# AJAP

AUSTRALIAN JOURNAL OF ACTUARIAL PRACTICE | VOLUME 3

Actuaries Institute

**The Australian Journal of Actuarial Practice (AJAP)**
The AJAP is the journal of the Actuaries Institute and is aimed at leading debate in areas where actuaries practise in Australia so as to enhance the work of practitioners and improve the service provided to their employers, their clients and the community. The AJAP will publish papers, notes and commentary. All content of the AJAP is subject to a peer review process.

The AJAP will publish volumes at least twice annually.



The Australian Journal of Actuarial Practice is published by
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**Design**
Kirk Palmer Design

ISSN 2203-5354

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- **Papers** of generally between 2,000 and 5,000 words that deal with some aspect of professional practice relevant to members of the Actuaries Institute and where the author(s) bring insights into how this aspect could be improved or better interpreted. Papers may focus on new applications of actuarial skills or on improving actuarial practice in more traditional areas, on the interpretation and implementation of substantial regulatory issues relevant to members and on the application of newly developed theory, methods or techniques from other disciplines to actuarial work.
- **Notes** of generally between 250 and 1,000 words that comment on matters of interest to members of the Actuaries Institute with the intention of bringing to members a new idea or understanding of a topic.
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The AJAP relies upon the goodwill and effort of many people to review papers and notes prior to publication. The Editor is grateful for the help of the reviewers of papers and notes for this Volume.

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## NOTES

## FROM THE EDITOR

One dominant issue for society and for actuaries today is dealing with the ageing population: How the population is ageing, the costs of that ageing population and product design for it. So it is no surprise that the papers published in this volume predominantly discuss post-retirement solutions, lack of annuitisation and increasing life expectancy, amongst other issues.

Still being relatively new to the editorship of *AJAP* I have been afforded the opportunity to look at how the journal currently operates, the review process, the papers published and the audience we engage with. In considering the current operation of the journal and as I grow into the role of editor, several thoughts come to mind. The main job of editor as I see it should be to increase the profile of the journal. This is no easy task but there are several actions that we can take to begin that process. Publishing high quality actuarial research that is of practical relevance in Australia is, and will continue to be, our main goal. But many issues of relevance to us are also issues internationally and we can enhance our profile by also encouraging more international papers to be submitted. The consequence will be an increase in the overall quality of the papers published in the journal, a wider range of authors discussing a wider range of actuarial topics and an increased audience beyond Australia.

Work is already underway to place the journal online, via the social science research network. This should make access to publications easier and should attract a wider range of readers. Hopefully this will also encourage more academics to consider submitting their work to the journal. In preparation for that increased number of submissions we need to have a more proactive approach to the reviewing process. This will not only help when processing papers but will also give confidence to authors of an efficient turnaround. A positive feedback loop, this will hopefully increase the number of submissions further. This is where the current readership may be able to help. We are looking to build a database of potential reviewers for the journal so that we can proactively review and return papers in a more timely fashion. If you feel that you can help in reviewing papers in a particular area then the journal committee would be keen to hear from you.

**Dr Colin O'Hare** PhD, FIA, FIAA, FHEA
EDITOR

## GUEST EDITOR DR DAVID PITT

This volume contains six papers and three notes. Four of the papers relate specifically to the areas of an ageing population and the analysis of mortality. The remaining two papers analyse long service leave systems and the impact of the AIG bailout on its insurance subsidiaries.

Since Ronald Lee and Lawrence Carter's seminal 1992 paper *Modeling and Forecasting the Time Series of U.S. Mortality*, which was published in the Journal of the American Statistical Association, we have seen an explosion in the number of published papers in this field. In this volume of our journal, we present two further papers on the topic of mortality. Cumpston et al describe a method for mortality forecasting that, instead of considering mortality rates across perhaps age, gender and time, and performing statistical extrapolation, looks to the individual causes of death and trends in the underlying rates of cause-specific deaths over recent years. These cause-specific mortality trends are observed and, when coupled with expert judgement, form the basis for the proposed method of mortality forecasting. On a related topic, Adamic, in a methodological paper, considers the effect of a medical breakthrough that removes a particular cause of death, with an associated probability distribution describing the likelihood of this cure being discovered, on mortality rates. While such cause-deleted life expectancy improvements have been calculated previously under the assumption of a cause of death being removed entirely, Adamic develops a model that allows for the more realistic scenario where the cure is not modelled as occurring with certainty but rather with an underlying probability of being developed.

The presence of an ageing population and its implications for society have long been on the political agenda of many nations. The ageing of populations has been used as justification for considerable research into mortality statistics. Another important area of research also related to an ageing population is annuitisation or, in the case of Australia, the lack of a strong market in this area. Bruhn provides a thought-provoking analysis of the so-called annuity puzzle which is present in Australia. Why is it that annuities, with a number of apparent benefits for retirees, are not popular? Bruhn's research brings together work from US and Australian professions as well as other academic work in this area, along with his own analysis to shed light on this conundrum. In another paper, Bruhn et al report on a study into the pricing of annuities using a range of currently published mortality forecasting methods with a particular focus on the recently developed methodology published by the UK Continuous Mortality Investigation (CMI) Bureau. The CMI mortality projection methodology is dynamic, allowing projections to be updated in line with emerging experience.

Two papers from Ferris complete this volume of our journal. In the first, Ferris et al consider long service leave schemes, a topic likely to be of interest to many readers regardless of their area of actuarial practice! With a national review of long service leave schemes imminent, this paper provides a timely historical review of long service leave schemes. Who benefits from long service leave schemes and in what ways: the employee, employer or community? What does the future hold for these schemes? These questions are all addressed in this original article. Finally, Ferris investigates the impact of so-called affiliate risk in a case study of the AIG bailout and its impact on the company's insurance subsidiaries. As a company with around 130 subsidiaries spanning the most significant areas of financial services provision and with a bailout that ended up costing around $180 billion, this provides an ideal case study of the effects of government bailouts on related companies.

I think I can speak for the editorial team when I say that we are very happy to publish this high quality volume of the *Australian Journal of Actuarial Practice*. We hope that the papers will be widely read and enjoyed and that they will lead to further debate and discussion amongst members on the topics presented.

**Dr David Pitt** BEc, BSc, FIAA, PhD
ASSOCIATE EDITOR

David Pitt is an Associate Professor in Actuarial Studies at Macquarie University. His research interests include income protection insurance, statistical model selection and actuarial education. He is currently a member of the Education Development Group of the Actuaries Institute. In this role he provides advice on the reforms to the actuarial education syllabus for Parts I and II currently being considered in Australia.

# Long service leave: past, present and future

SHAUNA FERRIS, DR NICK PARR, DR RAY MARKEY AND DR TIM KYNG

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AJAP 2015; 3: 5–22


## ABSTRACT

As a result of changes to the Australian industrial relations framework, long service leave benefits are under review. State and Commonwealth governments are working towards the development of a new national standard for long service leave (LSL). It is, therefore, timely to re-examine the purpose of LSL. How do people use their LSL benefits? What are the main benefits of LSL for employers, employees, and the community as a whole? This paper provides a historical overview of developments, as well as a summary of current trends, and discusses some proposals for improved vesting and portability of benefits.



## KEYWORDS

Long Service Leave, employee entitlements, National Employment Standards

## INTRODUCTION

Should Australian workers have a guaranteed entitlement to long service leave (LSL)? Is LSL an obsolete benefit that is no longer necessary? Or should LSL be retained, improved and extended to meet the changing needs of Australian society?

This issue has become more controversial over the last decade, as a result of changes in the industrial relations framework.

In the past, most Australian workers were eligible for LSL principally through Commonwealth, State and Territory legislation that set minimum LSL standards for all workers in each jurisdiction. State and federal awards, developed through the system of industrial conciliation and arbitration, also often provided LSL benefits that exceeded the statutory minimum standards for specific occupations or industries.

However, over the last 20 years there has been a trend towards increasing the role of enterprise bargaining in industrial relations, while reducing the role of awards. Minimum standards of employment which were previously included in awards are now specified in statutory safety nets. In 2009, the federal Labor government passed the *Fair Work Act 2009*. This Act created a new set of National Employment Standards (NES). It is intended that uniform national standards for LSL should eventually be included in the National Employment Standards,but at the time of writing these new LSL standards are still under development. The State and Commonwealth governments have commenced negotiations in relation to the new standards. However, progress has been slow.

In the meantime, transitional rules are in place, which generally carry forward any LSL entitlements from pre-existing legislation, awards and enterprise agreements.

In recent years, some trade unionists and politicians have suggested that LSL benefits should evolve to cope with modern working conditions. In particular, there have been suggestions that LSL benefits should be more portable, so that accrued benefits can be retained as workers move from one job to the next (Hannon 2008; Scott 2008a; Scott 2008b; O'Rourke 2011; Westwood 2012). In July 2014 Greens Party Senator Lee Rhiannon called for a Parliamentary inquiry into the creation of a nationwide portable LSL scheme (Rhiannon 2014).

Hence this seems to be an opportune time to review LSL. Do we really need LSL? What is the purpose of LSL? What are the costs of providing LSL, and what are the benefits? How well is the current system working? Who receives LSL benefits, and who misses out? Should LSL benefits be improved, and if so what improvements are desirable?

Section 1 of this paper summarises the historical evolution of LSL, including the impact of recent changes to Australian industrial relations legislation.

Section 2 describes how people use their LSL entitlements.

Section 3 discusses some proposals for improving LSL entitlements and administration.

## 1 HISTORICAL DEVELOPMENT OF LONG SERVICE LEAVE

The purpose of LSL has evolved over time to meet the needs of both employers and employees. To illustrate these changes, this section describes the development of the LSL entitlements for one particular group of employees: Commonwealth public servants.

Public servants were the first employees to receive long service leave entitlements. Over time, LSL benefits were gradually improved: more and more public servants became eligible for benefits under a wider and wider range of circumstances. Certain states tended to take the lead in improving benefits. Benefit improvements then tended to "flow through": that is, benefit improvements in one jurisdiction would be used to justify improvements in other jurisdictions.

State and Commonwealth governments are major employers, so the concept of long service leave became familiar to the workforce.[1] Eventually, private sector workers began to ask for similar benefits: that is, public sector benefits eventually had flow-on effects to the private sector.

### 1.1 Historical development of LSL for public servants

Long service leave originated in colonial Australia in the 1860s. At that time, many civil servants were "imported" from the United Kingdom. Long-serving civil servants were often given extended periods of paid leave in order to return to the United Kingdom to visit family and friends. Colonial governments passed legislation to codify these entitlements.[2]

Soon after Federation, these benefits were incorporated into the legislation governing the terms and conditions for Commonwealth Public Servants. Initially, under the Commonwealth Public Service Act 1901, long service leave was only available to Commonwealth public servants who had completed

1 State and Commonwealth governments currently employ roughly 14% of the workforce, i.e. about 1.7 million Australians. (Australian Bureau of Statistics (2013a) and (2013b)).

2 Selby (1983) provides a useful overview of the development of long service leave up to 1983.

20 years of service.[3] However, over the next century, LSL was extended to cover a variety of different situations, as described below.

### 1.1.1 LSL as a retirement benefit (1911)

The first amendments to Commonwealth LSL benefits were passed in 1911. The Public Service Commissioner noted that many long-serving public servants deferred taking LSL until retirement. Senior employees would take leave for six months and then retire, without ever returning to work. Clearly, in practice, for many employees, LSL benefits simply provided an additional form of retirement savings.

To simplify personnel administration, the rules were changed to allow a lump sum payment at retirement in lieu of LSL (only for those who had completed at least 20 years of service).

### 1.1.2 LSL as a death and/or disability benefit (1911/1922)

The 1911 amendments also allowed for cash payments of unused LSL benefits to the dependants of any public servant who died in service after completing 20 years of service. This made the system more equitable: it ensured, for example, that the widow of an employee who died the day before retirement would be eligible for the same benefits as the widow of an employee who died the day after retirement.

In 1922, the Act was amended to provide pro-rata benefits for those who left service after completing at least four years of service, if service was terminated due to death, ill-health retirement, or retirement after attaining age 60.[4]

### 1.1.3 LSL as a retrenchment and/or redundancy benefit (1953)

In the early 1950s, the Commonwealth government decided to privatise certain government services; this led to the retrenchment of about 10,000 public servants. Initially, those who had not completed 20 years of service were not eligible for any LSL payments. However, there was considerable public sympathy for those who had been retrenched. Politicians on both sides of Parliament acknowledged that most of the retrenched workers were efficient, hard-working, faithful employees who had been retrenched through no fault of their own, as a result of changes to government policy.

