart 11 must be regarded with great care. Perhaps it would be appropriate for the peak rate in each curve to be regarded as a fair estimate of the likely long-term average, rather than allowing for the decrease suggested by the curves.

Using the results to consider alternatives

The preceding discussion shows that a considerable variety of options exists in the design of risk benefits, even just limiting the options to income-based benefits. Section 3.3 introduces the variable of the salary cap, showing how this affects both benefits and contributions. The discussion that follows illustrates the potential for options to be used in combination and emphasises the need for consideration of the advantages and disadvantages of each approach.

Chart 12

Example Combinations: Income Benefits Only

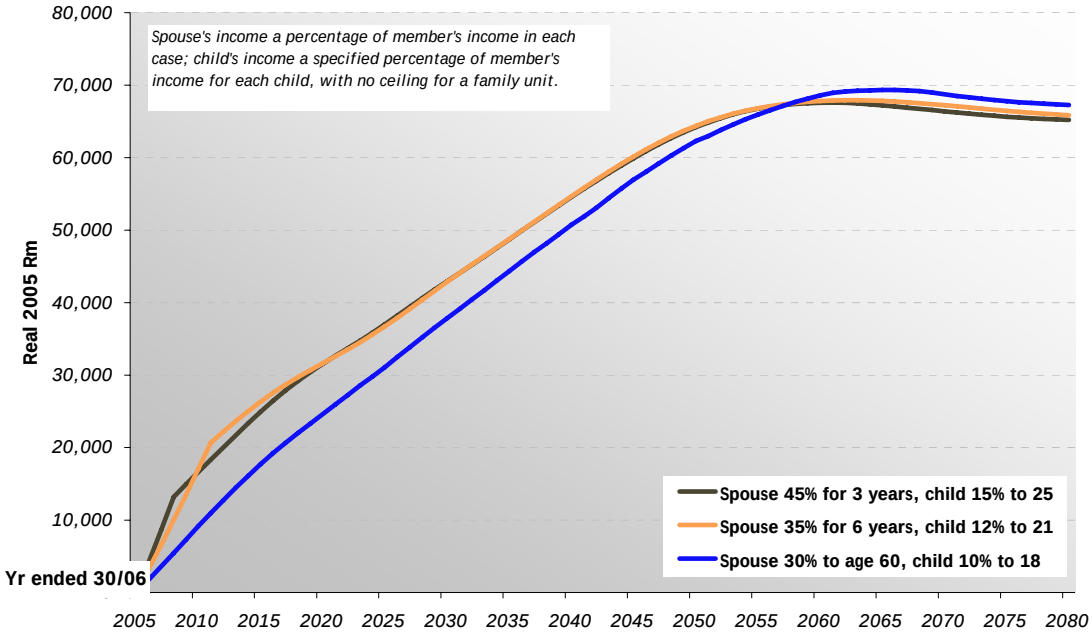


Chart 12 shows three strategies with roughly similar expected total cost.

[39] *Dependency rates refer, generally, to the ratio of dependents to workers, in this case more specifically to the ratio of children to those of working age.*

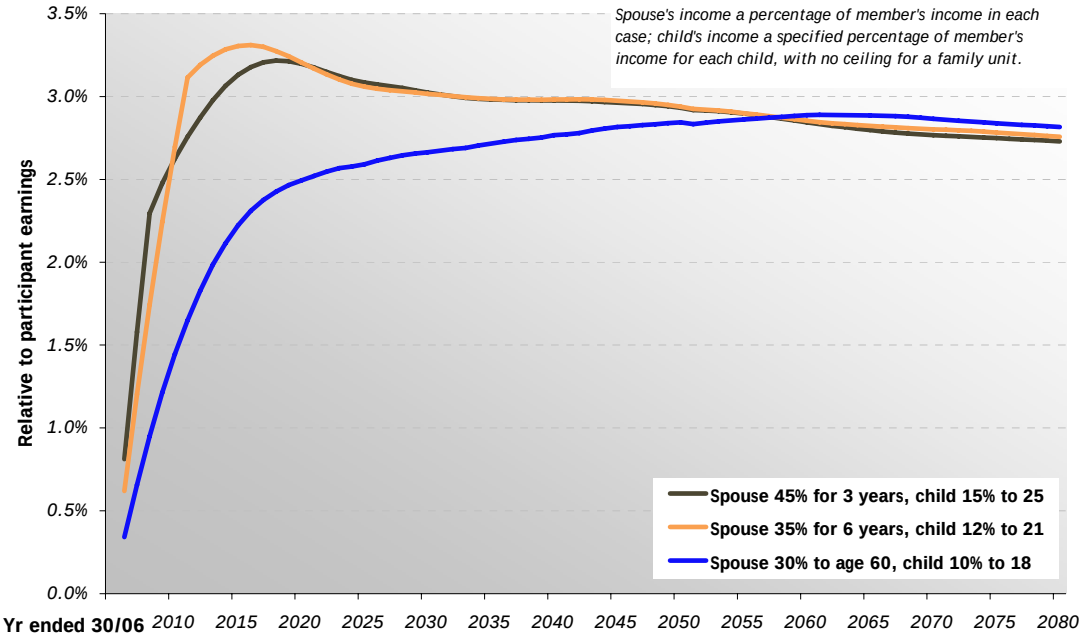
[40] *Calibration requires a reliable total number of covered children, both now and for each year in the future, so that the rates could be adjusted upwards as dependency ratios increase, to give a total number of covered children that is in line with the corresponding number determined independently.*

- Strategy 1 provides a reasonable spouse's benefit, at 45 percent of the income of the participant, but it pays this benefit for only 3 years. The severe limitation on the period permits the more generous percentage payment than under the other options, but leaves room as well for children's pension payable at a rate of 15 percent of income until age 25.
- Strategy 2 pays the spouse's pension for a longer period, now for 6 years. As a consequence of the longer payment period, the amount of the benefit is only 35 percent of the income of the participant, and the children's pension, while still generous, is limited to 12 percent payable until age 21. This provides a more balanced mix of spouse- and child pensions, but still limits the spouse pension to a fixed number of years.
- Strategy 3 errs further in favour of the widowed survivor, paying a benefit until age 60. However, the benefit value is reduced to 30 percent of the members' earnings and the pension payable to surviving children is limited to 10 percent of income and is payable only until age 18.

This shows just three combinations. Many are possible and the policymaking team needs to determine its priorities and set benefits that best meet these as part of an interactive process.

Chart 13

Example Combinations: Income Benefits Only



Benefit types produce different payment profiles. Those that pay spouse's benefit for a number of years grow at a more rapid rate than their alternatives. One of the benefits of strategy 3, consequently, is that benefits start out lower than under the others. The corresponding risk is that costs might be more difficult to control once an expectation of a certain benefit has been in place for some time. The combinations discussed with chart 12 are illustrated in a different way by Chart 13, which shows the expected payment profile expressed as a percentage of the income of participants.

As alternatives are considered – this is not a complex process once the building blocks have been developed – it is probably better to consider benefits relative to contributions because it provides a more

natural sense of the sustainability of alternatives. Each of the options illustrated in charts 13 could be delivered – it is expected – at a contribution rate of 3 per cent.[41]

3.2 Disability Benefits

The discussion turns now from death benefits – income or lump sums paid to the surviving dependents of participants – to disability benefits, which are paid in the event that a participant becomes incapacitated and unable to work.

Definitional problems

This form of benefit brings with it another set of problems. There are two main sources of disability coverage in existence at present – a third intermediate source is discussed further on.

- **Social disability grants** are paid to those with a functional disability, on a means-tested basis.[42] Claims rates are high. The arrangement is exposed to malingering and may be paying a relatively high proportion of claims to recipients who would not be regarded as disabled.[43]
- **Insurance benefits** are paid to those whose employers have purchased disability cover. Beneficiaries are assessed, must wait for a period of 3 or 6 months before being eligible for benefit and may be re-assessed with the intention of mobilising them back to work.

Chart 14 illustrates the substantial differences between the incidence – essentially the frequency – of disability in the social security system and the corresponding inferred frequency from a large private sector provider. More details on these differences are available in appendix 2.

The high level of assessment and re-integration in the private sector is one reason for the differential between the claims rates experienced by the social disability system and the insurance system.[44] Another reason is that insurers will only pay benefit if the disability is sufficient to prevent the insured

[41] COIDA pays benefits at a rate of 40 percent of income to a surviving spouse and 20 percent to each child, though it limits the total benefit to all dependents of a member to 100 percent of income (Garzarelli et al, 2008). This analysis shows that such a benefit structure is not expected to be financially feasible at a contribution rate of 3 percent of income – long-term costs are estimated at slightly above 4 percent of income.

[42] The incidence of disability impacts on other grants as well. Refer to the extract from the web site of the Social Security Administration in appendix 3 for a sense of the complex set of inter-relationships involving disability.

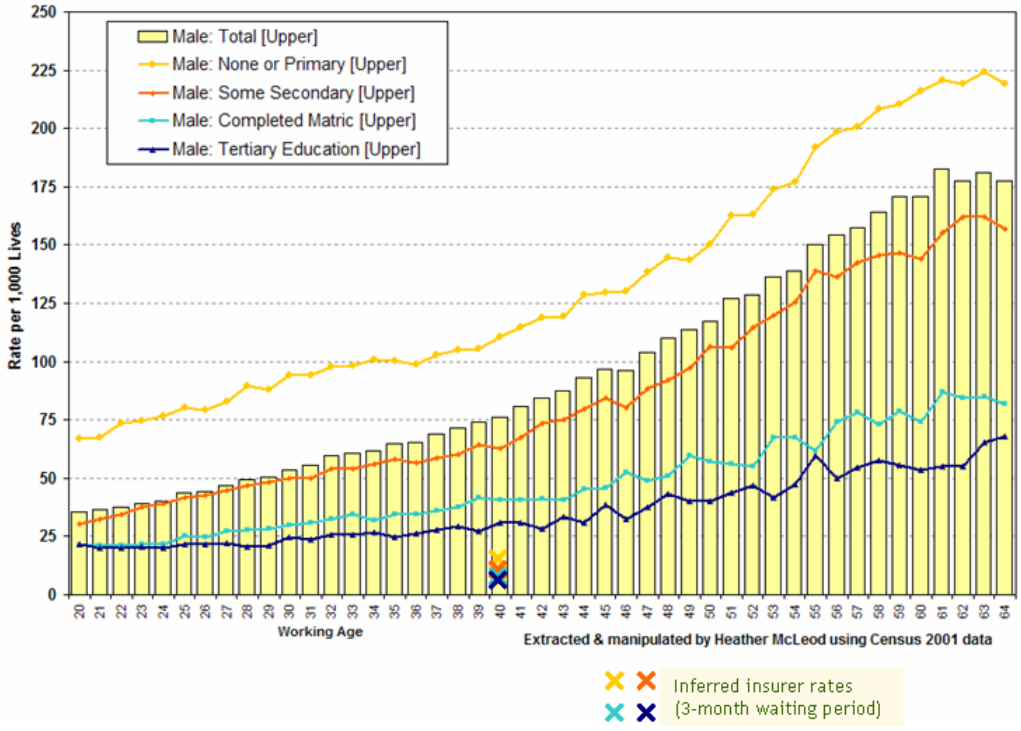
[43] This is reflected in the numbers that have been gathered (see chart 14 and appendix 2). The long and short of the issue is that, while administrators are hoping to redefine disability claims assessment to bring it into line with what is referred to in the analysis as a lower bound of the incidence, current practice probably permits disability benefits to be paid more in line with the upper bound.

[44] Insurers have an incentive to pay for treatment if it is likely to speed up the return to work and reduce the cost of paying benefits. This is not cynical behaviour; it is directly in the interest of all parties. But it does contribute to the very large difference between the implied incidence rates from the private sector and the corresponding rates from the public sector, where similar motivations to return beneficiaries to work are absent.

from carrying out their own or similar occupation. Partial disability, which may result in a grant under the social system, would often not qualify for a benefit under the insurance arrangement.[45]

Chart 14

Male Disability Rate per 1,000 by Education Upper Bound



Not only are disability rates under the two systems very different but administrative procedures vary widely as well. If a disability benefit were payable under the retirement reform, the conditions for eligibility would almost certainly have to correspond to the corresponding conditions under the existing social disability grant system, to streamline procedures and avoid inconsistency of practice and confusion by beneficiaries.

This suggests that existing disability rates under the grant system should be used as a starting point for assessing potential benefit levels, perhaps in combination with a target contribution rate, one or two per cent, for example.