In 1953, the Commonwealth legislation was changed to provide pro-rata benefits to any full-time Commonwealth public servants who were retrenched after completing eight years' service but before completing 20 years' service. The changes were backdated to cover many of those who had previously been retrenched (Costa 1953; Willisee 1953).

### 1.1.4 LSL as a resignation benefit (1966)

In 1966, the rules were amended to allow payment of a lump sum LSL benefit for any employee who left service for any reason other than misconduct, as long as the employee had completed the qualifying period (which at that time was 15 years' service).

This was a practical approach to simplifying LSL administration. Suppose an employee had completed the qualifying period and hence was entitled to take leave. If this person wanted to resign, he could simply go on leave and then resign at the end of the period of leave, without ever returning to work. This caused a delay in hiring a replacement. It was simpler to change the rules to enable payment of a lump sum in lieu to any employee who resigned after completion of the qualifying period.

### 1.1.5 Reduction in qualifying and vesting periods (1953 and 1973)

In 1953, the qualifying period for LSL was reduced to 15 years (providing four and a half months of leave after 15 years' service).

In 1973, the qualifying period was reduced again, to 10 years (providing three months leave after 10 years).

In 1976, the legislation was changed to allow pro-rata benefits after just one year of service, for exits due to death, disability, retrenchment or age-based retirement (but not for voluntary resignation before the completion of 10 years' service).

### 1.1.6 Extension of benefits to part-time employees (1976)

In 1976, the Commonwealth Parliament passed legislation to provide LSL benefits for part-time employees (previously LSL benefits were only available to full time employees).

In summary, over time, the government had extended LSL benefits to more and more public servants; and LSL benefits had become available under a wider range of circumstances (including retirement, death, disability, retrenchment, and resignation).

## 1.2 LSL for private sector employees

Prior to 1951, there was no legislation that required employers to provide LSL to private sector workers. If private sector workers wanted LSL, then they had to

3 Section 71 of the *Commonwealth Public Service Act 1902*. Long service leave was called "furlough".

4 Commonwealth Public Service Act 1911. If there were no dependants, then no benefit was payable. The rules were amended in the 1970s to provide for payment to a deceased member's estate if he or she had no dependants.

obtain these benefits by negotiation with employers, or via the conciliation and arbitration process. If they reached an agreement with their employers, LSL benefits could be included in awards by consent. If they did not reach agreement, then the matter would be referred to the relevant industrial tribunal for conciliation and arbitration. Most, and from the 1970s all, States had their own industrial tribunal, which could settle disputes by making awards that were binding on the employers; a Commonwealth tribunal dealt with matters pertaining to employees of the Commonwealth and in the territories and interstate disputes.

Before 1951, the State-based industrial tribunals were reluctant to include LSL benefits in awards. A relatively small number of private sector workers were successful in obtaining LSL benefits.

This situation changed in 1951, when the New South Wales government passed the *Industrial Arbitration (Amendment) Act 1951*. Under this Act, the New South Wales Arbitration Commission was required to approve any request to include LSL entitlements in an award.

When this legislation was introduced, the Australian economy was experiencing a post-war boom. There was strong demand for labour and there was concern about high labour turnover rates. Perhaps this made employers more willing to provide benefits that might help to attract and retain staff (many corporate superannuation schemes were also established in the same era). When introducing the legislation, the Minister for Labour and Industry said that the purpose of LSL was:

- to reduce labour turnover,
- to provide a reward for long and faithful service, and
- to enable employees halfway through their working lives to recover their energies and return to work renewed, refreshed, and invigorated (cited by Selby 1983: 4).

The New South Wales legislation provided for three months leave after 20 years of service, with additional benefits accruing at the same rate thereafter. Pro-rata benefits would be payable to workers who left service after 10 years for any reason other than serious misconduct (e.g. benefits were payable on resignation, as well as death, disability, retrenchment or age retirement).

The New South Wales decision had flow-on effects to the other states:

> Once the New South Wales legislature had acted, the then entrenched proposition that employees performing the same work should receive the same emoluments and respites from work operated to compel the legislatures in the other States to do likewise (Queensland Industrial Relations Commission 2000:1).

During the 1950s, other states also passed laws to provide minimum benefits of three months leave after 20 years of service (i.e. an accrual rate of 1.25% years of leave per year of service).

Since that time, there has been a trend towards gradual improvements in the minimum LSL benefits payable under State and Territory legislation.

- Benefit accrual rates have increased to 1.67% p.a. in most states (i.e. two months leave per 10 years of service) – with more generous accrual rates in South Australia and the Northern Territory (2.5% p.a. or three months leave per 10 years of service).
- Qualifying periods have reduced, so that workers can take leave after just 10 years of service in most states (or seven years in the ACT).
- Pro-rata benefits are generally payable for employees who leave service after completion of the vesting period, for exits caused by death, illness, incapacity, termination by the employer (for any reason other than misconduct), retirement after attainment of a specified age, or resignation due to domestic or pressing necessity; Victoria and Western Australia also provide pro-rata benefits for those who leave service for any reason, including resignation, after completion of the vesting period.
- The vesting period for payment of pro-rata benefits has reduced to just seven years in most states (five years in New South Wales and the ACT).

LSL benefits have continued to improve in recent years: for example, Queensland improved LSL benefits in 2000; Victoria improved LSL benefits in 2005; and Tasmania improved LSL benefits in 2011. In each case, the State legislatures collected submissions from a range of employers and employees before reaching a decision, and in each case, the politicians decided that the benefits of improved LSL outweighed the costs. Table 1 shows the statutory LSL standards in each State and Territory.

**Table 1: State and Territory legislation: LSL standards for private sector employees**

| State or Territory | Australian Capital Territory | New South Wales | Queensland | Northern Territory | South Australia | Tasmania | Victoria | Western Australia |
|---|---|---|---|---|---|---|---|---|
| **Leave entitlement** | **1.4 months after 7 years' service** | **2 months after 10 years' service** | **2 months after 10 years' service** | **3 months after 10 years' service** | **3 months after 10 years' service** | **2 months after 10 years' service** | **2 months after 10 years' service** | **2 months after 10 years' service** |
| **Vesting periods for pro rata benefits by cause of exit** | | | | | | | | |
| Death | 5 years | 5 years | 7 years | 7 years | 7 years | 7 years | 7 years | 7 years |
| Resignation due to illness, incapacity, domestic or pressing necessity | 5 years | 5 years | 7 years | 7 years | 7 years | 7 years | 7 years | 7 years |
| Resignation for other reasons | 7 years | 10 years | 10 years | 10 years | 7 years | 10 years | 7 years | 7 years |
| Age retirement | 5 years | 10 years | 10 years | 7 years | 7 years | 7 years | 7 years | 7 years |
| Termination by the employer for reasons other than serious or wilful misconductb | 5 years | 5 years | 7 years | 7 years | 7 years | 7 years | 7 years | 7 years |
| Dismissal for serious misconduct | 7 years | 10 years | 10 years | 10 years | 10 years | 10 years | 7 years | 10 years |

Notes:
a The ACT and Northern Territory allow for pro-rata benefits on retirement due to age, but have different definitions for age-based retirements.
b Note that there are some minor differences in legislation in different states. For example, NT refuses pro-rata payment in the event of "serious misconduct"; some other states refuse payment in the event of "serious and wilful misconduct"; In Queensland pro-rata payments are not payable if the employer terminated employment due to the employee's conduct, capacity or performance. SA also forbids pro-rata payments to employees who have unlawfully terminated their own employment.

## 1.3 DEVELOPMENTS IN THE INDUSTRIAL RELATIONS SYSTEM

State and territory legislation specified only *default* benefits. Unions could (and often did) negotiate with employers to obtain better LSL benefits. These might be specified in an award or enterprise agreement, or might be offered as above-award benefits. Information about the prevalence of LSL in awards and enterprise agreements is presented in Burgess et al (2002) and Casey et al (2012).

Traditionally, LSL entitlements for private sector workers were determined through the interaction of:

- State and Territory legislation which set default LSL standards, and
- State and federal industrial awards negotiated through a system of conciliation and arbitration.

There were different rules in each State and Territory. From time to time, someone would suggest that it would be much simpler to develop uniform national standards for LSL entitlements. Unfortunately, despite a number of conferences and governmental inquiries and discussion papers, there was never much progress towards meeting this objective.[5]

However, over the last few years the Australian industrial relation system has been going through turbulent times, with quite fundamental changes in the legal and administrative processes for determining workers' entitlements. There has been a trend to increasing the role of enterprise bargaining while reducing the role of awards. Minimum standards of employment that were previously included in awards are now specified in statutory safety nets.

Following the introduction of the WorkChoices legislation in 2005, the awards system was simplified – there are now just 122 "modern awards". Modern awards are restricted in scope: for example, they must not specify LSL benefits. The Howard government recognised that the new system might disadvantage the most vulnerable workers, so it created a set of "safety net" standards, called the Australian Fair Pay and Conditions Standards (AFPCS). The AFPCS specified minimum pay rates, hours of work, parental leave and annual leave, but did

5 More than 40 years ago, in 1974, the Whitlam government held discussions with the states about the development of uniform national LSL standards. In 2004 the Australian Industrial Relations Commission published a discussion paper that reviewed options for a national minimum standard for LSL (AIRC, 2004). Refer to Williams (2008) for a review of various other proposals for uniform national standards.

not specify any minimum LSL entitlements.

These proposals created some concern. Many workers had award-based LSL entitlements that exceeded the state-based statutory minimums. There were fears that they would lose their entitlements. State governments in Queensland and Victoria announced intentions to introduce State legislation to protect workers' LSL benefits (David 2005; Skulley & Ludlow 2005; Ludlow 2006).

After the 2007 federal election, the incoming Labor government replaced the AFPCS with a new set of "safety net" minimum standards, known as the National Employment Standards (NES). The NES will eventually include minimum standards for LSL, but at the time of writing these new LSL standards are still under development. In the meantime, transitional rules are in place, which generally carry forward any LSL entitlements from previously existing awards and enterprise agreements.[6]

Before the 2013 election, the Labour government was negotiating with the States in order to determine the minimum LSL standards which were to be incorporated into the NES. It appears that progress has been inordinately slow (i.e. stalled). The Fair Work Commission, set up to review the workings of the Fair Work Act 2009, recommended that: "the Commonwealth, state and territory governments should expedite the development of a national long service leave standard with a view to introducing it by 1 January 2015" (Fair Work Commission 2012: 22).

The Coalition Government, which returned to power in 2013, has indicated that it supports the introduction of uniform national LSL standards (Liberal Party of Australia 2013).

There has been some uncertainty about the interaction between the State-based LSL legislation and the *Fair Work Act 2009*. According to the 2013 CCH guide:

> Some commentators suggested that the intention of the Fair Work Act was … that federal enterprise agreements entered post 1 January 2010 cannot provide for long service leave entitlements less than those applicable under relevant state legislation. However there does not appear to be a specific prohibition in the Fair Work Act on new federal enterprise agreements modifying or excluding the effect of state long service leave legislation, and it is arguable that it remains the position that federal enterprise agreements can exclude state long service leave laws (Poon 2013: 831-832).

The legal issues involving federal and State powers in relation to LSL are discussed in Casey et al (2012).

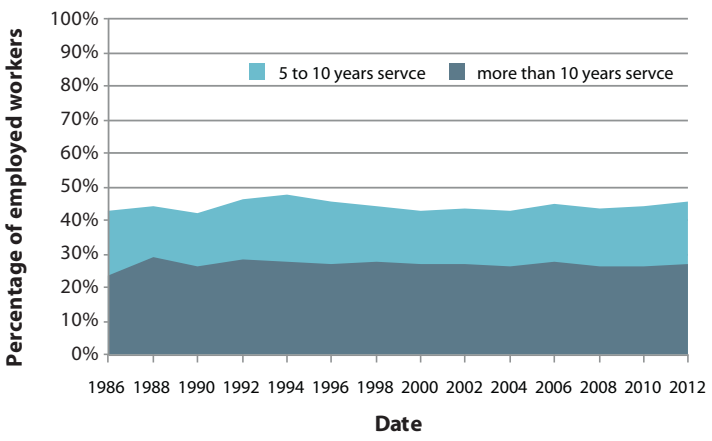


**Figure 1: Duration of service of male employees in current job at the date of survey, 1986–2012.**
Source ABS (2012)

## 2 WHAT IS LSL USED FOR?

Before determining the new national standards, it seems sensible to look at outcomes under the current LSL rules. Who receives LSL benefits? Who misses out? How do people use their LSL?

There is surprisingly little data available on the costs of LSL or the patterns of LSL usage. Indeed we only have very rough estimates of the nation's total LSL liability.[7] In the past, this dearth of data has sometimes created difficulties: proposed changes in LSL entitlements have seldom been accompanied by any reliable cost estimates.

### 2.1 Eligibility for LSL

How many people benefit from LSL entitlements under the current system?

Under State-based legislation, most public and private sector workers are entitled to LSL benefits after 10 years of service with one employer, so an analysis of labour force mobility data will give a rough indication of the number of people eligible to take LSL at any time.

The Australian Bureau of Statistics (ABS) periodically collects data about the length of time people have been working with their current employer. As shown in Figure 1, in 2012 about 27% of male

6 The transitional rules are quite complicated. Refer to the Fair Work Australia at www.fairwork.gov.au/about-us/policies-and-guides/fact-sheets/minimum-workplace-entitlements/long-service-leave#state-and-territory-laws for details.

7 Langton et al (2003) estimated the liability as $16.7 billion based on ABS data from 2000.

workers had been employed in the same job for at least 10 years. This percentage has remained fairly stable over the period from 1988 to 2012.

For women, the ABS data shows that about 23% of female workers who were employed in 2012 had been employed in the same job for at least 10 years. As shown in Figure 2, this proportion has been gradually increasing over time, from about 15%–16% to about 22%–23% in 2012. This might reflect improvements in maternity leave or increasing female workforce participation rates at older ages, or both.

The ABS data is consistent with data from the survey on Household Incomes and Labour Dynamics in Australia (HILDA), as shown in Table 2. According to the 2009 HILDA data, 27% of male employees and 22% of female employees had been with their current employer for at least 10 years (Markey et al 2013).

Based on such data, some discussion papers have suggested that only about one-quarter of the Australian workforce will remain with an employer long enough to qualify for LSL (Labour Ministers Council 1999; Bentley 2013). However, this statement is somewhat misleading. Although about 75% of workers are not *currently* entitled to take leave, many of these workers have simply not been in the workforce long enough to qualify for LSL. Most of them will remain in the workforce for many years, continuing to accrue LSL entitlements, and many will eventually qualify for LSL. For workers who have been in the workforce for at least 10 years, about 35% of them have already been with their current employer for at least 10 years (as shown in column (b) in Table 2).

Older workers have lower resignation rates than younger workers. Not surprisingly the percentage of long-serving employees increases rapidly with age. For those aged 55 to 64, more than half have been employed by their current employer for at least 10 years; for those aged 65 or more, about two-thirds have been employed by their current employer for at least 10 years. This suggests that for those who remain in the workforce over the longer term (until age 65), at least two-thirds are likely to become eligible to take LSL.

The proportion benefiting from LSL entitlements is likely to be significantly higher, because:

- Some employees will receive LSL benefits under enterprise agreements or awards which provide LSL on a more generous basis (e.g. providing leave for periods of service less than 10 years).
- Some employees are members of portable leave schemes which allow LSL to be retained even when the worker switches to a new employer; for example, public servants usually retain their accrued LSL entitlements when transferring between different jobs within the public service.
- The statistics given in Table 2 show only the proportion who have qualified for LSL by remaining in their *current* job for more than 10 years; some older employees might have already received LSL benefits from a previous job.
- Employees who leave service prior to the completion of the qualifying period service may not be eligible to take any leave, but will often be eligible for pro-rata cash payments for accrued benefits. Figures 1 and 2 show the proportion of workers with between five and 10 years' service:

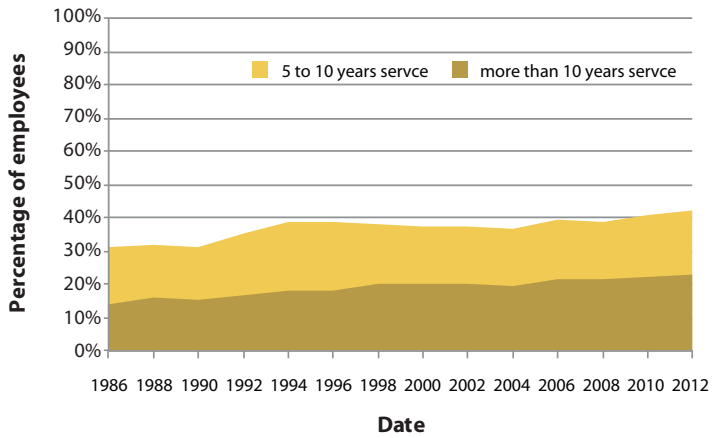


**Figure 2: Duration of service of female employees in current job at the date of survey, 1986–2012.**
Source ABS (2012)

**Table 2: Workers with more than 10 years' service with one employer**

| | A | B |
|---|---|---|
| | Workers with more than 10 years' service with one employer as a percentage of all currently employed workers | Workers with more than 10 years' service with one employer as a percentage of all workers with more than 10 years in the workforce |
| All | 25% | 35% |
| Males | 27% | 37% |
| Females | 22% | 32% |
| **Age** | | |
| 15 to 24 | 0% | n.a. |
| 25 to 34 | 8% | 17% |
| 35 to 44 | 25% | 27% |
| 45 to 54 | 39% | 40% |
| 55 to 64 | 52% | 53% |
| 65 and above | 66% | 67% |

many of them will be entitled to pro-rata benefits (this will vary depending on the award, the State legislation, and the reason for leaving service, as shown in Table 1).

Any long-term trends in the labour mobility data may be obscured by short-term economic factors: for example, the proportion of workers with less than one year of service fell at the 1992 survey and again at the 2010 survey. This probably reflects the fact that not many employers were taking on new staff during the 1990-91 recession or during the 2008-09 global financial crisis. Also, the lack of job opportunities would make it difficult for people to switch to a new job, even if they were dissatisfied with their current job. These factors would cause a temporary increase in the average duration of work.

Eligibility for LSL will also be affected by retirement decisions. There is a trend towards deferral of retirement. The proportions of male workers who were age 50 years or more increased from 23.9% in 2001 to 29.3% in 2011, and for females this proportion increased from 20.3% to 27.4% over the same period. Logically, the longer people remain in the workforce, the greater the probability of qualifying for LSL benefits.

**Table 3: Percentage of long-serving wage and salary earners who took LSL between May 1988 and April 1989**

| Duration of Employment | Males | Females |
|---|---|---|
| 10 to 20 years employment | 9.4% | 9.4% |
| 20 years and over | 10.8% | 11.1% |

Source: Australian Bureau of Statistics (1990).

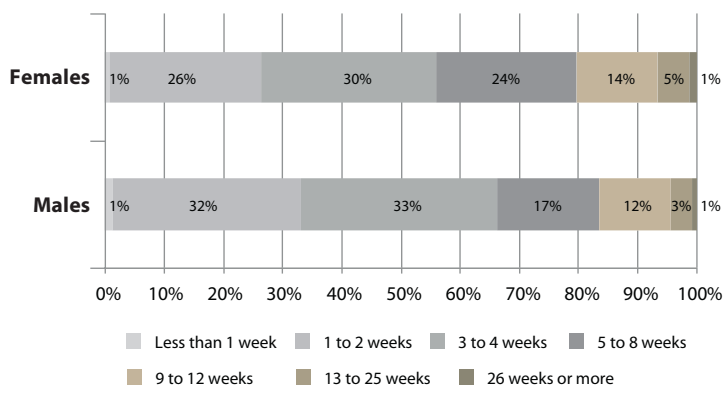


**Figure 3: Length of LSL taken, in weeks, as a percentage of those who took LSL during the year.**
Source: Australian Bureau of Statistics 1990

Conversely, those who leave the workforce at younger ages, or have extended periods out of the workforce, are less likely to qualify for LSL. This is more likely to affect women, if they are out of the workforce while caring for children or other family members.[8]

## 2.2 What is LSL used for?

According to the historical record, LSL was originally designed "to enable employees halfway through their working lives to recover their energies and return to work renewed, refreshed, and invigorated" (cited by Selby 1983: 4).

But in practice, it is clear that LSL entitlements are used flexibly, for a wide range of different purposes. LSL can be used for retirement savings; redundancy pay; death and disability pay; to extend parental leave or carers' leave; or as a lump sum resignation payment. In some jurisdictions, LSL payments can be cashed out, which means that LSL is simply a savings account that can be drawn upon in an emergency. As explained in section 2.3.1 below, employers might also use LSL as a means of managing fluctuations in demand for labour.

Unfortunately there is very little publicly available data to show how people use LSL. The ABS has not published data on LSL usage since 1990. This data, shown in Table 3, indicates that the rates of taking LSL were quite low: that is, many people deferred taking leave. These figures should be treated with caution because the denominator might include people who were ineligible for LSL benefits (in some states, at that time, workers were not eligible to take LSL before completing 15 years of service; in some states there was no requirement to provide LSL for casual workers). The numerator includes leave taken while in service and does not include any LSL payments on termination of employment.

The ABS data also suggests that people did not take all of their leave at once. Figure 3 shows the amount of LSL taken during the year, for people who did take leave. Many people took just one or two weeks of leave, even if they were entitled to take much longer periods of LSL. People often combined LSL with annual leave, adding on an extra week or two to their annual holidays.

More recent data, from portable industry-based LSL schemes, also suggests that very few employees take their LSL while in service. For example, in the coal miners portable LSL scheme, the actuarial valuation assumes that workers will take less than 1% of their accrued LSL entitlements while in service each year (Mercer Consulting Australia 2011). In the valuation of the WA Construction Industry Long Service Leave

8 In order to qualify for leave, service must be "continuous". Certain types of leave, e.g. parental leave, do not break continuity of service. The definition of "continuous" service varies between states.

Fund, the actuaries assume that workers will take only 7% of their accrued LSL while in service in any year (PricewaterhouseCoopers 2012). However the LSL patterns in portable LSL schemes are unlikely to be typical of LSL patterns in the wider community, since these schemes were set up for industries with atypical labour mobility patterns.

If employees do not take their LSL while in service, they will receive lump sum LSL payments on termination of employment. These payments are taxable, so the Australian Taxation Office records the amounts paid on termination each year. In 2011, approximately $1.6 billion was paid as eligible lump sum payments (which includes both unused LSL and unused annual leave) (Australian Taxation Office 2012). Figure 4 shows the estimated average number of months of unused leave at termination (unused annual leave plus unused LSL), categorised by age in the year of termination, for all people who received a lump sum termination payment.[9] This data indicates that many people "save up" their annual leave and LSL.

Survey-based studies confirm that many Australian workers accumulate their annual leave entitlements. Pocock, Skinner, and Pisaniello (2010) reported that about 40% of workers used all of their annual leave, but 60% of workers stockpiled some leave. This is consistent with results from an annual leave study by Tourism Australia, which found that:

> Annual leave accrual is endemic across all sizes of business and industries ... Annual leave stockpiling has become entrenched workplace behaviour potentially affecting every business regardless of size or type … 1 in 4 of Australian full-time employees are leave stockpilers (Tourism Australia 2005:1).

Males, older workers and longer-serving employees were particularly prone to stockpile their annual leave.

## 2.3 Influences on LSL patterns

We have seen that many people decide to save up their annual leave and LSL instead of taking leave. What influences this decision?

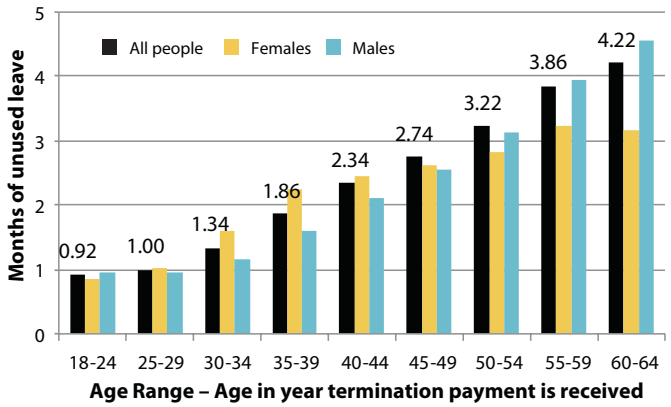


**Figure 4: Estimated months of unused annual leave plus unused LSL at termination.**

### 2.3.1 Employer attitudes to leave-taking

State and federal awards usually allow for considerable flexibility in LSL leave-taking. After the completion of the qualifying period, the employee has a right to take leave within a reasonable time frame. However, if the employer and the employee agree, the leave may be postponed to a mutually convenient date. If there is no agreement, the employer can insist that the employee take his or her LSL within a specified time frame.[10]

Some employers are apparently willing to let leave accrue and may even discourage leave-taking. The study of annual leave conducted by Tourism Australia found that 56% of "leave stockpilers" did not believe that their employers were supportive of leave-taking ("leave stockpilers" were people with more than 25 days of unused annual leave).