This represents the starting point for the analysis. Even so, it is difficult to use Census or General Household Data to determine the rates of disability implied by the available data.[46] Appendix 2 provides a short discussion of these difficulties and motivates the use of the so-called upper bound to estimates

[45] *Employers also play a natural underwriting role because they would like employees back at work and because their premiums are usually related in some way to the claims experience of the group.*

[46] *Census data was used in preference to General Household Survey data because the GHS information doesn't provide sufficient detail and results in very variable disability rates by age. Heather McLeod's patient and meticulous assistance is acknowledged.*

of disability incidence. Chart 14 and the corresponding charts in the appendix show the rates used in the modelling.[47]

The cost of providing disability benefits

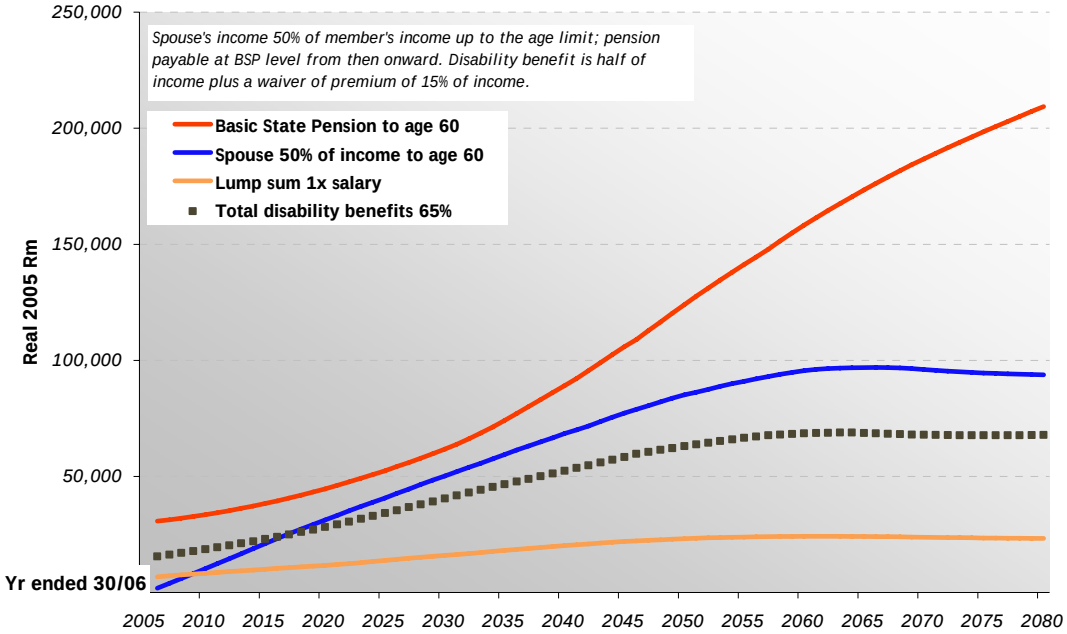
The methods used for calculating the disability benefits require brief commentary:

- It is assumed that the incidence rates implied by the upper bound estimate from the experience of the social security system are appropriate to these estimates (see Appendix 2 for more discussion on the upper and lower bounds).
- These simple incidence rates are applied to the earnings profiles of members to determine the cost of providing the benefits.

This implies that the payment of disability benefits increases at the same rate as the income of participants. This is appropriate for setting the starting level of a disability benefit. However, it is not realistic for a benefit in payment. This is because income is likely to grow at a rate reflecting increasing skills and seniority, while disability benefits are likely to increase in line with the price- or wage-index or some average of the two, which would lag the actual experience of a worker, on average.

Chart 15

Disability Benefits: Comparison with Alternatives



[47] *Note the steady increase in the rates by age and the significantly higher rates of incidence at lower levels of education. Note as well the fundamental – and rather simplistic – assumption that disability rates by education, age and gender are not expected to change in future. Since average education levels are expected to enjoy a slow but steady improvement, this suggests that overall disability rates, controlled for age and gender, will fall slightly over time.*

In light of the approximate methodology used in other parts of the system – for example, assuming that the disability experience in today's social security system is appropriate for tomorrow's counterpart – this is not considered a serious problem. It errs on the high side.

Chart 15 shows the projected cost of providing a disability benefit, In comparison with other standard benefit types, of:

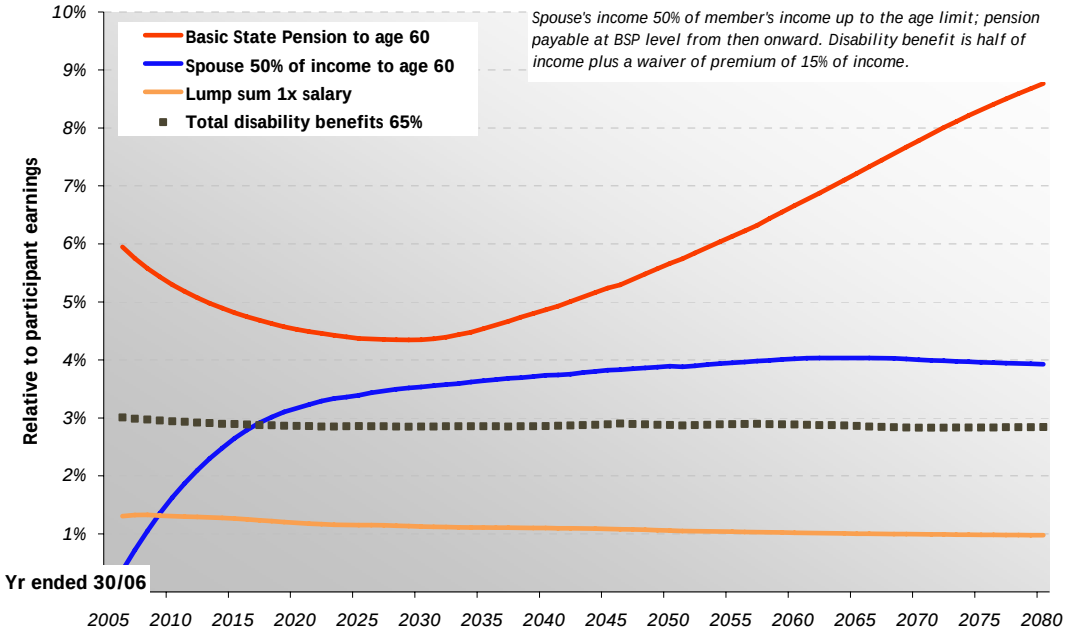
- half of the earnings of the participant at the time of the disability, plus
- 15 percent of the earnings of the participant representing a waiver of premium.[48]

The expected cost of providing these benefits starts out quite high, as all those disabled at the time of the launch immediately qualify for benefits.[49] The cost of providing this benefit starts out at a little more than half the corresponding cost of providing the Basic State Pension at the same level as today's Social Old Age Grant, but it is quickly overtaken by the cost of the spouses' death benefit, even assuming that the death benefit is payable only until age 60.

Chart 16 expresses this as a percentage of the total income of participants, converting large rand amounts into a form of premium equivalence.

Chart 16

Disability Benefits: Comparison with Alternatives



[48] *This is included in the benefit to prevent the disabled participant from losing out on retirement benefits due to absence from the system. Perhaps more importantly, since income-related death benefits are paid only to active participants, the waiver of premium sustains eligibility for death benefits.*

[49] *They would need to be registered under the system, but have a very strong incentive to do so as it would qualify them for benefits.*

Chart 16 shows that the cost of providing these disability benefits – conservatively calculated, it must be added – is equivalent to just under 3 percent of income over the projection period. Of all the benefit types shown, the disability benefit shows the most stable cost profile, expressed as a percentage of the aggregate income of participants.

Box 3. Cross-subsidy in the disability context

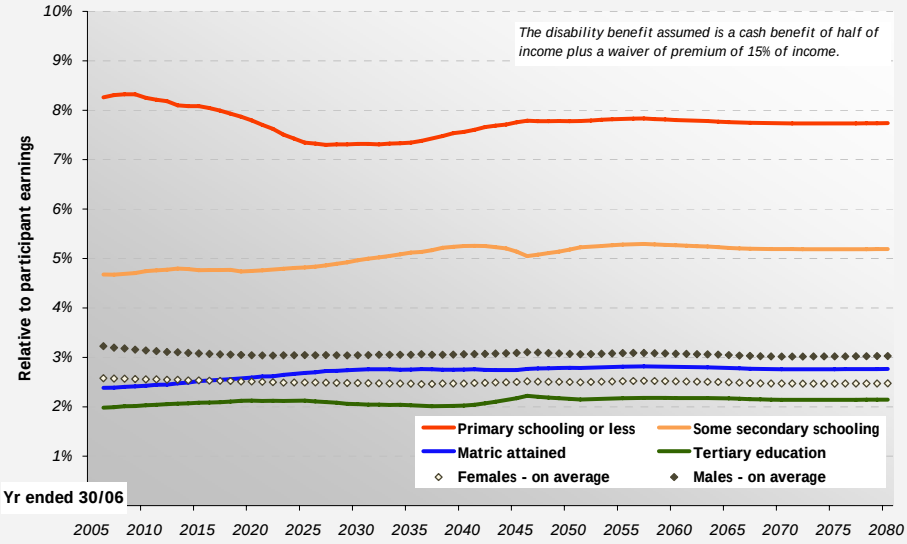
Earlier discussion raises the tricky issue of cross-subsidies in retirement funding and death benefits (refer to boxes 1 and 2 in this section). This discussion is completed with an illustration of cross-subsidies in disability benefits.

Chart 17 shows a break down of the average disability cost – approximately 3 percent of income as illustrated in chart 16 – across different groups of participants. It illustrates two types of cross-subsidy:

- The solid lines show the expected cost of the disability benefit for members with different levels of education relative to the corresponding income *of the members of these groups*.[50]
- The spots show the corresponding expected cost of the same income-based disability benefit for male members and females.[51]

Chart 17

Disability Benefits: Comparison across Sub-groups



The solid lines show that the higher incidence rates among those with lower education level would, if these groups were required to be self-sufficient, lead to a higher rate of contribution to meet the cost of benefits. Those with primary schooling or less would need to pay a contribution rate of around 8 percent to be financially self-sustaining

[50] *It illustrates the premiums that the members of each of these groups would be required to pay if the groups were each required to be self-sufficient and no surplus or deficit were permitted to arise.*

[51] *Note that groups shown in the chart are not mutually exclusive. We can think of each participating member as contributing twice to the data, once to an education class and once to a gender category.*

and those with tertiary education around 2 percent.[52] Compare these rates with the corresponding overall average of 3 percent and the cross-subsidy – assuming a constant rate across all members were used – becomes clear.[53]

A constant contribution rate for all members would benefit lower income participants – those with poorer education generally have poorer income – at the expense of their higher income counterparts. This cross-subsidy provides a clear example of solidarity with which many policymakers would be quite comfortable.

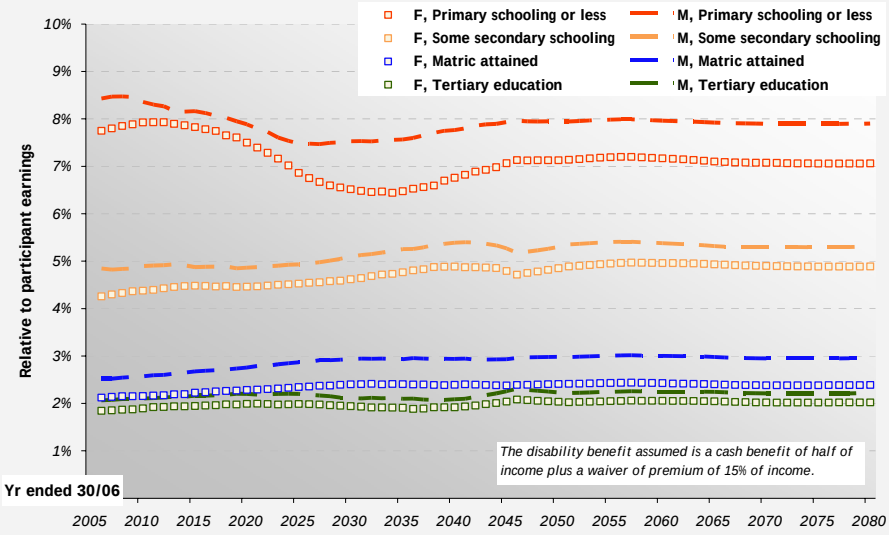
However, males are more prone to disability-causing events than females. They tend to work in more dangerous occupations, for example. Chart 17 shows that, taken as a group, men are expected to experience higher levels of disability than women, leading to rates of benefit as a percentage of income that are also higher, stabilizing at a level of around 3 percent compared with the 2.5 percent of women.

A constant contribution would result in cross-subsidy from women to men. Policymakers acknowledge that the principle of solidarity implies that, for a large group, all members contribute – according to their ability say – to the benefit of those who qualify to receive the benefits. Nevertheless, this may be a rather uncomfortable result. If the benefit were expressed as a constant rand income rather than a level of income related to earnings, but contributions continued to be expressed as a percentage of income, the implied cross-subsidy would be even greater.

Chart 18 completes the picture by showing the corresponding free-of-subsidy rates for all eight gender-education combinations.

Chart 18

Disability Benefits: Comparison across Sub-groups



As challenging as these issues are to policymakers, they must be considered. Furthermore, they must be considered holistically. Cross-subsidy of males by females in the area of disability benefits – which may form a relatively small part of the social security system, perhaps none at all – should be seen in the context of the corresponding cross-subsidy of females by males in the construction of the Basic Social Pension.

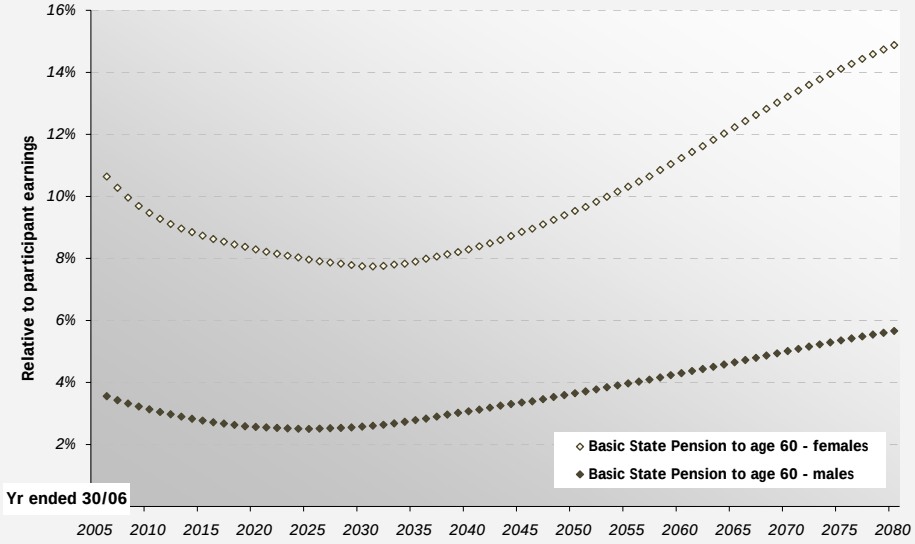
[52] *Problems with the underlying data have been discussed earlier, but ought to be acknowledged again here. As the disability incidence rates are based on personal declaration in the context of a social security system that pays a flat benefit, overstatement is more likely at lower levels of income.*

[53] *The rates for each education group show some interesting patterns. These result from the complex interaction of a number of factors, one of which is the slightly disjointed development of numbers in each education group with the passage of time.*

Chart 19 shows the extent of this cross-subsidy, sustained by the systematically longer expectation of life for women, lower average incomes and their significantly shorter average working lives (refer to charts A2 and A3 in appendix 1). This chart is by no means the end of the story. Women are proportionally better off in a flat-benefit retirement system not only because they live longer but because they are systematically disadvantaged during their working lives with lower rates of employment. At least part of the cross-subsidy in retirement is thus completely justifiable and the corresponding extent of the cross-subsidy in an income-related retirement benefit is much lower.