> There is a consistent and widespread perception that leave is harder to take than it used to be ... Increasing work pressures and organisational structures were seen to have resulted in more significant barriers to employees taking time off work. Organisations were no longer seen to factor leave-taking into employee workloads, but expected people to work 52 weeks per year (Tourism Australia 2005: 4).

9 This was calculated as 12 times average lump sum termination payment divided by average salary for taxpayers in the same category. The average lump sum payment was calculated as the total amount of lump sum termination payments divided by total number of lump sum termination payments within the same category. There is an implicit assumption that the average salary for those taking termination payments is similar to the average salary for all employees in that age group.

10 The time frame varies from one state to the next, e.g. in New South Wales employers must give one months' notice, in Queensland they must give three months' notice.

This is consistent with a 2002 survey of full-time employees in Australia, which found that 58% did not take all of their annual leave during the year; amongst this group, 29% said that did not take leave because they were "too busy at work" (Denniss 2003: ix).[11] A more recent study, the AWALI 2010 survey, reported that 31% of people said that they were too busy at work to take all their leave (Pocock, Skinner & Pisaniaello 2010:63-64).

Other employers might encourage, and even compel, their employees to take LSL. For example, in 2013 the West Australian government became concerned about increasing liability for accrued LSL liabilities for public servants (including schoolteachers). The government announced a cap on the build-up of LSL and then sent letters to employees with more than 65 days of accrued leave, telling them that they must either use their LSL or cash it in. The government spokesman explained that directing employees to take LSL was common practice in the private sector (Dalzell 2013; Hiatt 2013; Parker 2014; Emerson 2012). Compulsory leave-taking has also been introduced at some Australian Universities, in an attempt to limit the build-up of liabilities (MacDonald 2013; Lebihan 2012; Whitbourn & Lebihan 2012).

Some employers use LSL to manage fluctuating demand for labour. LSL might be discouraged during busy times; but employees might be encouraged to take their LSL when the business is suffering from a temporary downturn. Hence, flexible management of LSL might help to avoid the necessity for retrenchments. According to research by the Australian School of Business, during the Global Financial Crisis, companies sent workers on holidays in order to keep head counts up when workloads slumped (Australian School of Business 2010).[12] A few other recent examples, mentioned in newspaper reports, include:

- in the aftermath of the 2011 floods, Queensland employers sent workers off on LSL while businesses were closed as a result of flood damage (Drummond 2011)
- Qantas employees used their LSL to forestall redundancies when the airline cut capacity (Coorey & O'Sullivan 2009).

### 2.3.2 Tax incentives

Prior to 1978, tax incentives encouraged people to defer taking their LSL. If they took their LSL benefit as a lump sum at termination, just 5% of the lump sum was taxed at the taxpayer's marginal tax rate. This was similar to the treatment of lump sum superannuation payments at that time.

In 1978 the rules were changed: LSL lump sum termination benefits which accrued after August 1978 would be fully taxed, but at a concessional rate. At that time one financial adviser noted that:

> [LSL is] one of the few remaining tax breaks to individual taxpayers. Accumulated holiday pay, and long service leave accrued after August 15, 1978 is effectively only taxed at a maximum rate of 30 per cent. There are obvious tax incentives in negotiating generous holiday and long service leave entitlements (Richards 1987: 25).

In 1993, the rules were changed again: LSL lump sum termination benefits that accrued after 1993 would be fully taxed at the taxpayer's marginal rate (plus Medicare levy). These tax changes made it less attractive to defer LSL until retirement. People are now more likely to take leave while in service and then retire. However the decision is now more complex, and people might need financial advice before deciding. The CCH Master Tax Guide points out that:

> If a person takes time off to use up their annual leave and/or long service leave before terminating their employment, payments for this leave are paid as normal salary and are fully taxable at marginal rates. This may be a higher tax rate than if a lump sum is received as payment for unused leave. However because taking leave will lengthen the employment period, consideration should be given to the impact this has upon superannuation entitlements and other employment benefits (CCH 2011: 820)

Based on data from the ATO, it seems that there has been a downward trend in the amount of LSL termination payments since the tax rules were changed in 1993.

### 2.3.3 Precautionary savings

Workers might defer taking LSL in order to prepare for emergencies, such as illness, family emergencies or the loss of a job. Some workers certainly build up their annual leave for such purposes. The Tourism Australia study found that some people save up their annual leave for this purpose:

11 See also Denniss & Cameron (2013); as an example, Emerson (2011) describes the accumulation of leave in the WA public sector as the result of work pressures.

12 For specific examples where employers used LSL to cope with downturns, see Perpitch (2013); Roberts (2012); Sprague (2012); McGregor (2012).

> They are concerned about economic downturn and accrue their leave as an emergency back-up in the case of illness, job loss or the need for extra money. They know what leave they have accrued and always keep a minimum of 4 weeks. They tend to work in high pressure roles or volatile industries and are more likely to be older or parents (Tourism Australia 2005: 3).

According to research conducted by the Reserve Bank of Australia, precautionary savings increases during times of economic uncertainty (Lowe 2011). When people are concerned about the security of their jobs, they are likely to value the small buffer provided by LSL benefits.

### 2.3.4 Cashing out rules

Some states allow employees to "cash out" their LSL benefits. This means that they can take a lump sum cash payment, equal to the value of their accrued LSL benefits, without actually taking leave. In effect, the accrued LSL benefits provide an emergency savings buffer that can be drawn upon when needed.

Cashing out is forbidden under New South Wales and Victorian legislation. However it is permitted in Queensland, South Australia, Tasmania, and Western Australia (subject to agreement between the employer and the employee). In Queensland an employee may also apply for release of LSL benefits on the grounds of financial hardship.

### 2.3.5 Career breaks

LSL was originally supposed "to enable employees halfway through their working lives to recover their energies and return to work renewed, refreshed, and invigorated" (cited by Selby 1983: 4). Some people do indeed use their LSL to take a holiday – as noted previously, the available data (which is admittedly rather scanty and out-of-date) indicates that, about on average, people who are eligible to take LSL take about 10% of their accrued LSL in any year.

In some cases people will defer taking LSL in order to save up for a longer break from work.

The ABS has collected data about career breaks – defined as periods of leave of six months or more while remaining with the same employer. Only about 1% of the surveyed employees had ever taken a career break for "personal reasons" (e.g. for travel, holidays, education). Those who took career breaks for personal reasons usually used a mixture of accrued annual leave, LSL and unpaid leave (ABS 2002). This fits in with annual leave research: many people said that they were saving up their annual leave in order to take a "bigger, better holiday" (Tourism Australia 2005; see also Pocock, Skinner & Pisaniello 2010).

The ABS data shows that people also commonly took career breaks for family reasons (e.g. on the birth of a child, to care for children, or to care for other family members). That is, some people used LSL to stay at home for a few extra weeks or months after they had used up their entitlement to paid maternity leave or carer's leave.

Similarly, people also took long breaks from work as a result of injury or illness. It is possible that some people used LSL to stay at home to recover from injury or illness, after they had used up their sick leave entitlements.

## 3 PROPOSALS FOR THE FUTURE

The Australian industrial relations system now places greater reliance on enterprise bargaining, which allows both employers and employees to have greater flexibility in the terms and conditions of employment.

However, there are limits to flexibility. Industrial relations legislation also acknowledges the importance of meeting certain broader social objectives: hence the terms and conditions of employment must include certain minimum standards in order to meet these social objectives. For example:

- Employers must provide parental leave. Parental leave no doubt imposes some costs on employers; however, the government has decided that the social benefits outweigh the costs. The social benefits of providing parental leave include better health outcomes for parents and children, and promotion of greater female workforce participation (which is considered to be important in a country with an ageing population).
- Employers must pay compulsory contributions into superannuation funds. The social benefits include improved retirement incomes; reduced reliance on social security benefits; and a higher rate of national savings (partially offset by reductions in non-superannuation savings).

In determining the new LSL standards under the NES, the government should weigh up the economic, productivity and social costs and benefits of LSL benefits, and should compare the relative impact of different types of benefit design.[13]

We would suggest that the following factors are important in assessing the benefits of LSL to the Australian community.

13 For example, when the government was reviewing parental leave arrangements, it commissioned a Productivity Commission report to assess the costs and benefits or different approaches. Productivity Commission (2009).

### 3.1 Length of working life and work intensification

The demographic data shows that Australians are spending more of their lifetimes in employment. People are deferring retirement, and as a result the average age of workers has been increasing. For males, the length of time spent in employment has increased from 35 years to 37 years and (under reasonable assumptions) is likely to increase to 39 years in the future (see Figure 5) (Markey et al 2013). The increase is even more marked for females (see Figure 6).

The Australian government has already adopted policies that are designed to encourage people to defer retirement. For example the government has announced plans to increase the eligibility age for the Age Pension from 65 to 70.[14] The preservation age (for access to superannuation benefits) is due to increase from 55 to 60; further increases to the preservation age have already been mooted.[15] These measures are designed to help the government deal with the budgetary pressures that will be caused by the ageing of the population.

Is it reasonable to expect that workers will work for 40 years without taking any extended breaks from work?

Australian workers are also facing an increase in workplace intensity. Workers are expected to do more work within a shorter time, meet tighter deadlines and continually seek to meet ever-increasing standards. There are many theories about the causes of work intensification, including (among other things) changes in technology, increasing competition, the drive for higher profits, downsizing and understaffing, changes in workplace organisation and changes in human resources management techniques (Skinner, Hutchinson & Pocock 2012; Green 2002).[16]

High levels of workplace intensity may cause increased stress, leading to more mental health disability claims. Actuaries working in the Australian life insurance industry will already be aware of the increase in mental health disability claims being made through superannuation fund group disability insurance policies. The National Occupational Health and Safety Commission has also noted the high cost of stress-related workers compensation claims. According to WorkSafe Australia:

> Work-related mental stress has become a major concern in workplaces in Australia because of the impact on individual employees and the costs associated with the long periods away from work that are typical of these claims.
>
> Work-related mental stress claims are the most expensive form of workers' compensation claim because of the often lengthy periods of absence from work typical of these claims. Besides the burden work-related mental stress places on the health and welfare of employees, the impact on productivity of workplaces and the Australian economy is substantial (Safework Australia 2013: ix).

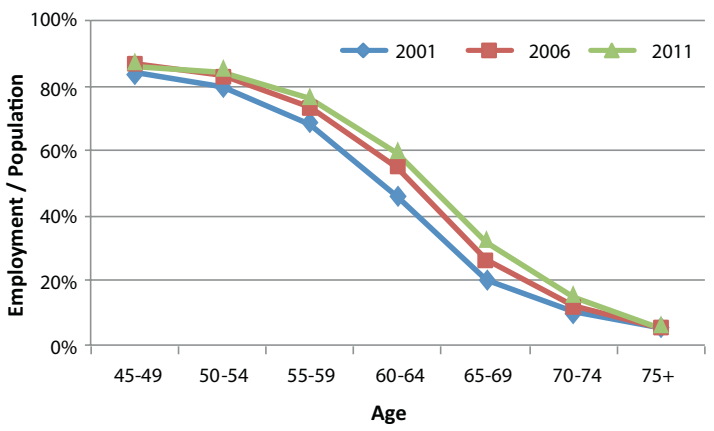


**Figure 5: Employment to population ratios by age for Australian males aged 45 and above, 2001, 2006, 2011.**
Source: Markey et at 2013

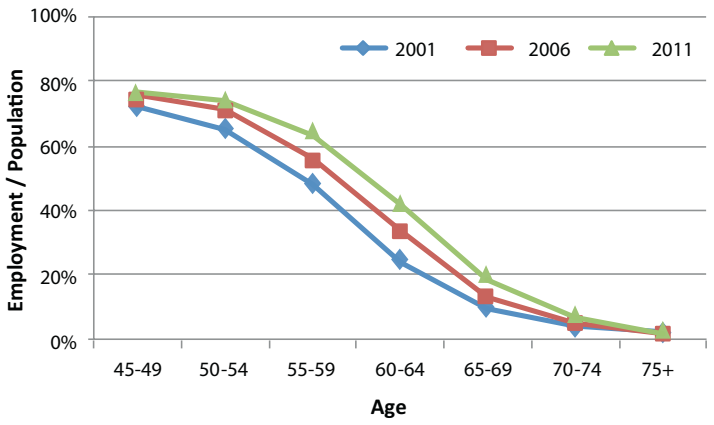


**Figure 6: Employment to population ratios by age for Australian females aged 45 and above, 2001, 2006, 2011.**
Source: Markey et al 2013

14 Under current rules, the pension age will increase from, 65 to 67 by 1 July 2023. In May 2014, the Treasurer announced the intention to increase the pension age to age 70, which is to be phased in by 1 July 2035, but this proposed change has not yet been incorporated into legislation (Hockey, 2014).

15 Under current legislation, the preservation age is 55 for people born before 1 July 1960, increasing to 60 for people born after 1 July 1964.

16 Several Australian studies on work intensification have been published by the Australian Centre for Work+Life at the University of South Australia, which conducts regular surveys and periodically produces the Australian Work+Life Index (AWALI).

A 2008 study by the health fund Medibank Private found that the cost of work-related stress to the Australia economy was about $14.8 billion (Medibank Private 2008). As the duration of employment increases, and work becomes more intense, workers are more likely to value the opportunity to take LSL, and LSL may produce economic benefits as well as health benefits for the Australian community.

## 3.2 Family-friendly flexibility

During the 1990s, State and Commonwealth governments began to develop industrial relations policies that were intended to help Australians to improve their work-life balance. This objective was explicitly incorporated into industrial relations legislation: for example, in 1996 the *Workplace Relations Act*'s objectives included "assisting employees to balance their work and family responsibilities effectively through the development of mutually beneficial work practices with employers". *The Fair Work Act 2009* includes similar objectives.[17]

These family-friendly policies were a response to demographic and social changes, including:

- a sharp increase in female labour force participation rates,
- an increase in the number of single-parent families, and
- an ageing population, which means that many workers have increasing responsibilities in caring for older family members.

Over many years, trade unions ran industrial campaigns to help their members win entitlements to family-friendly policies, such as paid parental leave, family leave and more flexible hours. Employer organisations acknowledged that such policies also provide benefits to employers by helping them to retain experienced staff. Government policymakers argue that family-friendly policies are in the national interest, since higher workforce participation rates will lead to higher national productivity.[18]

This focus on work-life balance has already provided the impetus for some improvements in LSL. For example:

- In 2005 the Victorian government passed amendments to the minimum LSL standards for Victorian workers, reducing qualifying periods and vesting periods. The Minister for Industrial Relations explained that the purpose of the amendments was "to provide real assistance to workers with family responsibilities" (Hulls, 2005). The changes were consistent with the Victorian government's Better Work and Family Balance policy.[19]
- In 2011, the Tasmanian government also amended their LSL legislation to reduce qualifying periods. An improvement in work-life balance was cited as one of the benefits of the new rules.

Employer organisations have also suggested that LSL benefits should evolve. In submissions to the Australian Industrial Relations Commission in the Family Provisions Test Case (2005), employer organisations suggested that awards should be varied to "permit employees, by agreement, to take long service leave in a variety of different periods to assist them in balancing their work and family responsibilities" (Australian Industrial Relations Commission 2005:10).[20] They suggested that LSL should be more flexible: for example, workers should be allowed to take longer periods of leave at reduced pay, and workers should be allowed to take shorter periods of leave to deal with family emergencies No doubt these issues will be addressed during negotiations about the new national safety-net LSL standards.

## 3.3 Improved precautionary savings

For workers who have met the vesting requirements, LSL provides a lump sum payment in the event of death, illness, incapacity or retrenchment. No doubt these benefits are very important for improving the financial security of many Australian families, because their own precautionary savings are inadequate. According to the ME Bank Household Financial Comfort Report 2012, 43% of families are uncomfortable about the level of their cash savings (see Figure 7) (ME Bank 2012).

The survey asked people to assess their own ability to cope with a financial emergency such as retrenchment: 52% of respondents reported that they would have difficulty in finding another job within two months. Many reported that their savings would not be adequate to maintain their lifestyle for more than a

17 Other examples: the *Queensland Industrial Relations Act 1999* objectives include "helping balance work and family life"; the *South Australian Industrial and Employer Relations Act 1994* seeks "to encourage and assist employees to balance work and family responsibilities". The *Fair Work Act 2009* is designed to "assist employees to balance their work and family responsibilities by providing for flexible working arrangements".

18 For an extensive discussion of these demographic and social changes, and the development of various family- friendly workplace policies, refer to Australian Industrial Relations Commission (2005) and Australian Department of Family and Community Services (2002).

19 See also the discussion paper which set out the rationale for the changes, produced by Industrial Relations Victoria (2005).

20 Employer submissions to the AIRC in favour of greater flexibility in LSL came from the Australian Chamber of Commerce and Industry and the National Farmers Federation.

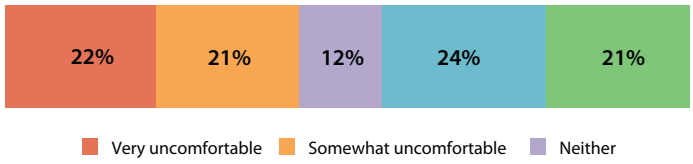


**Figure 7: Level of comfort with cash savings among Australian families.**
Source: ME Bank (2012:12).

**Table 4: Ability to maintain lifestyle if lose main source of income**

| Category | Would be able to maintain lifestyle for less than a fortnight | Would be able to maintain lifestyle for six months or more |
|---|---|---|
| Single parents | 43% | 11% |
| Couples with young children | 20% | 24% |
| Couples with older children | 16% | 31% |
| Young singles and couples under age 35 with no children | 23% | 17% |
| Middle aged singles and couples with no children | 23% | 21% |
| Empty nesters (50 years old or more) | 14% | 29% |
| Retirees | 9% | 36% |

Source: ME Bank (2012: 17).

fortnight. As shown in Table 4, this was a particularly severe problem for single parents.

Of course, many workers have substantial superannuation savings, but these savings are normally preserved for retirement and hence difficult to access prior to retirement. People facing financial hardship can apply directly to the trustee of their superannuation fund for release of funds owing to financial hardship, but there are fairly tight restrictions on the release of superannuation savings. Superannuation fund members can apply to withdraw money from their superannuation accounts when they are facing difficulties in meeting medical expenses, paying funeral costs, or when their homes are threatened with foreclosure. The Department of Human Services received more than 18,000 such requests in 2012–13. This indicates quite a strong demand for access to a flexible source of funds to cover financial difficulties arising from illness or unemployment, or both.

At present, many workers rely on social security benefits to cover living costs during periods of unemployment or disability. However the adequacy of this approach has been questioned: many would argue that unemployment benefits are too low at $255 per week, and the government has already announced proposals to impose tighter restrictions for access to unemployment benefits (e.g. a six-month waiting period for those under age 30; a lower benefit for those under age 25) (McLintock 2014).

According to Burgess et al (2002: 33), LSL has, for many years, provided an important supplementary source of income during the transition between jobs:

> Where LSL may require some modification is as an entitlement that provides some security to employees in the event of job termination. Often LSL is the largest accrued entitlement available to employees who have a record of continuity of service. Since Australia has few protections regarding notice of termination and employment assistance in lieu of termination, the LSL entitlement is an important form of employee insurance that provides assistance in job search and transition into a new job in the case of corporate restructuring and closure. Not only does this provide financial assistance to workers when they are most in need, it also provides financial support for localities hard hit by job loss on occasion of closure or major restructuring. It also reduces the potential cost of the State in providing financial support for those made redundant ... This provision remains extremely relevant despite the restructuring of the workforce and the discussion about the flexibility of entitlements.

## 3.4 Improved retirement savings

Many researchers have suggested that Australians should be saving more for retirement. The Age Pension, plus Superannuation Guarantee contributions, might provide a modest level of retirement income for a hypothetical average Australian (depending on the assumptions used in projections), but additional voluntary contributions are needed in order to provide a more comfortable standard of living in retirement and to allow for longevity risk. Many workers – especially women – are not making voluntary contributions. According to some researchers, this is creating a "retirement savings gap".[21]

Can LSL help to fill this gap?

LSL provides a defined benefit that accrues at the rate of at least 1.67% of final salary per year of service

21 Research on adequacy of the retirement savings system and the level of voluntary contributions may be found in the Henry Review (Australia's Future Tax System) (2009) and Rice Warner (2014a). For data on voluntary contributions for females, see Rice Warner (2014b)

(i.e. two months leave per 10 years of service). For workers who have remained with the same employer for 30 years, the LSL leave benefit amounts to six months' salary. For the purposes of comparison, employees would need to make additional voluntary superannuation contributions of about 1.25% per annum to provide an equivalent benefit.[22]

For a public servant, with an accrual rate of 2.5% of final salary per year (i.e. three months per 10 years' service), the LSL benefit at retirement would be nine months' salary. For the purposes of comparison, employees would need to make additional voluntary superannuation contributions of about 1.87% to provide an equivalent benefit.[23]

The ATO statistics cited previously show that many Australians already rely on LSL to top-up retirement savings. Some of these workers take their LSL just before retirement; others take their benefit as a lump sum at termination.[24]

LSL lump sums might be used for a holiday, but it is likely that they are also used to pay off the mortgage or buy a car or pay off credit card debt. The money might simply be invested to augment investment income during retirement. The ABS has collected data on lump sum superannuation payments. Table 5 shows the percentage calculated as number of retirees who used their lump sum for the specified purpose, divided by the number who received a lump sum at retirement (Rothman & Wang 2013 citing data from ABS surveys). It would be reasonable to assume that LSL benefits paid at retirement are often used for similar purposes.

Rothman and Wang (2013: 10-11) have noted that:

> "A reasonable interpretation of the data is that persons retiring mostly do not spend the money frivolously but on items which will raise their standard of living in retirement".

They also found that:

> "More households are entering retirement with debts, particularly mortgage debts, increasing the usefulness of lump sums for at least part of the benefit."

**Table 5: The most common uses of superannuation lump sums by retirees 2010–11**

| Use of lump sum | Percentage of those with a lump sum |
|---|---|
| Paid off home or paid for improvements or bought new home | 30.8 |
| Invested the money elsewhere, or in personal savings or bank | 21.6 |
| Rolled it over or invested it in an approved deposit fund or deferred annuity or other superannuation scheme | 19.0 |
| Paid for a holiday | 14.1 |
| Bought or paid off car or vehicle | 13.5 |
| Cleared other outstanding debts | 12.7 |

Source: Rothman and Wang (2013)

LSL benefits are not, at present, subject to any preservation requirements. Hence they might be used to fund early retirement, that is, cover the period between retirement and the preservation age or the Age Pension eligibility age. This flexibility is likely to become more valuable to retirees if the government decides to increase the preservation age for access to superannuation benefits.

## CONCLUSION

The purpose of LSL has evolved over time. Although some workers use it to take a short respite from work, LSL may also be used as a retrenchment benefit; as a death benefit; as a disability benefit; as a resignation benefit; as a source of cash in an emergency; or as a supplement to retirement savings. Workers might also use LSL to balance work and family responsibilities, for example, by extending parental leave, sick leave or carer's leave. These benefits are particularly important to those workers who have low levels of cash savings and those who face insecurity of employment.

Since LSL provides so many benefits to the community, it would be worth considering the extension of LSL benefits, for example, by improving the portability of benefits. After all, workers who

22 Calculated using 4% salary growth and 6% net investment returns; no contributions tax (assuming voluntary contributions are paid from after-tax salary); for a term of 30 years.
23 Calculated using 4% salary growth and 6% net investment returns; no contributions tax (assuming voluntary contributions are paid from after-tax salary); payable at year end, for a term of 30 years.
24 ATO statistics show that the average lump sum termination payment is about $18,000, for those aged 55-59; and about $16.700 for those aged 60 to 64. This sum includes unused annual leave as well as unused LSL. Since many people take their LSL as ordinary income shortly prior to retirement, these lump sum figures underestimate the contribution of LSL payments towards boosting retirement income.

change jobs frequently have many of the same needs as those who remain in the same job for decades. Trade unionists and politicians have already asked for a study of the costs and benefits of a national portable LSL scheme, and recommendations of the best approach for provision of such benefits. This is an area for further research.