Chart 19

Retirement Benefits: Illustration of Cross-subsidy



The way forward

Chart 16 indicates how expensive it could be to provide disability benefits, particularly if the method of assessing claims is broadly in line with the corresponding approach to today's disability grants, which for practical purposes it would probably have to be.

The analysis suggests that, without a significant change to the fundamental philosophy underlying the system, it may not be possible to provide any more than a flat disability benefit designed to provide a minimum level of support. As the social grant system already provides something like this, an additional benefit may be regarded as inefficient.

Since disability benefits are currently provided under a number of state and quasi-state systems (the third source referred to above), it may be more productive to consolidate existing disability arrangements than to launch a separate benefit system.

These arrangements include:

- the Road Accident Fund, covering victims of motor vehicle accidents,
- the Compensation for Occupational Injuries and Diseases Act (COIDA), which broadly covers work-based injuries across a range of industries, and
- the Mines and Works Act (ODMWA), which provides compensation specifically to employees of companies in the mining industry.

Providing yet another form of disability benefit without consolidating existing arrangements may be wasteful. Modelling continues to be used to provide an idea of the cost of a disability benefit, but the limitations of this modelling must be understood when designing a social security system that must be practically and financially sustainable.

3.3 Income Limits

The discussion so far has aimed to build an understanding of the relative impact of various types of benefits. The complexity of the trade-offs is becoming evident. However, another variable needs to be introduced. This short section closes the discussion of alternatives by showing the impact of a qualifying salary limited by a ceiling.

Focus & cross-subsidies

Death and disability benefits are expensive. This is evident from the analysis in this paper. Providing them on a mandatory, contributory basis can be difficult. Since the most exposed are those with lower income, a focus of benefit parameters on these individuals may produce a better outcome. The charts that follow show the reduced cost arising from a cap on the level of income that qualifies for a benefit, death or disability.

Contributions also need to be formulated. A sensible starting point may be a contribution that is defined according to the same income limits. This retains equity across the members of the system by discarding, for both contribution and benefit purposes, income above a certain level.[54] But it is also possible to build in an explicit cross-subsidy by defining contributions on the entire salary and setting benefits on a limited salary definition. The rationale for such a cross-subsidy may be stronger in the area of death and disability benefits than in its retirement savings counterpart, because low income individuals are less likely to survive until retirement. Proponents of such an approach may suggest that some form of cross-subsidy would be no more than equitable.

The issues are complex and need to be considered with care. What follows is a high-level presentation of the projection of costs and benefits.

Choice of income limits

Since income limits could be set at any level, some sensible rationale needs to be identified to start off the analysis. Two limits have been used:

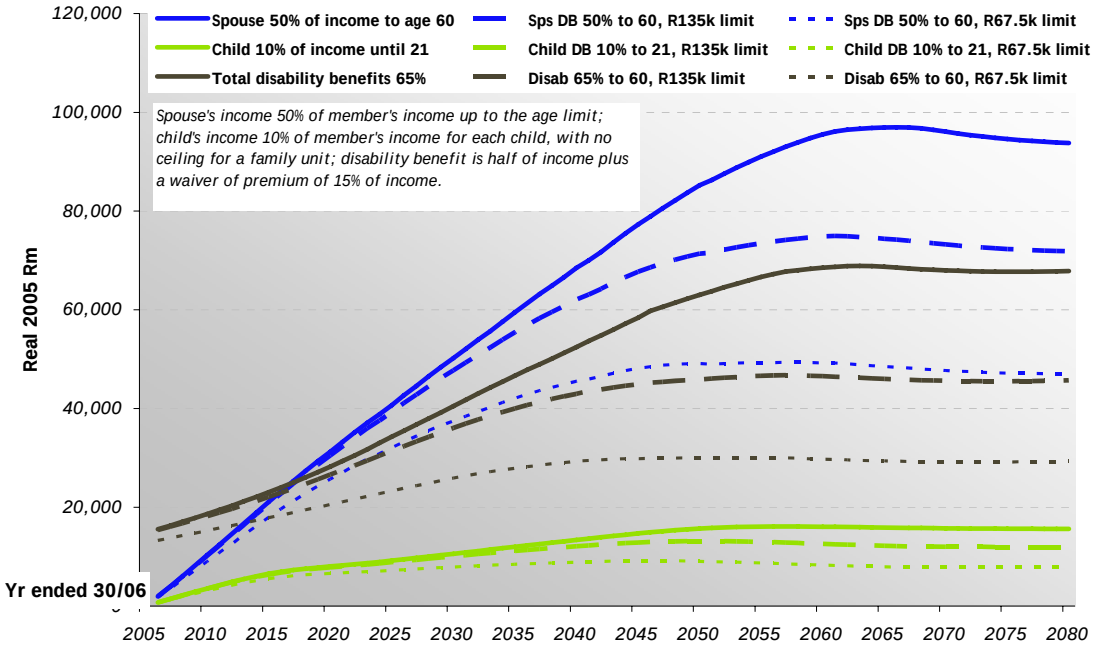
- The 2007/08 level of the UIF ceiling is approximately R150,000. This is roughly equivalent to R135,000 in mid-2005, the base year of the calculation.

[54] *It also reduces solidarity, compromising the natural mechanisms through which higher-income participants support their lower-income counterparts.*

- Half of the UIF ceiling, R75,000, has been mooted as a possible key level for centralising retirement contributions. This is used as an alternative, set in the model at a level of R67,500 in equivalent 2005 terms.[55]

Chart 20

Death & Disability Benefits: the Impact of Income Limits



Results of initial analysis

A rather busy chart 20 shows the overall impacts of the limits on three major benefit types:

- a spouse's benefit equal to 50 percent of the member's income at death, increasing at a rate of 1 percent above inflation, but terminating at age 60 or earlier death;
- a child's benefit, for each registered child dependent of the member, equal to 10 percent of the member's income, increasing at the same rate as for the spouse, but terminating at age 21; and,
- a disability benefit equal to an effective 65 percent of member's income, of which 50 percent is paid as cash and 15 percent as a waiver-of-premium benefit to prevent exclusion from other benefits.

These are all defined in the same way as before.

The curves show the projected total cost, in inflation-adjusted 2005 rands, of each of these three benefits, assuming a different level of income ceiling.

[55] *The model is somewhat limited in its flexibility with respect to these limits. Increases to the limits over time are fixed at the rate of inflation. This is expected to generate a gradual erosion of the earning power of the limits, slowly reducing the effective generosity of the benefits, though not their purchasing power. The impact is small, but might need to be tested in later iterations.*

- The solid lines show the expected cost of benefit assuming no limit to qualifying income. They correspond to the patterns used in the projections discussed earlier in this paper, as illustrated in charts 4, 9 and 15.
- The dark dashed lines show the corresponding projected cost of benefits determined on a benefit ceiling of R135,000 (in 2005). In all cases, not surprisingly, the total cost of benefits is significantly lower than in the absence of a ceiling. The proportional impact is greater for disability benefits than for death benefits.[56]
- The light dashed lines show the projected cost on a benefit ceiling of R67,500 (in 2005), illustrating a further significant cut on the cost of these benefits. Death benefits with this ceiling stabilize at a level of almost exactly half of the level in the absence of a ceiling. The expected cut in the costs of disability benefits is nearly 60 percent.

As discussed earlier, projecting benefits in rand terms may be interesting but it is not particularly useful. The charts that follow show the expected costs, for each of the three main types of benefit, expressed as:

- a proportion of modified income, similarly limited to a ceiling, and as
- a proportion of total income.

The first assumes that there is no subsidy from the wealthy to those with less income. The second represents the subsidised alternative.

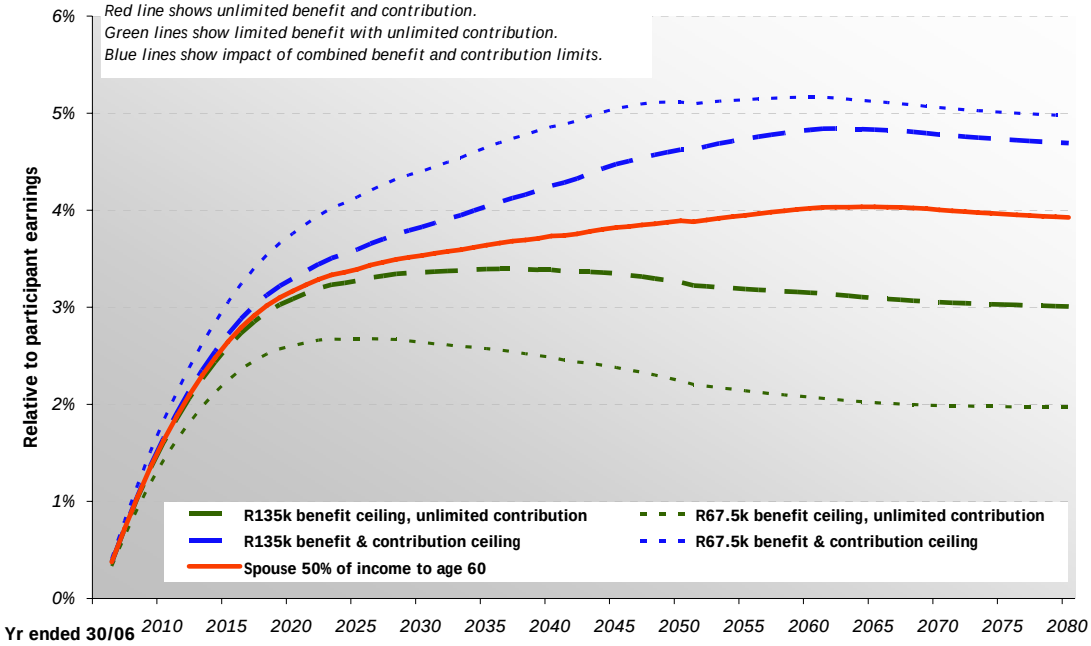
Chart 21 shows the results of this analysis.

- The red line assumes no ceiling on either benefits or contributions and corresponds to the light blue curve in chart 8, just touching 4 percent of aggregate income in the long term.
- The two green curves, dark for the R135,000 benefit limit and light for the R67,500 benefit limit show the natural impact of reduced benefits on unmodified contribution definitions. The long-term projected cost of, respectively, 3 percent of contributions and 2 percent of contributions are in line with the corresponding reduction in the expected total costs of spouse's death benefits shown in chart 20.
- The two blue curves show the combined impact of a benefit limit and a contribution limit. They lie above the red curve because of the mortality differentials by income level. The impact of the loss of contributions from the upper income levels of the wealthy, those expected to live longer and contribute more consistently, exceeds the impact of the lost benefits for the same group, again because they are expected to live longer and therefore claim less.

[56] This is most likely because the difference between disability rates at high and low income, respectively, is not as great as the corresponding differential for mortality rates. This means that, relatively speaking, disability benefits for the wealthy play a greater part in the system, which in turn leads to a greater reduction in the cost of such benefits where they are subject to an income cap.

Chart 21

Spouses' Death Benefits: the Impact of Income Limits



The relative position of the blue and red curves has profound implications for the design of the system. Assuming that an explicit cross-subsidy of contributors to beneficiaries is ruled out, the combined effect of the benefit and contribution ceiling removes some of the solidarity implicit in a system without contribution ceilings and pushes up the average contribution rate required.

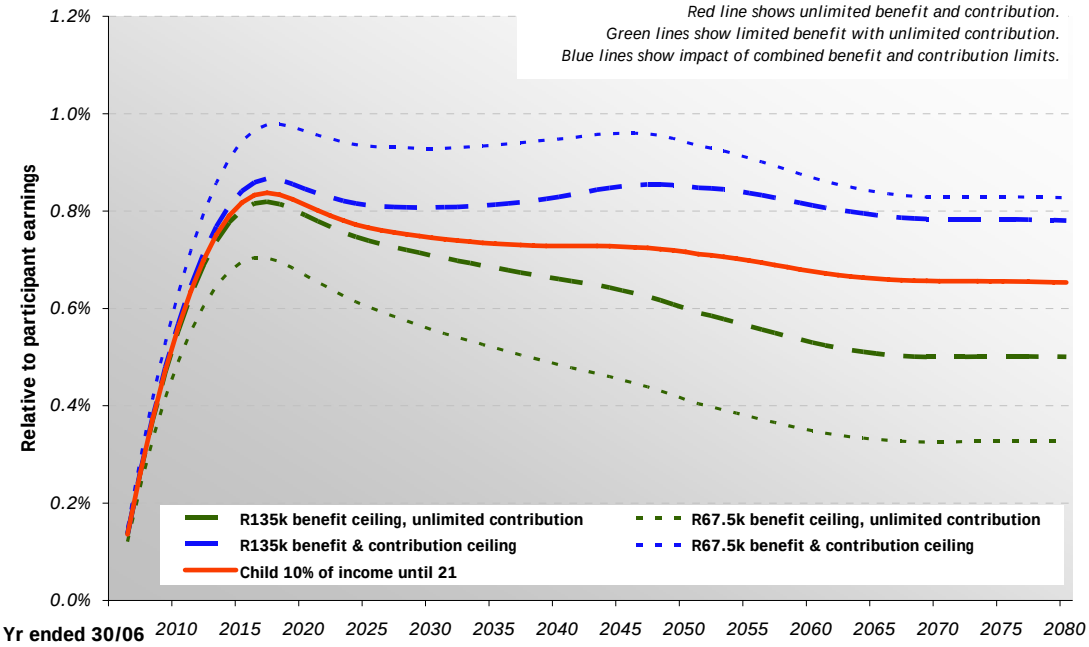
Chart 22 shows almost exactly the same dynamics for child's income benefits. Though the shape of the curves has changed, in line with earlier projections of the cost of this benefit, the relative position of the green and blue curves around their red counterpart are the same as for spouse's benefits.