Although LSL clearly provides benefits to the community, there is very little information available about the costs and benefits of LSL from the employers' perspective. Historically, it seems that decision-makers often made decisions about LSL benefits despite an absence of reliable data about the cost of the benefits provided. Before determining the National Employment Standards for LSL, it would be desirable to collect more data on many aspects of the current system, including patterns of LSL usage, LSL costs, compliance, funding methods, tax treatment and employer attitudes. Better data would enable better policymaking.

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**Acknowledgements**
Our thanks to the Actuaries Institute for provision of a research grant for research into long service leave. Thanks to our research assistant, Anthony Jones. Thanks also to two anonymous peer reviewers who made useful suggestions for improving this paper.

# Valuing annuities based on alternative mortality projections

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## ABSTRACT

Future mortality is a key component when pricing longevity-based products such as annuities. Estimating future mortality is, however, a significant challenge, with a range of approaches adopted by various users to date. We describe the recent developments in mortality projections that have arisen from the UK Institute and Faculty of Actuaries' Continuous Mortality Investigation (CMI), and apply this method to Australian mortality data. Projected mortality under this approach is used to calculate values for both immediate and deferred life annuities, and is compared with values arising from other mortality projections for Australia. Our results are noticeably similar to other projection approaches, in particular those of Tickle and Booth (2014) and the Productivity Commission (2013). Sensitivity analyses are also presented. It is apparent that an embedded and ongoing practice of effective risk management, rather than the mere pursuit of a more "accurate" picture of future mortality, is key to managing longevity exposure.



## KEYWORDS

annuities, CMI, mortality projections, Australian mortality, longevity risk

## 1 INTRODUCTION

Various factors make an "accurate" picture of projecting future mortality an ongoing challenge, with the Actuaries Institute (2012) stating that it is "notoriously difficult" to predict improvements in mortality over time. In this paper we add a further perspective on mortality projections in the Australian context, by adapting the approach of the Institute and Faculty of Actuaries' Continuous Mortality Investigation (CMI) to Australian data. We outline the CMI's approach, and describe how we have adapted it to the Australia context to complement the existing modelling work performed by actuaries and demographers.

As assumptions about future mortality are a key component of pricing annuities, we apply the resulting projection of future mortality to suggest values for both immediate and deferred life annuities. We also present a range of sensitivity analyses for such values. We conclude that the essential issue for products heavily dependent on future mortality changes is not so much one of projecting a more "accurate" picture of the future, but rather having an embedded and ongoing practice of effective risk management.

## 2 MORTALITY AND THE CMI

A projection of future mortality differs from a forecast of future mortality in terms of their respective intents, with demographers differentiating between the two (Booth 2004): a projection is the numeric outcome if a particular set of assumptions were to hold true, while a forecast is the outcome considered most likely to occur in the future. In practice, demographers prefer the term "projection" over the term "forecast" for various reasons, including the following: a forecast is a special case of projection; projections have functions other than just predicting future populations; and demographers tend to use illustrative calculations rather than predictive ones (Smith et al 2001). Furthermore, Pressat and Wilson (1985) highlight that, given the uncertainties involved, projections are a more realistic focus. Such uncertainty is also highlighted by the Actuaries Institute (2012). This has obvious implications for policy and practice, particularly in terms of longevity risk faced by private and public pension and retirement schemes, public health provision, and welfare policy and provision (for example, see Currie et al 2004; Delwarde et al 2007; Li 2010; AIHW 2013).

### 2.1 Modelling mortality

The modelling of mortality in recent years has involved various degrees of attention being given to three important dimensions for a given population: age, period and cohort. A reasonable approach should reflect mortality movement along at least one of these variables. These variables are used to classify the underlying approaches as zero-, one-, two- or three- factor models (Tabeau 2001). Zero-factor models have each age treated independently (Booth & Tickle 2008). One-factor models treat mortality as a function of age, taking advantage of the stability of the age pattern (Booth 2006). Two-factor models normally take age and period into account, but sometimes age and cohort may be modelled as well, although this generally requires a longer series of past data (Booth 2006). Three-factor or Age-Period-Cohort (APC) models treat mortality rates as a function of age, period and cohort (Booth & Tickle 2008).

Age effects account for mortality rates being different at different ages, whereas period effects account for mortality rates differing across different periods or calendar years. One obvious period effect is that mortality rates have generally been decreasing, worldwide, over time. Cohort effects reflect that some birth cohorts exhibit differing rates of mortality improvement[1] from other cohorts around them (Berry et al 2010) – a typical example is the "Golden Cohort" in the UK (those born from 1925 to 1934[2]) who have shown relatively high rates of mortality improvement for an extended period of time.

Numerous stochastic mortality models have emerged over the past 20 years, with the 1992 Lee-Carter Model[3] still widely used. Many of these are in the form of time series models with parameters estimated from historical mortality rates. However, differences do exist in the incorporation of age, period and cohort effects, the approach to smoothing, and assumptions regarding the main sources of underlying randomness.[4]

The original Lee-Carter model does not incorporate a cohort term, whereas cohort effects have been observed in some populations.[5] Some more recent mortality models make explicit allowances for

1 Mortality improvement (MI) is defined as: MIx,t=1-(qx,t+1/qx,t) (CMI 2002).

2 According to the BBC (http://www.bbc.co.uk/news/uk-15024436), although others consider this as a wider cohort, for example, those born between 1923 and 1940 (O'Connell 2009).

3 For example, the Lee-Carter Model (Lee & Carter 2002), the Renshaw and Haberman extension of the Lee-Carter Model (Renshaw & Haberman 2006), the P-Splines Model (CMI 2005, 2006; Currie et al 2004; Currie, 2006), the Cairns-Blake-Dowd (CBD) Model (Cairns et al 2006), three generalisations of the CBD Model (Cairns et al 2009), and the Age-Period-Cohort Model (Currie 2012).

4 For a more detailed discussion of these differences and for comparisons between various models, see, for example, Cairns et al (2006), Cairns et al (2011), Coughlan et al (2007), Delwarde et al (2007).

5 See for example, discussion in Booth et al (2002a), Butt & Haberman (2009), Debonneuil (2010), Li (2010) and Wang (2007).

cohort effects which give flexibility to allow mortality improvement to vary by year of birth (Berry et al 2010). Some models have also allowed for interactions amongst all three factors, with the most common being an age-period interaction. This allows rates of mortality improvement to be different at different ages for a given period. Furthermore, this age-period effect is backed up by the empirical observations in developed countries such as the US and UK (Berry et al 2010), in which the rates of mortality improvements at extremely old ages have tended to decrease. Therefore, keeping the age-period interaction term in the models may provide a more meaningful projection.

## 2.2 Classification of models

Booth (2006), Booth and Tickle (2008) and Tickle and Booth (2014) provide several detailed and helpful reviews of the development of mortality projection methodologies and apply a broad classification based on each methodology's underlying driver for projection, namely: expectation, explanation and extrapolation. This classification is also utilised more widely (for example, Booth 2006; Coughlan et al 2007; Booth & Tickle 2008; Li 2010).

An expectation approach obtains qualitative inputs based on expert opinion from scientific and medical experience for the underlying model or the parameters (Berry et al 2010). The qualitative incorporation of demographic, epidemiological and other knowledge suggests that this approach can be appropriate for long-term projections (Booth & Tickle 2008), and it can also accommodate the situation where credible data is more limited (Berry et al 2010). The main criticisms of this approach relate to the subjectivity and bias of opinion-based inputs, and the conservatism of expert opinion, which tend to underestimate mortality improvement when compared with an extrapolative approach, as well as actual experience (Booth & Tickle 2008).

An explanatory approach incorporates causative relationships between various risk factors and mortality rates, including medical knowledge and information on behavioral and environmental changes (Booth & Tickle 2008). It then builds a projection based on examining changes in these risk factors or explanatory variables (Berry et al 2010). However, this approach is not yet fully developed and its use for projections of overall mortality is limited to date. This is because relationships between risk factors and mortality are not understood well enough for many causes (Booth & Tickle 2008), and problems in the identification of cause of death at older ages makes the method of decomposition of mortality by cause difficult (Tabeau et al 2001).

An extrapolation approach essentially models future trends based on what has happened in the past, by fitting a model of mortality rates to historical mortality rates using various statistical methods and extrapolating the fitted model into the future (Berry et al 2010). Historical regularities suggest that this approach is reasonable in some circumstances (Booth & Tickle 2008), particularly for short-term projections (Coughlan et al 2007). However, given uncertainty surrounding the cause of recent mortality changes and the potential impact of future medical advances and other related factors, various researchers recommend caution with such models (Berry et al 2010).

## 2.3 A selection of Australian studies

Various mortality studies and projections have been made based on Australian data, mainly using the method of extrapolation (for example, Booth et al 2002; Productivity Commission 2013; Tickle & Booth 2014). As the Actuaries Institute (2012) points out, given the enormous policy and fiscal implications, some effort is also being made within government to improve the quality of mortality forecasting, including the consideration of cohort life expectancies. However, they caution that the risk remains that life expectancies may well continue to be underestimated. Some existing uses, commentaries and projections on mortality for Australia are summarised in Table 1.

**Table 1: A selection of Australian mortality studies**

| Source | Synopsis |
|---|---|
| Actuaries Institute (2012) | Uses the Australian Government Actuary (AGA) 25-year average mortality improvement rates (Australian Government Actuary 2009). |
| ABS (Australian Bureau of Statistics) (2013) | Uses an expectation approach via an assumed rate of change in life expectancy at birth. |
| Berry et al (2010) | Explores a variety of extrapolation methods, and highlights the issue of model risk. |
| Productivity Commission (2013) | Combines an extrapolation approach (based on Lee & Carter 1992) with a long-term expectation for mortality improvement. |
| Tickle and Booth (2014) | An extrapolation approach (Booth-Maindonald-Smith, see Booth et al 2002), modified from Lee-Carter. |

## 2.4 The CMI approach, adapted for Australian mortality

In contrast to the above approaches, the Continuous Mortality Investigation (CMI) of the Institute and Faculty of Actuaries has developed and continues to modify an alternative approach to projecting mortality. The CMI approach combines elements of both extrapolation and expectation approaches to

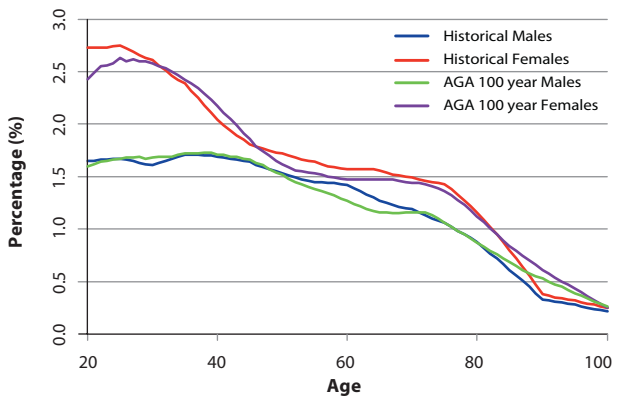


**Figure 1: Average annual rates of MI for Australian males and females, 1921 to 2009, labelled "historical" and AGA 100-year rates of MI.**

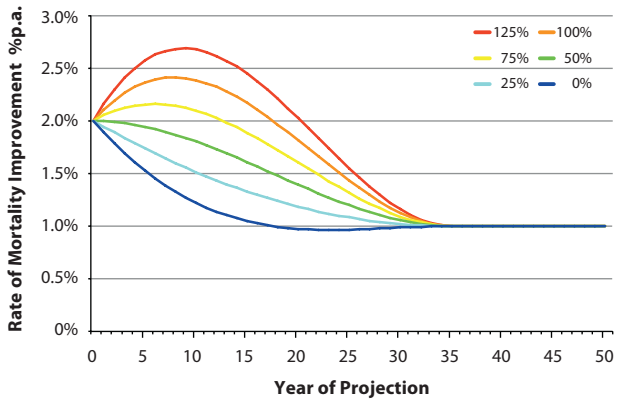


**Figure 2: Convergence of MI with various proportions of convergence remaining at mid point (for an illustrative convergence period of 35 years).**
Source: CMI (2009a: 65)

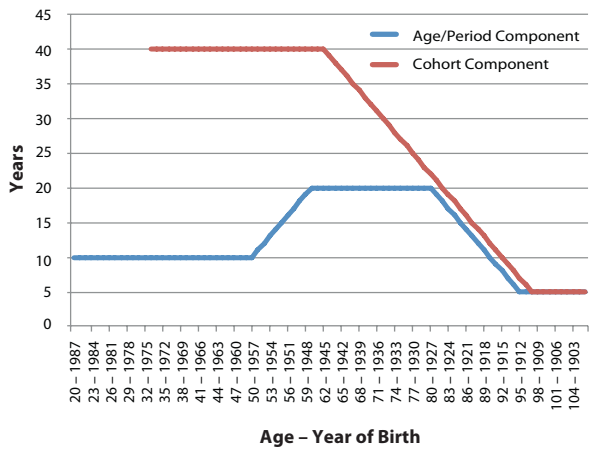


**Figure 3: Duration of convergence from initial to long-term for Age/Period and Cohort components of MI.**

firstly project annual rates of mortality improvement (MI) which, when combined with a set of starting (baseline) mortality rates, generates a set of mortality rates for each year. The CMI approach has recently been adapted and applied beyond UK studies to also include Canadian, US and Chinese mortality (SOA 2013; Huang & Browne 2014; Office of the Chief Actuary 2014; SOA 2014). Feedback from users in the UK suggests the model is highly valued (CMI 2013). The work on which this paper is based, as far as we are aware, is the first to publicly apply the CMI's approach to Australian mortality data.