When it comes to the issue of income limits, therefore, similar considerations apply to child's death benefits as to spouse's income-based death benefits.

The picture is not quite the same for disability benefits. Refer to chart 23. On the subsidised model, the savings are greater than for death benefits.

Chart 22

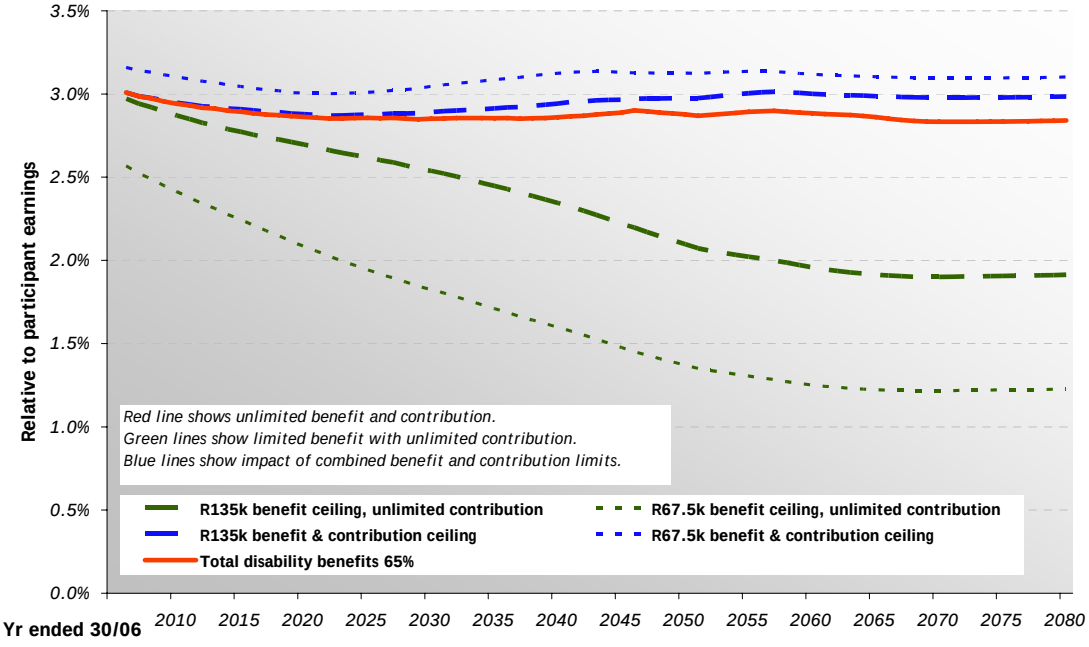
Child's Death Benefits: the Impact of Income Limits



But on the unsubsidised model, the picture is somewhat changed. The smaller differential between the disability experience of the wealthy and their lower-income counterparts leads to a much smaller increase to the break-even contribution rate applying to benefits and contributions with an income limit than to the corresponding unlimited contribution.

Chart 23

Disability Benefits: the Impact of Income Limits



Conclusions to the modelling

This section has vividly illustrated the extraordinary complexity of issues impacting on the choice of death and disability benefits. In the absence of careful consideration by a wide range of stakeholders, accompanied by rigorous and open discussion, it would be very unwise to venture a set of recommendations. The objective of this paper is to illustrate some of the dynamics of the issues, indicate roughly the expected relative costs and provide a guide for policymakers wrestling with these difficult decisions.

The last part of this report sets out a number of thoughts for these policymakers aiming to define a path through this jungle of complexity, trade-offs and conflicting objectives.

4 Closing Comments

This section summarises the complexities raised in this paper and its counterpart discussing retirement savings. It outlines a suggested way forward for resolving these conflicts and reminds readers that policymakers cannot escape the challenges of trade-offs.

Key challenges

The analysis of the previous section brings to light a number of issues affecting the design of the old age and social security systems.

First, **death and disability benefits are expected to be expensive to provide** in this country. In contrast to the corresponding position elsewhere, the cost of these ancillary supporting benefits is not merely a small add-on.[57]

- The cost of providing an income to the surviving spouse of a participant at a rate of half of the member's income at death, increasing appropriately until the spouse reaches age 60, is expected to stabilize at around 4 percent of participant earnings.
- An income payable to surviving child dependents until they attain age 21 is projected to cost approximately 0.75 percent of participant earnings.
- The corresponding projected costs, again relative to earnings, of a lump sum alternative equal to the annual income of the participant at death amount to in excess of 1 percent.
- A benefit providing half of the income of the participant in the **event of disability** and covering the cost of the social security premium during this term is projected to cost approximately 3 percent of participant income.

Second, **estimation of these costs is not straightforward**. A wide variety of demographic assumptions and a range of data sets are used to put together the figures illustrated in this paper. While they represent the best available assessment of the risks being contemplated, the commentary frequently comments on the uncertainty implicit in these long-term projections. Establishing a set of financial promises to participants needs to be embarked upon with great care.

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[57] Chilean participants pay a contribution equal to around 13 percent of earnings. Of this a full 10 percent goes to retirement savings. The balance of at most 3 percent covers the cost of death and disability benefits and the administration costs of the private sector providers to which retirement savings are entrusted. The premium for death and disability benefits started at around 1.5 percent of wages but fell rapidly to a level of approximately 0.6 percent of wages in 1998 (Monika Queisser, "The Second-Generation Pension Reforms in Latin America, OECD, 1998). This sort of premium clearly buys very little in the South African context.

Third, **administration of these benefits is extremely complex**. This paper is not intended to comment on the difficulties associated with running a system like this one, but as it is concerned with finances it must note that:

- administration costs have not been taken into account and these may well be significantly higher for ancillary benefits like those covered in this discussion, than for the corresponding retirement benefits, and
- the potential for the understatement of actual claiming levels due to moral hazard and fraudulent claims cannot be excluded.

There is a very big difference between undertaking a financial projection of a system on paper, as this document and its predecessor set out to do, and running the corresponding finances of an enormously complex enterprise in practice. This is particularly the case when participants have substantial incentives to take advantage of any administrative inefficiency that may undermine the effectiveness of the system. Complexity opens the door for misinterpretation of rules and for administrators to err in favour of participants.[58]

Fourth, **existing vehicles must be taken into account** in the benefit design process. Failing to do so runs the risk of duplicating benefits in place, adding unnecessarily to cost and substantially complicating the interaction of systems, confusing participants and increasing the risk of wasteful or fraudulent behaviour.[59]

Fifth and most difficult, **trade-offs must be taken into account** when determining how to provide benefits. A few of these are set out below by way of example.

- The high-level allocation between retirement savings and survivor benefits must recognise the delicate balance and the interests of different parties. Participants less likely to survive until retirement – broadly those with lower income – would prefer survivor benefits to retirement savings.
- The retirement age under the social security system and complementary private-sector arrangements go a long way to determining the likely cost of the system and the mix of savings and survivor benefits – the later the retirement age the lower the effective value of retirement savings and the higher the corresponding value of survivor benefits.
- Within the survivor benefits, resources need to be allocated between death benefits and disability, between spouses and children, and between income- and lump sum benefits,(if both are deemed

[58] *Disability assessment is an area fraught with complexity and subjectivity, creating the possibility of unexpectedly high claims payments. Dependent registration is another function that requires very careful attention, making sure that individuals cannot be registered as dependent on more than one participant and that applications for registration as dependents do not take place after the death of the participant but before notification of this event.*

[59] *The provision of disability benefits, for example, should include a clear and thorough assessment of what is currently in place and the considerable efforts required merely to standardise these arrangements, let alone combine them with a social security alternative. Interested readers should refer to the review of workers' compensation arrangements currently in place. This provides a useful list of promising areas for standardisation, including compensation payments, worker rehabilitation schemes, projected earning capacity, tariff harmonization, access to information, interfaces, standardised electronic transactions, claim event notification, ultimate liability, dispute resolution, mechanism design and policing (Garzarelli et al, 2008).*

appropriate). Trade-offs involving various interest groups and the administrative complexity of the alternatives must be taken into account.

- Once the parameters establishing the level of benefits have been set – not forgetting that income-related benefits may need to be complemented by a rand floor to protect the poor – appropriate terms for increasing the benefits on a year-to-year basis must be determined. This requires an assessment of the likely development of benefit levels, again with their associated trade-offs.
- Income-related parameters need to be set, in theory separately for the benefits and contributions, though it is recommended that the same income floor and ceiling is used for both. These need to take into account a number of other possible developments, for example, establishing rand ceilings on the levels of tax-deductibility of retirement contributions and the introduction of government subsidies supporting low-income participants.

Way forward

The complexity described above suggests that the problems cannot be resolved simultaneously. An iterative process is required, but the efficiency of this process can be improved by establishing some form of sequencing. The following steps are suggested:

1. **Establish an unambiguous set of objectives**. These need to be comprehensive and measurable.[60]
2. **Prioritise the objectives**. Determine which of the goals come first and how negotiable the numerical targets are. Identify pairs of objectives that partially or completely contradict one another and consider ways in which the conflicts could be resolved in a way that creates a partnership between these apparently conflicting aims.[61]
3. **Determine the simplifying principles that guide the process**. Example of these principles include, for example,
    - a contribution ceiling expressed as a percentage of income,
    - lower and upper bands on income that are the same for both contribution- and benefit formulae, and
    - some form of wage- or contribution-subsidy.
4. **Set an acceptable percentage contribution level or ceiling**. Any combination of benefits is theoretically possible, but practical limits to the benefits are determined by an acceptable limit to the contributions.

---

[60] *It is not enough to say "reduce poverty", for example, if it is not clear exactly what is intended by poverty and how significant the reduction needs to be. Similarly, a limited set of aims is not sufficient, even though a few might be more important than the others.*

[61] *"Ensure financial stability" and "keep contributions as low as possible" are contradictory objectives, for example, that can be resolved by setting an acceptable level of contribution and taking steps to manage other parts of the system with the goal of ensuring financial stability. Another approach may be to set the contributions as subordinate to all other objectives subject to a pre-determined overall contribution ceiling.*

5. **Determine an acceptable split of contributions for savings and survivorship**. This represents a starting point, not a conclusion, but it at least establishes a philosophical allocation from which deviations would need to be justified.
6. **Set the floor and ceiling for savings and survivorship contributions and benefits**. These two parameters have a strong impact on the resulting relationship between contributions and benefits, so it helps to gain some sense of where these might be set early in the process.[62]
7. **Exclude forms of benefit that are not to be considered further** and set out the rationale for these exclusions, checking back against the objectives as this decision is taken**.**[63]
8. **Venture parameters for the remaining benefit types,** run the models and test these parameters against the objectives.

The next steps depend on the extent of the success with which objectives have been met.

- If the system after running projections appears to be close to overall balance, small changes can be made to the parameters mooted to achieve a better fit to the goals.
- More extreme differences between the goals and the projected reality suggest that the process needs to be started again, though the objectives ought to have been set with sufficient confidence for the assessment to restart at point 3 in the list above.

This paper is intended to give a broad sense of the likely cost of the major benefit types. Taking it from this point to a coherent set of benefit and contribution definitions will require careful consideration and detailed supporting analysis.

[62] *Significant progress seems to have been made in this regard already.*

[63] *Disability benefits may be regarded as too complex to introduce to the system or too similar to benefits already in place at present, for example. Lump sum death benefits may be excluded on the risk of over-insurance.*

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APPENDIX 1 ASSUMPTIONS

Any modelling requires a set of assumptions to support it. It is important to be clear about the assumptions underlying both models described in this paper so that readers can assess the usefulness of the modelling, particularly if they hold different views. The notes that follow are a modified version of the corresponding content in the first paper, adding information on mortality rates and family relationships.

Guiding principles

The modelling of retirement and ancillary benefits is founded on an underlying rationale supported by the following:

- **Sound actuarial practice**. The models are established within the framework of established actuarial practice and guided by the principles and norms underpinning international actuarial practice in social security, as set out in the ILO and ISSA text on the subject (Plamondon *et al*, 2002).
- **Best estimate assumptions**. Models sometimes err on the side of caution or optimism in order to satisfy particular objectives. That is not the case in these models: in all instances, the intention is to manage uncertainty by using the best available estimate.
- **Comparability of options**. As a number of alternative designs are considered, they need to have common traits to ensure consistency and comparability. In this case, comparability is established by using a constant 'budget' of contribution rate, 15 per cent of qualifying earnings. Of this, 12 per cent is assumed to be available for retirement saving, with the 3 per cent balance set aside to meet the costs of death and disability benefits, separately modelled.

Data sources

Data is obtained from the 2005 GHS, based on 2001 census data and modified by EPRI. Modelling parameters are drawn as well from the ASSA 2003 Aids model, standard assumptions, with acknowledgement. Enormous assistance has been received in managing the GHS data set from Professor Heather McLeod.