In order to project future mortality improvement, four main parameters need to be ascertained (CMI 2009): base mortality rates, initial rates of mortality improvement, long-term rates of mortality improvement, and the convergence period and pattern from initial to long-term improvement rates. The selection of values for long-term rates of mortality improvement, the convergence time-period and the pattern of convergence are primarily based on expert opinion – hence the classification of the CMI approach as involving features of an "expectation" approach. Furthermore, all of these inputs, other than the base mortality rates, need to be decomposed into Age/Period and Cohort components.

A description of the technical detail associated with the discussion that follows is given in more detail in Tang (2013).[6] While overall we adhere closely to the methodology used by the CMI, there are differences in the parameters that we select. In the following discussion, we give a brief overview of each of the four key parameters in general, within the context of choices available to us arising from the Australian experience. We then give a brief overview of the projected mortality that results.

### 2.4.1 Base mortality rates

The base mortality rates provide a starting position for projection, and do not impact the projected rates of improvement. The Australian Life Tables (ALT) 2005–07 (Australian Government Actuary 2009) are adopted to determine the base mortality rates,[7] which ties into the use of 2007 as the starting point for our projection which follows.

6 This work has also been presented to Innovations in Australian Mortality Research: Analysis, Models And Methods, Canberra, November 2013, and the Actuaries Institute Financial Services Forum, Sydney, May 2014.

7 Although analysis of mortality improvements may be needed, for example, for an insured lives population, the derivation of mortality improvement rates needs very large datasets and even in the UK general population data is used for this purpose. Although insured lives mortality tables are available, these sources themselves use population mortality at older ages.

### 2.4.2 Initial rates of mortality improvement

The initial rates of mortality improvement reflect the current estimate of rates of change in mortality, and the data we use to estimate these rates is sourced from the Human Mortality Database (HMD 2013).[8] As mortality improvements can exhibit age, period and cohort effects, we decompose the initial rates of mortality improvement using an age-period-cohort model, in a slightly modified fashion to that adopted by the CMI. The resultant patterns can be seen alongside the final projection (Figure 4).

### 2.4.3 Long-term rates of mortality improvement

The long-term rates of mortality improvement (LTIR) are intended to be what the initial rates of mortality improvement will converge to, over a chosen convergence period. We adopt the average rates of mortality improvement over the 1921–2009 period, and Figure 1 shows these in comparison with the Australian Government Actuary (AGA) 100-year mortality improvement factors (from Australian Government Actuary 2009) for both males and females.

As for initial rates of mortality improvement, LTIRs can exhibit age, period and cohort effects, but in contrast to the initial rates of mortality improvement, the decomposition of long-term rates of mortality improvement into these effects is primarily subjective. We set the cohort component to zero given the assumption that the influence of current year-of-birth features on patterns will disappear over the period of convergence (CMI 2009). Thus, 100% of the LTIR is allocated to the Age/Period component in line with the CMI approach.

### 2.4.4 Convergence period and pattern

The period and pattern of convergence from initial rates to long term rates of mortality improvement involves three aspects: a choice of the convergence period; a choice of the proportion (P) of overall convergence that remains outstanding halfway through the chosen convergence period; and the fitting of cubic polynomials in time to give the overall shape of convergence. The first two aspects are based on judgement, and the third follows from the first two.

Figure 2 shows how such choices determine the trajectory of mortality improvements. For an initial mortality improvement rate of 2% per year and a long-term mortality improvement rate of 1% per year, different patterns of convergence are observed when different proportions are given at the mid point of the selected convergence period.

Our choice of P (the proportion of overall convergence remaining outstanding halfway through the chosen convergence period) is 50% for all ages, again in line with the CMI neutral position.

With respect to the duration of the convergence for the Age/Period and Cohort components of MI and the speed of that convergence, we followed the CMI arguments and resulting recommendations as they are fairly universal rather than UK-specific (see CMI 2009a: 63 for further discussion). The durations for males and females are shown in Figure 3.

### 2.4.5 Overview of projection

The determination and selection of these four key parameters gives rise to a projection of future mortality improvements, which in turn gives rise to a set of projected mortality rates. These improvements are presented in Figure 4 in the form of a heat map, which is a two-dimensional presentation of changes in mortality rates over age and time. They are analogous to a topographical map, where peaks represent higher rates of mortality improvement and troughs represent lower rates (Browne 2011).

In contrast to our projection in Figure 4 is the projection generated by the AGA 25-year mortality improvement rates, as shown in Figure 5.

The differences between the projections are stark, with a clear difference emerging between the CMI approach with its convergence over time to LTIRs, and the extrapolative approach of average historical experience (in this case without a cohort effect) as per

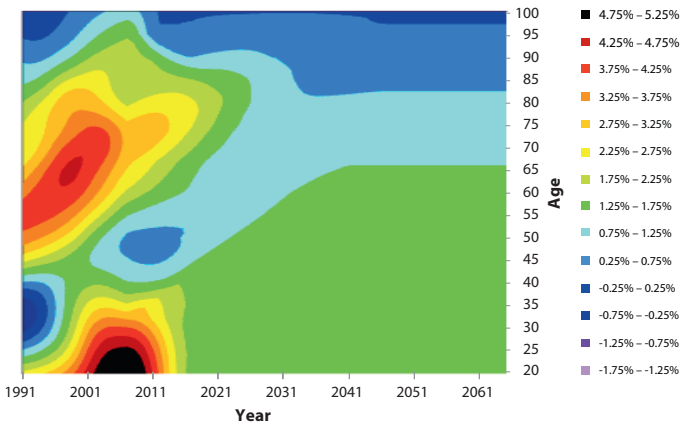


**Figure 4: Heat map of past (to 2007) and projected (from 2008) rates of mortality Improvement for Australian males.**

8 The Human Mortality Database (HMD) was launched as a collaborative project in May 2002, arising from the Berkeley Mortality Database (BMD) (HMD 2013). The HMD was to create a database including data for 30 to 40 countries/areas following the format of the BMD, with adjustments for old ages by using the methods from the Kannisto-Thatcher Database (which provides uniformly recalculated old age mortality data for 35 countries (Jdanov et al 2008). However, the main goal of the HMD now is to facilitate research into longevity by the way of documenting the data

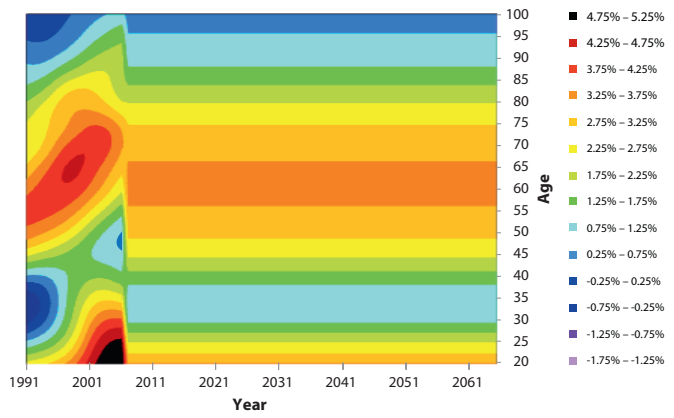


**Figure 5: Heat map of male MI, using AGA 25-year average rates, as per Actuaries Institute (2012).**
Source: Authors' calculations up to 2007, Australian Government Actuary (2009) from 2008

the Actuaries Institute's use of the AGA rates. We note two major features in Figure 5: the discontinuity in moving from the past into the projection period, and the constant pattern of MI by age over time. Although extrapolation methods can be refined extensively from this relatively simple application, there are merits with the alternative CMI approach to gradually trend from current MI to LTIR. The comparison of Figure 4 with Figure 5 certainly highlights the challenge facing those who need to project future mortality rates.

## 3 APPLYING CMI MODEL MORTALITY TO ANNUITY VALUES

To consider further the implications of different approaches to mortality projections, we now apply these differing approaches to valuations of both immediate and deferred lifetime annuities. An immediate lifetime annuity provides an income with payments at regular periods for life, and a deferred lifetime annuity similarly provides an income with payments at regular periods for life, but with that income starting at the end of a chosen deferral period, provided the policyholder is alive at that time.

Despite providing protection against longevity risk, for various reasons annuities are not currently a popular product choice for Australian retirees. The Actuaries Institute (2012) describes how greater incentives would have to be provided for annuities to gain a foothold in the Australian retirement income market. Encouragingly, the Financial Systems Inquiry of 2014 recommends the removal of barriers to product development and the promotion of products that provide longevity protection (Australian Government Treasury 2014). The Actuaries Institute (2012) further suggests changes to the taxation treatment that could allow deferred annuities in particular to play an important role in providing insurance against longevity. As a result of this and other efforts to draw attention to the utility of deferred lifetime annuities, recent government announcements have indicated a favourable change to their taxation status (RIWG 2013). If combined within or with a mechanism to retain flexibility and access to more capital in the early years of retirement than would be the case with an immediate lifetime annuity, then deferred lifetime annuities could become a particularly useful product in the retirement plans of many Australians.

Despite their current lack of popularity, we model future payments under both an immediate and deferred lifetime annuity to illustrate an application of the CMI mortality projection method to Australian data. We compare the expected present value (EPV) of annuity payments under five different mortality bases: the AGA 25-year improvement rates; the AGA 100-year improvement rates; the extrapolative method of Tickle and Booth (2014); the approach adopted by the Productivity Commission (2013); and our application of the CMI approach. For consistency, we compare across these different mortality projections by using the same base mortality and varying only the respective mortality improvement projection.[9] To further explore a range of potential scenarios, the EPV of the annuity payments under each mortality assumption is valued using annual discount rates of 3%, 4%, 5% and 6%.

**Table 2: Immediate life annuity values on different mortality bases**

| Basis of future mortality | Value of annuity for 65-year-old male, in 2010 | | | |
|---|---|---|---|---|
| | 3% | 4% | 5% | 6% |
| AGA 25-year improvement rates | 15.596 | 14.162 | 12.944 | 11.901 |
| AGA 100-year improvement rates | 14.741 | 13.461 | 12.365 | 11.419 |
| Tickle and Booth (2014) | 15.464 | 14.056 | 12.858 | 11.831 |
| Productivity Commission (2013) | 15.502 | 14.090 | 12.887 | 11.856 |
| CMI | 15.453 | 14.046 | 12.848 | 11.821 |

9 It is essential to note that this approach produces different results from the original work of Tickle and Booth and the Productivity Commission, due to a different choice of the base years from which the projection commences. Hence the illustration of values under different approaches is not a direct application of their results, but rather a purely comparative one. Productivity Commission mortality improvement factors were provided in personal correspondence with the authors in November 2013.

**Table 3: Summary of outcome differences for immediate life annuities (at 4%)**

| Mortality basis for pricing | Mortality experience | | | | |
|---|---|---|---|---|---|
| | AGA 25-year improvement rates | AGA 100-year improvement rates | Tickle & Booth (2014) | Productivity Commission (2013) | CMI AU |
| AGA 25-year improvement rates | 0.0% | –4.9% | –0.7% | –0.5% | –0.8% |
| AGA 100-year improvement rates | 5.2% | 0.0% | 4.4% | 4.7% | 4.3% |
| Tickle and Booth (2014) | 0.8% | –4.2% | 0.0% | 0.2% | –0.1% |
| Productivity Commission (2013) | 0.5% | –4.5% | –0.2% | 0.0% | –0.3% |
| CMI AU | 0.8% | –4.2% | 0.1% | 0.3% | 0.0% |

## 3.1 Lifetime immediate annuities

Results for the EPV of future payments under an immediate lifetime annuity for a 65-year-old male, paying $1 annually in arrears (but not inflation-linked), are given in Table 2.