Long-term projection parameters

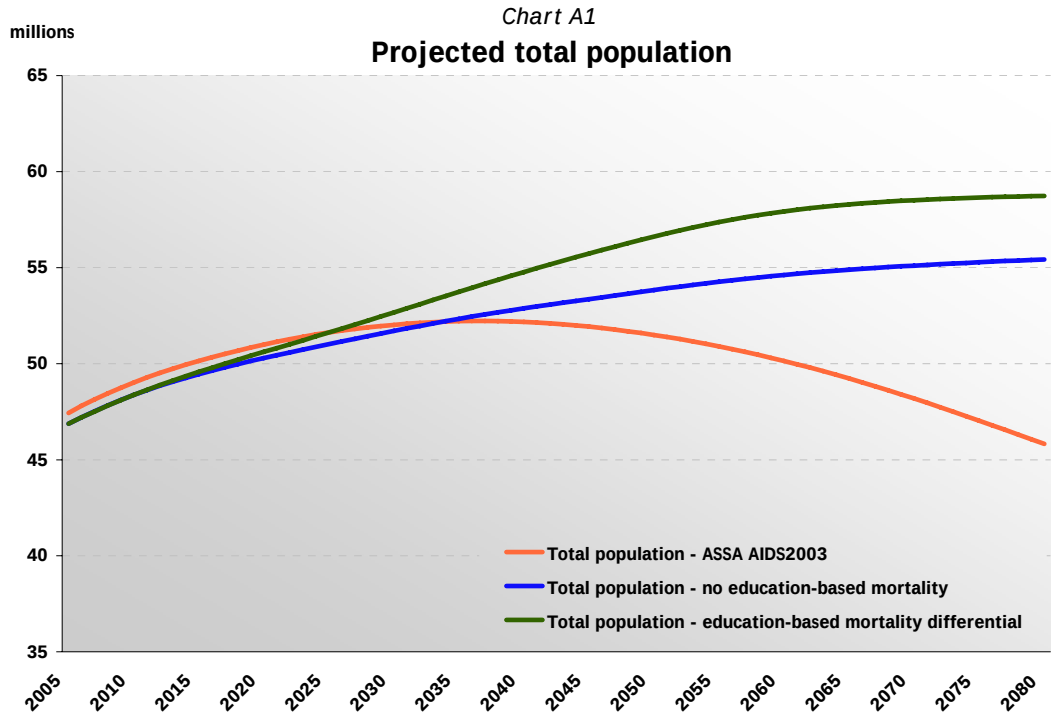
The following assumptions are used to drive the long-term projection of system income and outflows:

- **Mortality**, the assumed rate at which participants die, is based on the corresponding mortality assumptions of the standard version of the ASSA 2003 Aids model, but modified by introducing a differential mortality multiple by education. Rates vary by age and gender and also change over time. The education-based factors have been inferred from income-based differentials supplied by a

major insurer[64] and calibrated to give the same overall mortality rates – small differences remain and the overall population grows slightly faster than in the previous modelling (see Chart A1).

- **Fertility**, the rate at which women have babies, is based also on the corresponding assumptions underlying the ASSA model set until 2020 and are thereafter modified. The ASSA model results in significant population decline over the very long term, which is probably not sustainable. The model used in this paper adds 0.75 percent to the age- and time-based fertility rates in the ASSA model in 2021 and an additional 0.75 percent in each successive year until 2050, levelling at a rate of 22.5 percent above the corresponding rates in the ASSA model. The resulting total population increases gradually over the course of the projection period (see Chart A1).[65]

Chart A1



- **Immigration** is ignored, in line with projections in the ASSA model, which allows for immigration as experienced in the past, but projects zero net immigration in the future.[66]
- **Gross domestic product** does not form a significant part of projections, with most outputs set out in real money terms rather than as a percentage of GDP. The model assumes long-term real growth

[64] *With thanks for the effort and time expended on this data.*

[65] The difference in the 2005 level arises because each model projects population from an earlier date, with a slightly different outcome. The preference is to stick with the GHS total, based on projected 2001 census data, rather than re-calibrate to ASSA 2003 Aids data, but to re-weight GHS data across age in line with ASSA in order to ensure total mortality and fertility rates are consistent. Differences in the starting population are small.

[66] It is the author's firm belief that net immigration will be positive and one of the strongest drivers of total population growth, but modelling immigration with confidence is difficult because one needs to make assumptions not only on the numbers but on the age, gender and socio-economic standing of immigrants. Allowing for higher fertility helps to sustain overall population growth at levels in line with conviction but is a poor substitute, equivalent to assuming that all immigrants are new-borns with the same average socio-economic status of the population as a whole.

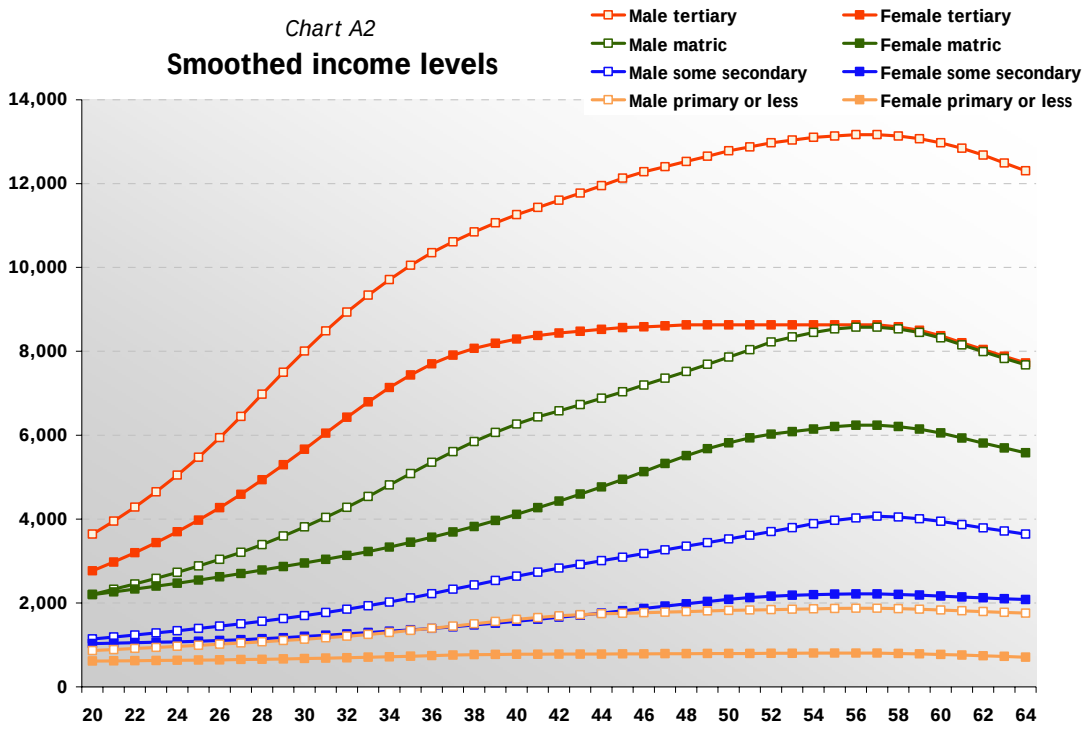
in gross domestic product of 3.5 percent, higher than the general real wage growth by 1.5 percentage points, reflecting some benefit to capital.[67]

- The **starting date** is 2005 to correspond with the data set. Subsequent modelling should test for later starting dates, but the results and conclusions are unlikely to be affected by this, because it amounts essentially to adopting a slightly different starting population mix.

Income level and distribution

The income level of participants is a key parameter set because it drives the economics of the system. Setting today's and tomorrow's income distribution involves a number of considerations and it helps to think of members as falling into a number of different categories, as described below.

Chart A2



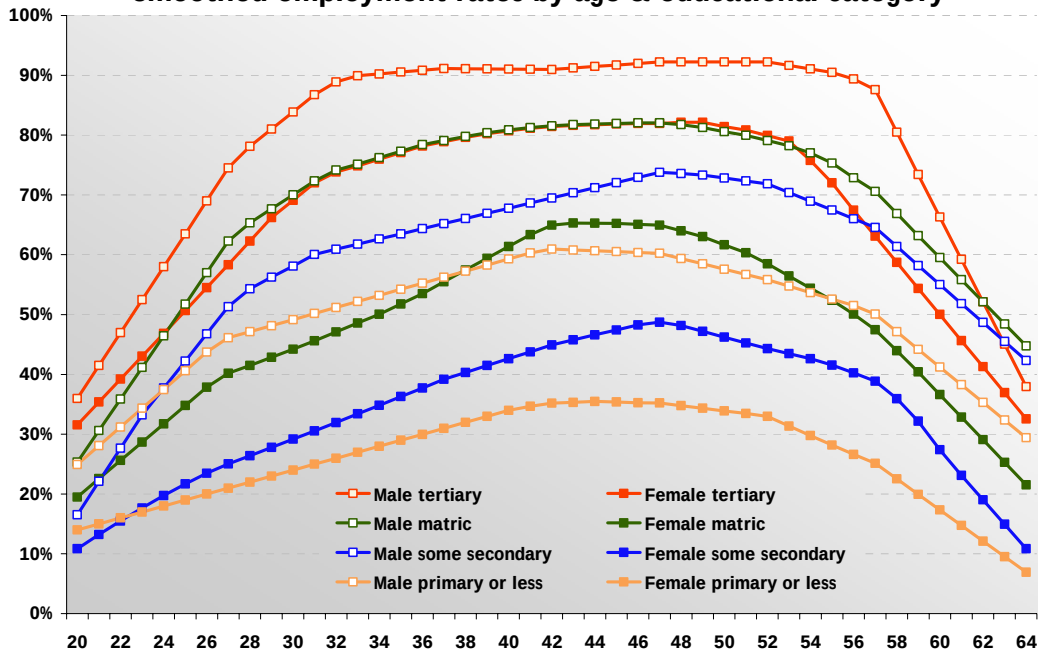
- **Today's elderly** are not affected by income assumptions under a universal BSP system, as they all receive the basic state pension no matter their current or future earnings.
- **Today's workers** are assigned an income level according to GHS2005 data. This data is likely to suffer two forms of under-reporting: (1) some respondents refuse to disclose income, and (2) those that do so declare below actual income. The data is assigned by education category and gender,

[67] Few of the projections reported in this paper make reference to GDP, but this is nevertheless an important assumption. The difference between wage growth and GDP growth is relatively large. World Bank authors report an assumed gap for long-term modelling in Kazakhstan of 0.5 percentage points (Hinz et al. 2005). It is not clear from the description in that paper whether similar assumptions would apply to other countries. In the modelling described in this paper, it is assumed that a relatively large share of economic growth accrues to the owners of capital.

and smoothed by age (see Chart A2, which charts smoothly monthly income).[68] Employment rates for each gender and education category combination are smoothed across the age range (see Chart A3). Under-reporting of income is adjusted for by applying employment rates to the income curves.[69]

Chart A3

Smoothed employment rates by age & educational category



- **Today's children** are allocated to education bands and assumed to follow the same salary patterns with the addition of a year-by-year real increase in background wage rates.[70] Allocation to educational status is random according to the population distribution of South Africans aged between 25 and 34 inclusive.[71]

[68] Smoothing is a semi-automatic process that removes outliers but retains the broad shape of curves. Logical reasons for every peculiarity were not sought and some unexplained peculiarities remain. The salaries of females with a tertiary education, for example, climb rapidly until the late thirties and then level off. This is clearly evident from the available data and is retained in the smoothed data without seeking reasons for the phenomenon. It may result from a mixing of generations or from other explainable features such as increased incidence of part-time work.

[69] The size of the group in the GHS that describe themselves as employed is larger than the group that declared an income. The earnings patterns are applied to the population proportion describing itself as employed. This raises total declared annual income from R445.7m to R520.8m, an increase of 16.8 percent, which should be verified against credible independent sources.

[70] This is the year-to-year increase in wages on a like-for-like basis across education category, gender and age. The real increase experienced by a given individual is this background wage increase plus the increase implied by the smoothed salary progression for the particular personal characteristics of age, gender and educational status.

[71] Considerable attention was given to this allocation. Thought was given to the option of linking the education status of a child to the corresponding status of his or her parents. Determining which parent to use or setting up some sort of average of the two parents is complex and flawed. This is particularly challenging in the case of tomorrow's babies because paternal fertility rates are difficult to establish and predict. Even the option of randomly allocating children to educational bands is tricky because appropriate weights need to be developed. The 25-34 age range has been

- **Tomorrow's children** are allocated at birth to notional education categories according to the same distribution across education bands and also assumed to follow the same salary patterns with the addition of year-to-year increments given by the background wage growth rate. This results in a gradual increase in education levels, as illustrated in Chart 2, in the main part of the report.[72,73]
- **General wages** are assumed to grow at 2 percent above the rate of inflation on a year-to-year comparison of equally educated, age-and-gender-constant workers.

Family structures

Crucial to the accuracy of this modelling is a clear understanding of the relationships between participants and their dependents, their wives and children, who would receive any benefits defined under the system.[74]

The model uses the following parameters, all differentiated by the age and gender of the participant:

- the average number of spouses, allowing for a probability of marriage but also for the possibility of multiple spouses;[75]
- the average age of the spouse, which grows with the age of the member, as could be expected, and always shows married men older than their wives on average, but with a wider gap between males and females for young married women and older married men and a correspondingly smaller difference at the opposite ends of the age spectrum (see chart on the next page);[76]
- the average number of child dependents for each participants, based on a range of age cut-off options; and
- the average age of the dependent children.

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decided on because this group is considerably better educated than the population as a whole, and therefore better representative of tomorrow's education standards, but is old enough for tertiary degrees to have been completed.

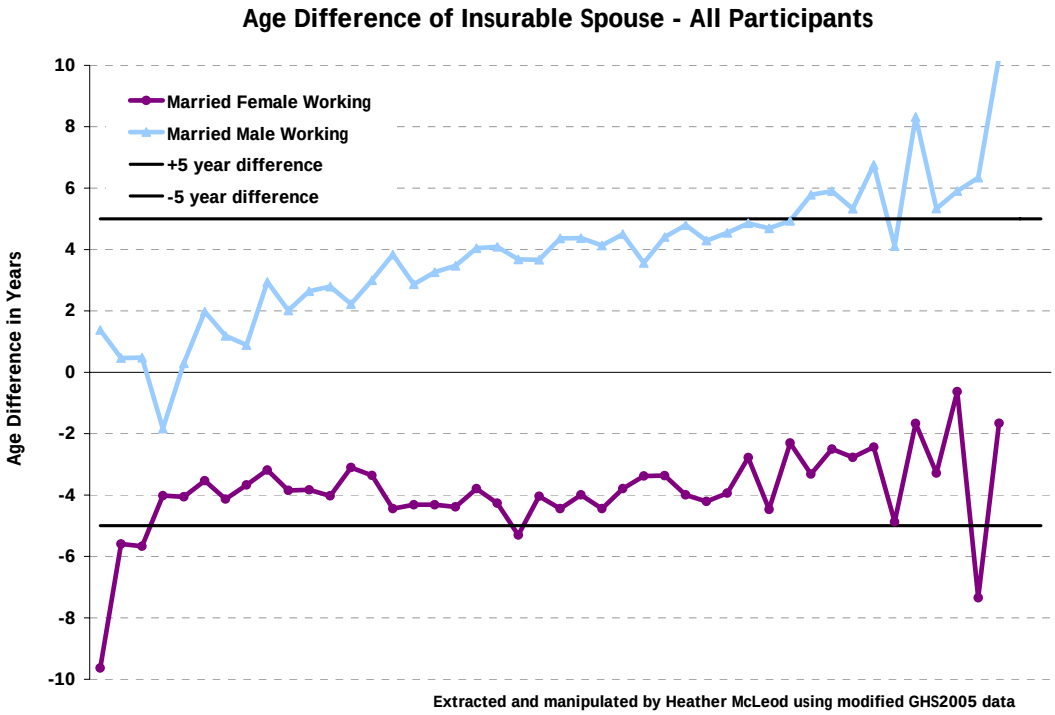
[72] One of the by-products of this approach is a steady increase in the educational standard of South Africans, in turn resulting in an increase to wages in excess of the background real-wage growth assumption. This has been measured to determine whether it might be regarded as appropriate. The additional annual wage growth of 1.8 percent in the early years is regarded as not unreasonable.

[73] Small disconnects appear in some of the long-term projections because of systematic changes in assumptions between the cohorts. Today's children, for example, have a constant average education status that is slightly different to that of the generation that precedes them, most likely because the age group 20 – 24, whose educational status is regarded as fixed, have poorer education levels, on average, than the generation modeled to follow them, who are randomly assigned to education groups. The resulting elbows in the curves are very small and sophisticated blending across the boundaries of the cohorts is not regarded as sufficiently valuable for the potential errors that such a process might introduce.

[74] The work of EPRI is acknowledged in this regard, together with the patient additional analysis carried out by Heather McLeod.

[75] The information permits this probability to be based either on those who are married now or those who were every married. The former has been used to set marriage probabilities on the basis that a spouse is only eligible for benefits if married to the participant at the time of death.

[76] A simple bias is in action here. Older men who are married are more likely to be married to a younger woman simply because older wives are more likely to have died than their younger counterparts. Data has not been smoothed because to do so may introduce inappropriate subjectivity and because the set is large enough for irregularities to have little or no impact on modeling outcomes.



The data analysis showed significant differences in spouse characteristics by education status, so these differences were retained, creating a separate set of spouse numbers and average age for each education group. The same was not true of the dependents, so the same assumptions have been used for each education group.[77]

The calculations allow for different maximum ages of eligibility for children's' benefits. Data was re-sampled to create different sets of child statistics for each of the age cut-offs. At younger ages, 15 or 18, the average number of child dependents for each participant is lower and so is their average age. For higher cut-off ages, like 21 or 25, numbers and average ages are correspondingly higher.

The real challenges in the data analysis arise from the difficulties distinguishing household from family. This is particularly challenging because the primary source of data is the General Household Survey and the fundamental unit considered in that survey is, of course, the household.

Consider the following examples:

- A male-headed household has no other males, two females and four children. One of the women is the man's wife, the other his sister. Three of the children are dependent on him, the fourth on his sister. His oldest son is at school in the nearest city and is therefore not in the household.

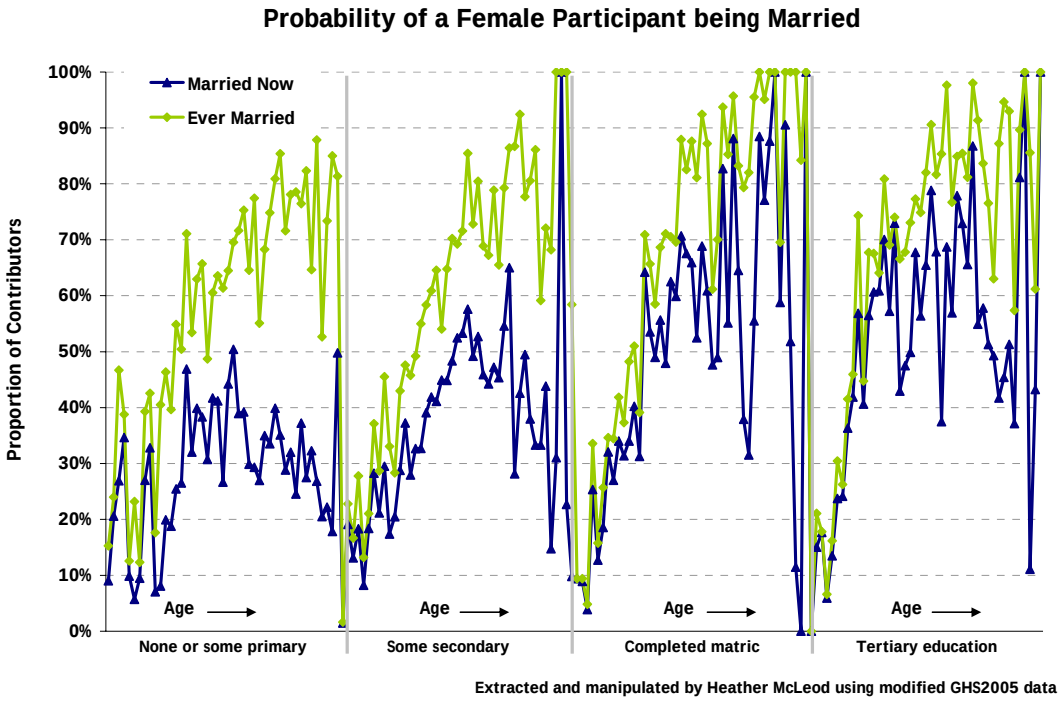
[77] *This may be surprising, as the conventional wisdom appears to be that lower-income adults have more children. The data does not support this view. Note, however, the distinction between family and household: the extract aims to understand the number of children for each participant in a family grouping, because these are regarded as dependent on that member. Much research considers these groups in their households. Since multiple families are more likely to live in the same household in a lower-income context, poorer households are more likely to have more children even if families do not.*

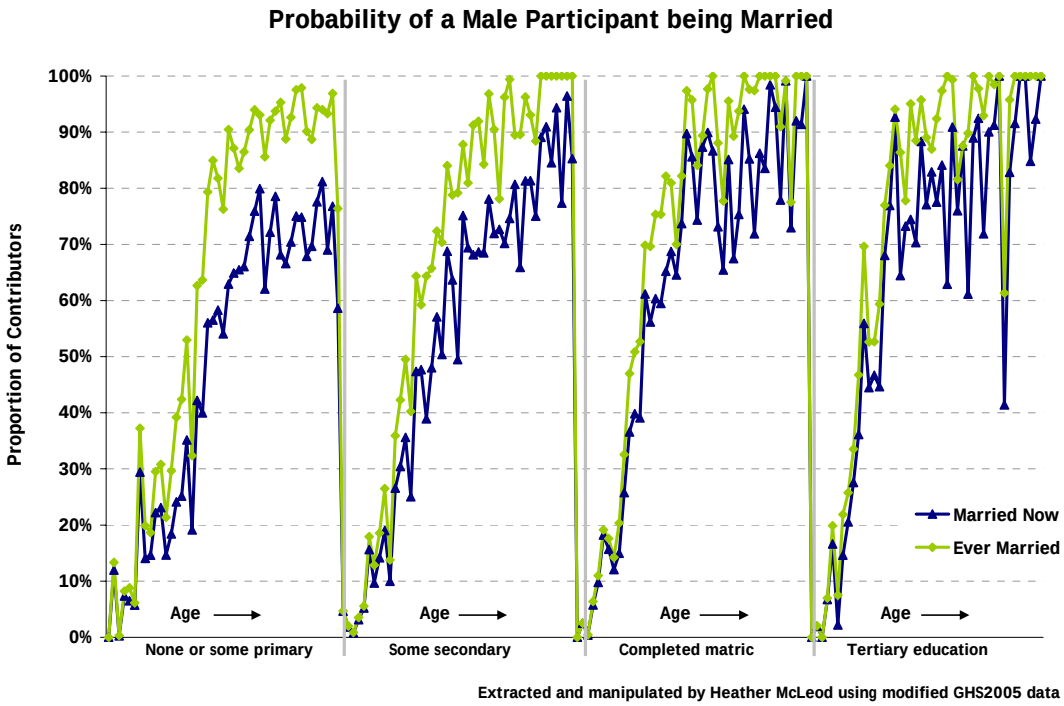
- The man's brother-in-law, husband of his sister, also lives in the nearest city, looking after the man's son and living with his own brother.

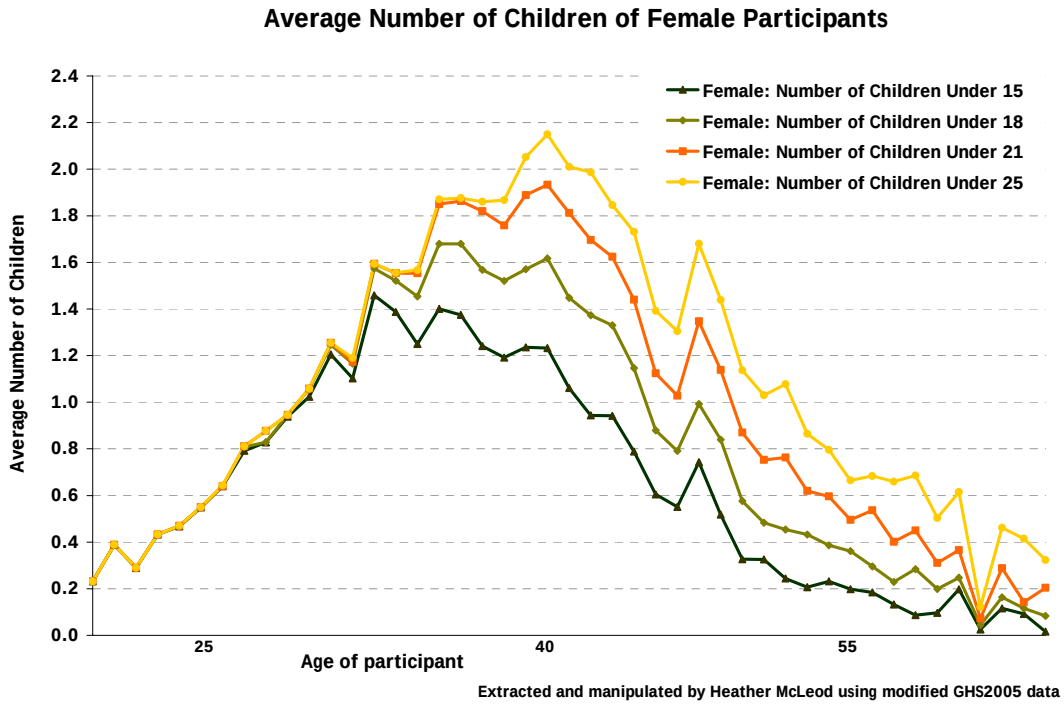
These relatively common complications – they take a variety of forms – are not easy to pick up when working with household-based data. Details of the analysis are available on request from Heather McLeod, whose efforts at ensuring the integrity of the data used in this paper are deeply appreciated.

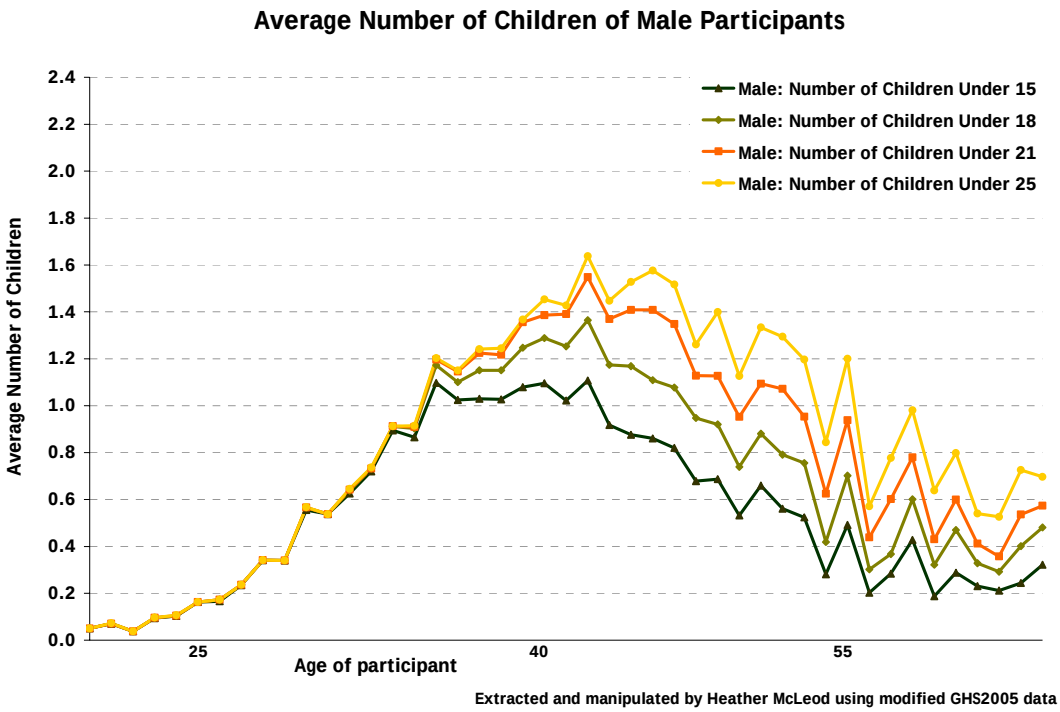
A number of illustrative charts follow for information:

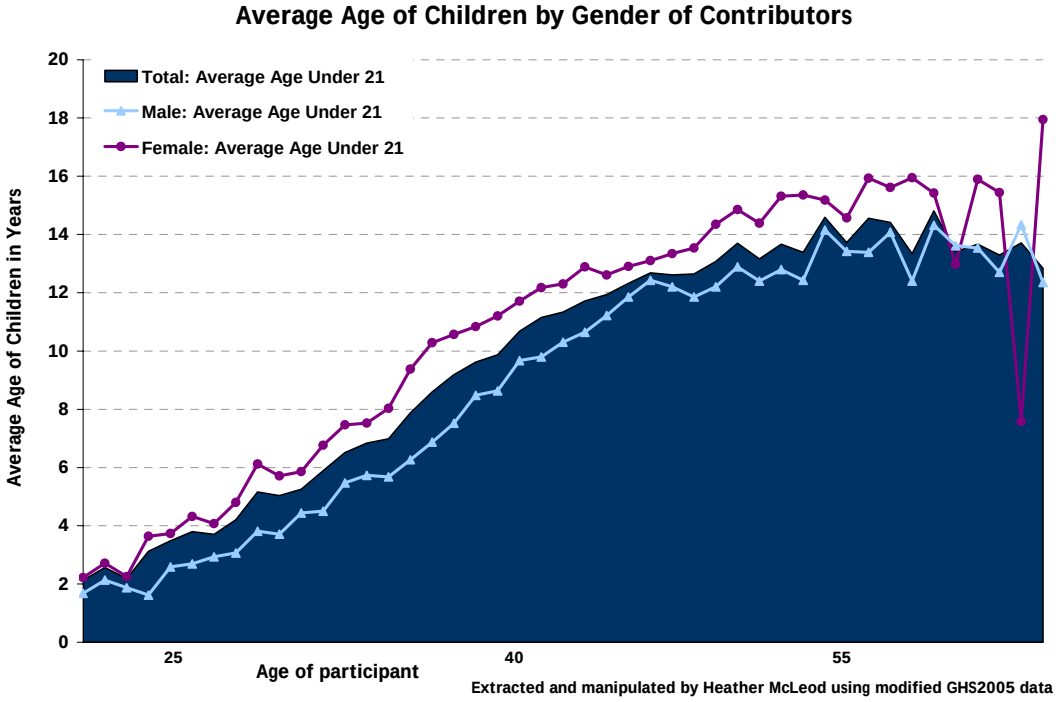
- the probability of marriage for females, by education status;
- the probability of marriage for males, by education status;
- the average number of children per female participant;
- the average number of dependent children for each male participant; and,
- the average age of children by gender of participant




Probability of a Male Participant being Married
Proportion of Contributors
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Age
Age
Age
Age
None or some primary
Some secondary
Completed matric
Tertiary education
Married Now
Ever Married
Extracted and manipulated by Heather McLeod using modified GHS2005 data


Average Number of Children of Female Participants
Average Number of Children
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
25
40
55
Age of participant
Female: Number of Children Under 15
Female: Number of Children Under 18
Female: Number of Children Under 21
Female: Number of Children Under 25
Extracted and manipulated by Heather McLeod using modified GHS2005 data

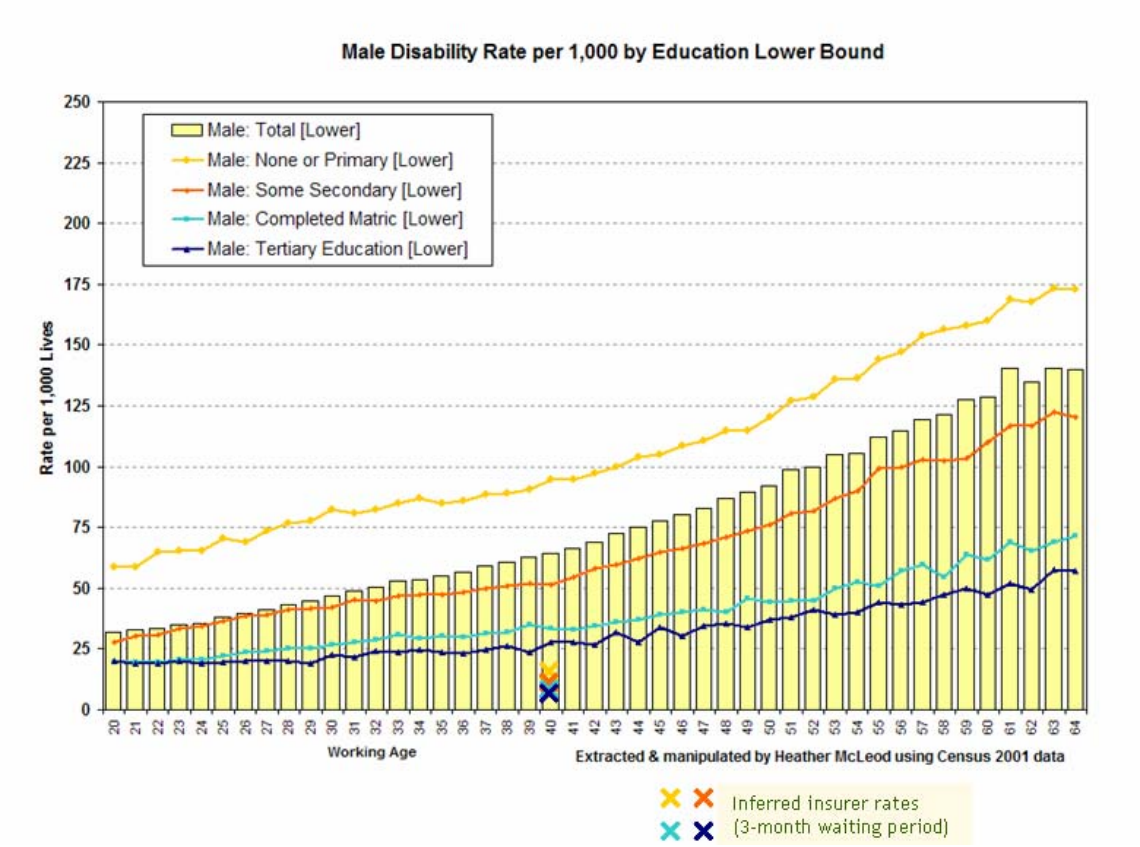

Average Number of Children of Male Participants
Male: Number of Children Under 15
Male: Number of Children Under 18
Male: Number of Children Under 21
Male: Number of Children Under 25
Average Number of Children
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
25
40
55
Age of participant
Extracted and manipulated by Heather McLeod using modified GHS2005 data


Average Age of Children by Gender of Contributors
Total: Average Age Under 21
Male: Average Age Under 21
Female: Average Age Under 21
Average Age of Children in Years
20
18
16
14
12
10
8
6
4
2
0
25
40
55
Age of participant
Extracted and manipulated by Heather McLeod using modified GHS2005 data

APPENDIX 2 DISABILITY RATES

The charts below are modified versions of those prepared by Heather McLeod as part of her analysis of census data to provide the disability incidence rates used in the model.

To the curves and bars indicating the experience of the social grants system have been added four crosses that show the corresponding inferred rates for a large insurer. These rates are for 40-year-olds with education levels corresponding to the four curves and are averages of the corresponding males and female rates.



Disability rates are very difficult to determine, even from detailed census data. An upper bound and a lower bound to the incidents rates have been determined. While both depend on self-assessment by respondents to the census, they are based on responses to different questions.

- The lower bound is based on an affirmative response to the question:

  "Does (the person) have any serious disability that prevents his/her full participation in life activities (such as education, work, social life)"

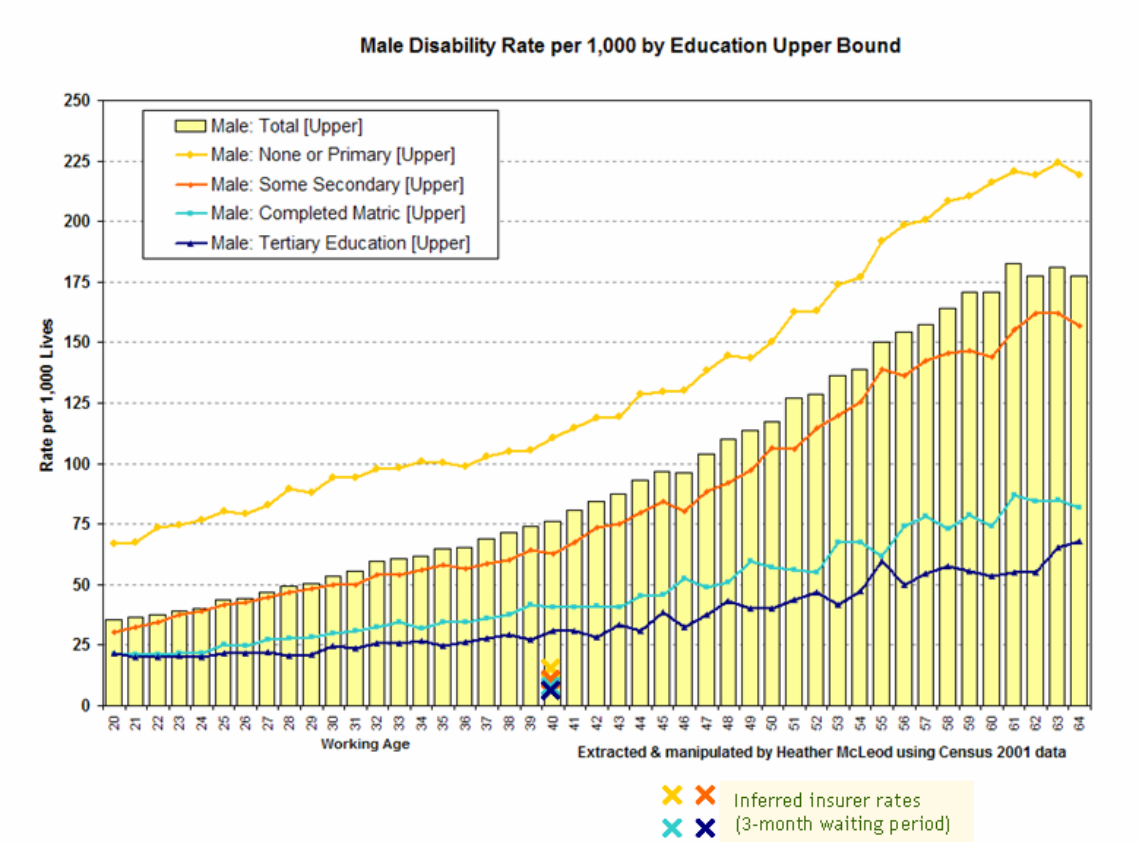
- The upper bound is based on the selection of option 4 in the following:

  "What is the mean reason why (the person) did not have work in the seven days before [the census date]? ...

  ... (4) Unable to work due to illness or disability"

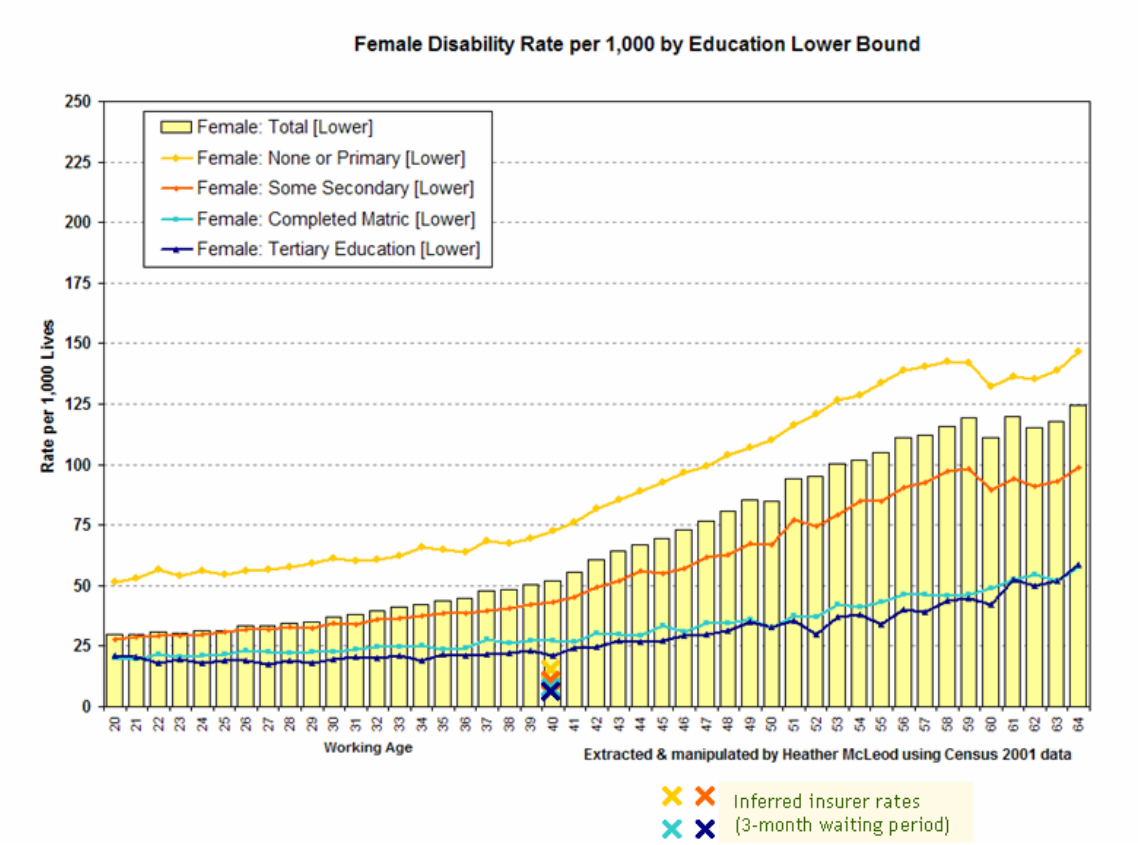
Discussion with practitioners in the Department of Social Development suggests that, while changes are being developed that are likely to produce rates more in line with the lower bound, the practice at present probably results in incidence levels somewhat closer to the upper bound.

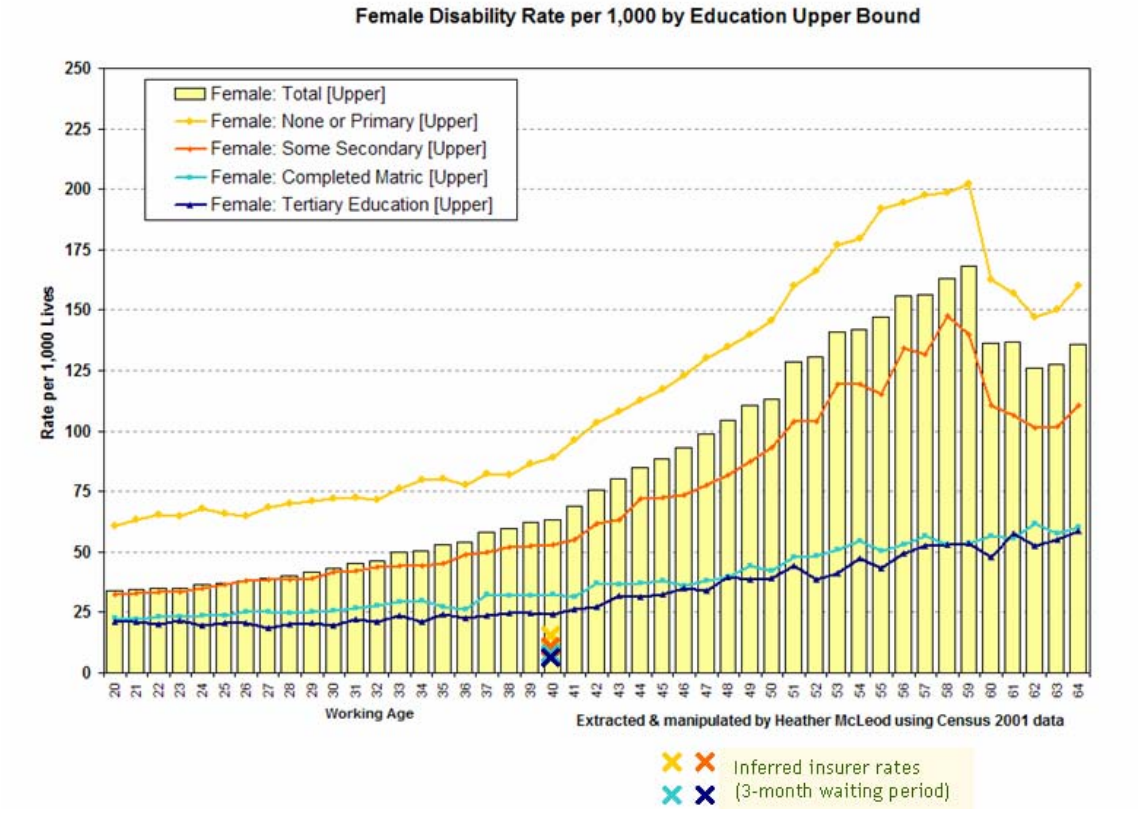
The modelling used in the analysis set out in the main part of the paper uses the upper bound in the interests of prudence. The chart below, compared with the previous chart, shows how much higher the disability rates on an upper bound assumption are than the alternative rates on the lower bound.



The corresponding experience for female grant recipients follows on the next page.

These rates appear to be distorted by eligibility for the social old age grant. The dip in the rates from age 60 should not be regarded as indicating a fall in the incidence of disability, but a fall in the rate of claims of disability grants, as beneficiaries may not receive two grants simultaneously.


Female Disability Rate per 1,000 by Education Lower Bound
Female: Total [Lower]
Female: None or Primary [Lower]
Female: Some Secondary [Lower]
Female: Completed Matric [Lower]
Female: Tertiary Education [Lower]
Rate per 1,000 Lives
Working Age
Extracted & manipulated by Heather McLeod using Census 2001 data
Inferred insurer rates
(3-month waiting period)


Female Disability Rate per 1,000 by Education Upper Bound
Female: Total [Upper]
Female: None or Primary [Upper]
Female: Some Secondary [Upper]
Female: Completed Matric [Upper]
Female: Tertiary Education [Upper]
Rate per 1,000 Lives
Working Age
Extracted & manipulated by Heather McLeod using Census 2001 data
Inferred insurer rates
(3-month waiting period)

APPENDIX 3 DISABILITY DEFINITIONS

Disability as criterion for a social assistant grant is more widespread than the disability grant itself. The definitions used to determine eligibility for these grants are set out below[78] with the disability definitions in bold text. The amounts paid under each grant are as at 1 April 2007.

Disability Grant

The applicant:

- must be a South African citizen / permanent resident;
- must be resident in South Africa at the time of application;
- must be between 18 to 59 years of age if a female and 18 to 64 years of age if a male;
- **must submit a medical / assessment report confirming disability;**
- and spouse must meet the requirements of the means test;
- must not be maintained or cared for in a State Institution;
- must not be in receipt of another social grant in respect of yourself;
- must submit 13 digit bar coded identity document.

War Veteran's Grant

The applicant:[79]

- must be a South African citizen / permanent resident;
- must be resident in South Africa at the time of application;
- must be 60 years and over **or must be disabled**;
- must have fought in the Second World War or the Korean War;
- and spouse must meet the requirements of the means test;
- must not be maintained or cared for in a State Institution; and
- must not be in receipt of another social grant.

Care Dependency Grant

The applicant:

- must be South African citizens except for foster parents who have foster children who also qualify for a care dependency grant;

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[78] Source: SASSA web site, www.sassa.gov.za/content.asp?id=1000000512, accessed 19 February 2008, accents added.

[79] This grant is not collected separately in the GHS2005 data.

- the applicant and child must be resident in South Africa / permanent resident;
- age of child must be from 1 to 18 years;
- **must submit a medical / assessment report confirming disability;**
- applicant, spouse and child must meet the requirements of the means test (except for foster parents);
- the care-dependant child/children must not be permanently cared for in a State Institution;
- 13 digit bar coded ID document (applicant);
- 13 digit birth certificate (child).

Grant-in-aid

The applicant:

- **must require full-time attendance by another person owing to his/her physical or mental disabilities;**
- must not be cared for in an institution that receives subsidy by the State for the care/housing of such beneficiary;
- must be a social grant recipient not a child grant recipient;

A grant- in- aid is an additional grant awarded to persons who are in receipt of Old age, Disability or War Veteran's grants, and **who are unable to care for themselves**.

Social Relief of Distress

Social relief of distress is a temporary provision of assistance intended for persons in such dire material need that they are unable to meet their or their families' most basic needs. In order to qualify for Social Relief of Distress, the applicant must comply with one or more of the following conditions:

- the applicant is awaiting permanent aid;
- **the applicant has been found medically unfit to undertake remunerative work for a period of less than 6 months;**
- the breadwinner is deceased and insufficient means are available;
- the applicant has been affected by a disaster, and the specific area has not yet been declared a disaster area; and the applicant has appealed against the suspension of his or her grant;
- the person is not a member of a household that is already receiving social assistance;
- the person is not receiving assistance from any other organization.

Period of Social Relief of Distress (New Policy)

Social Relief of Distress is issued monthly or for any other period for a maximum period of 3 months. Extension of the period by a further 3 months may be granted in exceptional cases.

Transport expenditure may be paid in exceptional cases where:

- The applicant is referred for treatment by a medical officer and no other transport arrangements can be made; and
- The applicant must travel to a specific destination to accept employment where he or she will not be dependent on further State Aid.

Amounts of Grants as at 1 April 2007

• Old Age grant	R 870.00
• Disability grant	R 870.00
• War veterans' grant	R 890.00
• Grant-in-aid	R 200.00
• Child support grant	R 200.00
• Foster child grant	R 620.00
• Care-dependency grant	R 870.00
• Institution (25%)	R 217.50

Asset and Income Thresholds as at 1 April 2007

Asset threshold

• Single person	R 313 200
• Married persons	R 626 400

Income threshold: social grants

• Single person	R 21 612
• Married person	R 40 092

Income threshold: child grants

• Child support grant:(Urban)	R 9 600
• (Rural/informal dwelling)	R 13 200
• Foster child grant	R 14 880
• Care-dependency grant (parent)	R 48 000
• Care-dependency grant (foster child)	R 20 880

APPENDIX 4 MODELLED PARAMETERS

The model has been developed to allow for a variety of possible system designs. For completeness, the table below illustrates the range of parameters included in the model. The figures shown in red are examples, not the actual parameters used in any particular calculation.

Table A1. Input parameters with example values

ProjectionTerm	75		Duration of projection
StartYear	2005		Fixed starting year
StartMonth	7		Fixed starting month
RetirementAgeF	65		Fixed retirement age for women, for earnings-related pension benefits and all medical benefits
RetirementAgeM	65		Fixed retirement age for men, for earnings-related pension benefits and all medical benefits
RetirementAgeFBSP	60		Fixed retirement age for women, for basic state pension
RetirementAgeMBSP	60		Fixed retirement age for men, for basic state pension
Inflation	5.00%		Annual difference between real and nominal prices
SalaryLower	0	real	Lower limit to qualifying salary
SalaryUpper	unlimited	real	Upper limit to qualifying salary
PensionGrowth	0.00%	real	Assumed fixed annual increment to pensions in payment (above the rate of inflation)
PensionGrowthMed	0.00%	real	Assumed fixed annual increment to post-retirement medical benefits in payment (above inflation)
ContributionPercentGeneral	12.00%		Contribution rate for retirement benefits (per cent of qualifying salary)
ContributionPercentNDC	0.00%		Contribution rate for purposes of NDC build up (per cent of qualifying salary)
ContributionFlat	0	real	Flat contribution per participating member for retirement benefits
ContributionPercentMedical	0.00%		Contribution rate for medical benefits (per cent of qualitying salary)
ContributionFlatMedical	0	real	Flat contribution per participating member for medical benefits
BenefitFlat	9,600		Flat annual payment per beneficiary - pension
BenefitFlatInstant	TRUE		If true, then the specified flat benefit applies immediately to all participants currently above BSP age
BenefitFlatPerYear	0	real	Annual benefit per year of participation - pension
BenefitFlatIncreases	1.00%	real	Year to year increases in the starting value of all flat retirement benefits
BenefitFlatMed	0	real	Flat annual payment per beneficiary - medical cover
BenefitFlatPerYearMed	0	real	Annual benefit per year of participation - medical cover
BenefitFlatIncreasesMed	0.00%	real	Year to year increases in the starting value of all flat medical benefits
BenefitSalaryMultipleFlat	0.00%		Annual benefit per unit of career average salary
BenefitSalaryMultiplePerYear	0.75%		Annual benefit per unit of career average salary for each year of participation
DeathBenLSSalaryMultiple	1		Lump sum death benefit: multiple of salary (all earnings, not just qualifying), only before retirement
DeathBenLSFlat	5,000		Lump sum death benefit flat amount, after age 20, before age of commencement of BSP
DeathBenLSFlatChild	2,500		Lump sum death benefit flat amount, before age 20
DeathBenChildMaxAge	21		Age at which child is deemed eligible for adult-level lump sum death benefits
DeathBenLSFlatAged	0		Lump sum death benefit flat amount, after age of commencement of BSP
DeathBenLSFlatIncreases	0.00%	real	Annual real increases to flat amount lump sum death benefit, applying to all recipients
DeathBenIncomeInService	50%		Death-in-service income benefit as percent of salary prior to death
DeathBenIncInServMaxAgeF	60		Death-in-service income benefit as percent of salary prior to death, maximum age for female recipier
DeathBenIncInServMaxAgeM	60		Death-in-service income benefit as percent of salary prior to death, maximum age for male recipients
DeathBenAccFundOffset	TRUE		Deduct notional accumulated fund in calculation of death benefit (TRUE) or not (FALSE)
DeathBenIncomeInRetirement	50%		Death-in-retirement income benefit as percent of pension prior to death
DeathBenIncomeIncreases	1.00%	real	Annual real increases in payment of income benefit
DeathBenIncomeChild	10%		Death-in-service income benefit as percent of salary prior to death, to child dependent
DeathBenIncomeChildAgeMax	21		Maximum age for receipt of child income benefits - currently set from 'Tables Insurable Family v2.xls'
AnnuityRate	1.50%	real	Net-of-charges investment return implied by annuity rate, using best-estimate mortality assumptions
FinalSalaryYears	10		Period used for purposes of defining final salary
LimitedFinalSalary	TRUE		Market to indicate whether the final salary period is limited (TRUE) or applies over a lifetime (FALSE)
BirthsFemalePropn	49.69%		Based on 2005 ASSA populations and race-based male proportion assumption