As might be expected, annuity values are lowest when based on AGA 100-year improvement factors, given the lower rates of mortality improvements adopted under that approach. Despite the differences in the shape and pattern of future mortality improvements projected under the CMI approach and via the adoption of the AGA 25-year rates (as seen in Figures 4 and 5), their annuity values as well as those under the predominantly extrapolative approaches of Tickle and Booth and the Productivity Commission are relatively close.

Table 3 summarises this further, by giving two-way comparisons in EPVs arising from each of the five mortality assumptions. This gives a broad outline of the mortality risks involved in pricing such annuities, if one basis is assumed for pricing, and another is assumed to represent actual future experience. In Table 3, a negative percentage implies that pricing has been conservative in comparison to eventual experience, and a positive percentage indicates the extent to which pricing has been inadequate.

## 3.2 Deferred annuities

In line with the suggestion given by the Actuaries Institute (2012: 35), the choice of our deferred period for a deferred annuity is 20 years. As such, the results shown in Table 4 relate to a deferred lifetime annuity of deferment period 20 years, taken out by a male now aged 65. Results for the EPV of future payments under this deferred lifetime annuity, paying $1 annually in arrears, are given in Table 4.

Table 5 summarises the two-way comparisons in EPVs arising from each of the five mortality assumptions in Table 4, by giving the percentage difference between the respective EPVs. Again, a positive percentage implies that pricing has been conservative in comparison to eventual experience, and a negative percentage implies the extent to which pricing has been inadequate.

**Table 4: Deferred life annuity values on different mortality bases**

| Basis of future mortality | Value of deferred annuity for 65-year-old male, in 2010 | | | |
|---|---|---|---|---|
| | 3% | 4% | 5% | 6% |
| AGA 25-year improvement rates | 2.283 | 1.800 | 1.425 | 1.133 |
| AGA 100-year improvement rates | 1.797 | 1.423 | 1.130 | 0.901 |
| Tickle and Booth (2014) | 2.201 | 1.739 | 1.379 | 1.097 |
| Productivity Commission (2013) | 2.205 | 1.742 | 1.381 | 1.099 |
| CMI | 2.202 | 1.739 | 1.379 | 1.097 |

When no benefit is payable on death (or withdrawal) before the end of the deferment period, a deferred annuity is effectively a financial instrument whose EPV of future payments is more sensitive to changes in mortality assumptions than an immediate lifetime annuity. This is also discussed by the Retirement Incomes Working Group, which highlights the "highly leveraged" nature of deferred annuities. They also state that deferred annuities "carry the same tail risk as for the standard lifetime annuities but at much lower initial purchase price. Conceptually it is like being exposed to an option of a stock instead of owning the stock out right" (RIWG 2013: 35).

This leveraged nature is highlighted in Tables 4 and 5, whereby there are larger differences in EPVs between some mortality bases than was the case for immediate annuities. This is particularly so for the AGA 25- and 100-year improvement rates, when compared with

the three other mortality approaches. This shows that deviations in terms of the future shape and pattern of mortality (such as between the AGA 25-year rates and the CMI) are exacerbated more in deferred rather than lifetime annuities. Conversely, there are only minor differences in EPVs between the CMI and the predominantly extrapolative approaches of Tickle and Booth and the Productivity Commission.

### 3.3 Sensitivity to key CMI parameters

A useful benefit of the CMI approach is the ability to easily project under a range of assumptions regarding the key parameters of interest. This is an especially motivating aspect where the beliefs and purposes of the user may differ across time, and across different users themselves.

In particular, a more detailed look at annuity values

**Table 5: Summary of outcome differences for deferred life annuities (at 4%)**

| Mortality basis for pricing | Mortality experience | | | | |
|---|---|---|---|---|---|
| | AGA 25-year improvement rates | AGA 100-year improvement rates | Tickle & Booth (2014) | Productivity Commission (2013) | CMI AU |
| AGA 25-year improvement rates | 0.0% | –20.9% | –3.4% | –3.2% | –3.4% |
| AGA 100-year improvement rates | 26.5% | 0.0% | 22.2% | 22.4% | 22.2% |
| Tickle and Booth (2014) | 3.5% | –18.2% | 0.0% | 0.2% | 0.0% |
| Productivity Commission (2013) | 3.3% | –18.3% | –0.2% | 0.0% | –0.2% |
| CMI AU | 3.5% | –18.2% | 0.0% | 0.2% | 0.0% |

**Table 6: Sensitivity of annuity values to CMI parameters for immediate life annuities (at 4%)**

| Difference from annuity value based on original parameter choices | Proportion (P) of total convergence at mid-point of convergence period | | | | | |
|---|---|---|---|---|---|---|
| **Long term rate of mortality improvement (% pa)** | **0%** | **25%** | **50%** | **75%** | **100%** | **125%** |
| Base assumption | –2.7% | –1.3% | 0.0% | 1.3% | 2.6% | 4.0% |
| 0% at all ages | –5.1% | –3.3% | –1.4% | 0.4% | 2.2% | 4.0% |
| 1% at all ages (up to 120) | –1.5% | –0.1% | 1.2% | 2.5% | 3.8% | 5.1% |
| 2% at all ages | 2.7% | 3.5% | 4.2% | 5.0% | 5.7% | 6.5% |
| 3% at all ages | 7.4% | 7.6% | 7.7% | 7.9% | 8.0% | 8.1% |

**Table 7: Sensitivity of annuity values to CMI parameters for deferred life annuities (at 4%)**

| Difference from annuity value based on original parameter choices | Proportion (P) of total convergence at mid-point of convergence period | | | | | |
|---|---|---|---|---|---|---|
| **Long term rate of mortality improvement (% pa)** | **0%** | **25%** | **50%** | **75%** | **100%** | **125%** |
| Base assumption | –14.3% | –7.2% | 0.0% | 7.3% | 14.7% | 22.1% |
| 0% at all ages | –25.6% | –17.1% | –8.3% | 0.7% | 9.7% | 18.9% |
| 1% at all ages (up to 120) | –4.5% | 2.5% | 9.5% | 16.6% | 23.7% | 30.8% |
| 2% at all ages | 21.5% | 26.2% | 30.9% | 35.7% | 40.4% | 45.0% |
| 3% at all ages | 52.8% | 54.7% | 56.4% | 58.1% | 59.8% | 61.5% |

provides insights in light of uncertainty of two key assumptions: the total change in rate remaining by the mid-point of the convergence period (P), and the LTIRs. We provide sensitivity tests by varying P across a range of values (0%, 25%, 50%, 75%, 100%, 125%), and also by varying the LTIRs from the base assumption given in Figure 1, with LTIRs instead being constant across all ages, with values 0%, 1%, 2% and 3%.

Table 6 gives the output of these sensitivity tests for the case of the immediate lifetime annuity, and Table 7 for the deferred lifetime annuity. In both cases, the base case is where the LTIR = "base assumption" and P = 50%.

The variation in results indicates the uncertainty involved with any such projections and valuations. The results for the deferred lifetime annuities in particular illustrate their relatively heightened sensitivity to the two key parameters. This illustrates once more their highly leveraged nature. As one example, an LTIR of 1% across all ages in combination with the base assumption of P = 50% gives rise to an 8–10% increase in eventual benefits (on an EPV basis). With LTIRs and values of P higher than this, the inadequacy of the base deferred lifetime annuity valuation is even more pronounced, and significantly so.

## 4 CONCLUSION

The difficulties in accurately forecasting future mortality are well known amongst key users, and as such the adoption of various methods to project mortality for specific uses and timeframes is a useful approach to identify key sensitivities and vulnerabilities. In this paper we demonstrate our adaptation of the CMI approach to Australian data, and use the valuation of immediate and deferred lifetime annuities to illustrate its projection capabilities and output relative to other approaches that have been adopted.

We find that the projection from the CMI approach is similar to existing projections in the near term, in particular those of Tickle and Booth (2014) and the Productivity Commission (2013). Projection results are sensitive to changes in the proportion of convergence and the assumed long-term mortality improvement rate, and especially so in the case of deferred lifetime annuities.

Of course, longevity risks arising from annuities sold at a single point of time are just an illustration of one single-cohort experience. An insurer's overall portfolio of such retirement products will see differing levels of profitability arise in line with all of the pricing basis, the reserving basis, and actual experience changing over time. If the CMI approach is accepted as a reasonable approach to managing ongoing risks with the uncertainty of future mortality, our analysis can be modified and applied to any model office, in terms of a portfolio of current or projected business.

The sensitivity results, in particular, do highlight the challenges with risks arising from mortality changes over time. Furthermore, it is not primarily a question of getting "better" projections of mortality, but is more an issue of embedding into the business a risk management practice and process that is flexible adaptable and practical. The underlying flexibility and adaptability of the CMI approach to adjust in line with emerging experience is one of its key features, by allowing "users the flexibility to modify projections to suit their own views and purposes" (CMI 2009: 2). As such, we see the CMI approach as a useful tool to be considered in work that requires such projections. This supports the CMI's own statement based on recent feedback that "the Model is highly valued by users and widely-regarded as a "common currency" for discussions of future mortality improvements" (CMI 2013: 5). In this vein, this study provides an addition to the existing projections of Australian mortality, to inform practitioners and policymakers in managing longevity risk.

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# Estimates of individual life expectancies

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## ABSTRACT

Estimates of individual life expectancies require assumptions about future causes of death, and allowances for socio-economic factors.

Deaths from circulatory diseases, cancers, respiratory diseases and external causes were 75% of deaths in Australia in 2012. All have shown continuing downwards trends since 1986. Reported deaths from the next three major causes of death have all increased. Expert advice is needed to understand the reasons for past changes, and to make reasonable assumptions about future deaths from each cause.

Unmarried persons have higher mortality rates than the married. Recent Danish data show that lone persons are more likely to die from cardiovascular disease, respiratory disease and suicide. Australian data show that lone persons are more likely to have mental disorders and nervous system diseases, and disabilities arising from external causes. UK data show that persons in unskilled occupations have higher mortality rates.

The paper proposes the use of macro-models to approximately replicate past changes in causes of death, and the use of microsimulation to validate assumed relationships between socio-economic variables and diseases.



## KEYWORDS

microsimulation, death causes, disease differentials, life expectancies


AJAP 2015; 3: 35–46

## 1 INTRODUCTION

This paper arose from the development of a large household microsimulation model for Australia. As part of this model, we project the development of diseases for each individual, and their ultimate death from one or more of these diseases (Cumpston 2014). This allows us, for example, to project the numbers of persons requiring nursing care as a result of dementia.

With the help of a research grant from the Actuaries Institute, we have started a project to quantify the relationships between socio-economic variables, diseases and mortality. This may allow better estimates of individual life expectancies, helping individuals make investment and lifestyle choices. The knowledge gained from this project may help actuaries working in a variety of fields.

Estimation of individual life expectancies using a disease-based model requires projections of mortality trends from different causes of death, as well as assumptions about the effects of socio-economic factors on disease incidence and development probabilities.

It is not yet clear that microsimulation can be a practical method of estimating individual life expectancies.

## 2 TRENDS IN MAJOR CAUSES OF DEATH IN AUSTRALIA

This section looks at past data on the seven major causes of death in Australia, and at some of the changes in risk factors and treatment methods. It suggests some sources of expertise to help understand past changes, and to help make sensible assumptions about future disease-specific mortality rates.

### 2.1 Explanatory methods of mortality forecasting

Booth & Tickle describe explanatory methods of mortality forecasting as

> "based on structural or causal epidemiological models of certain causes of death involving disease processes and known risk factors. Thus use is made of valuable medical knowledge and information on behavioural and environmental change... The relationships between risk factors and mortality are imperfectly understood, making their use in forecasting less than reliable." (2008: 9)

Greater understanding of the relationships between risk factors and disease incidence is emerging, together with longer data series for risk factors. Explanatory methods of mortality forecasting may thus become more useful, particularly where projections by cause of death are needed.

### 2.2 Trends in major causes of death from 1986 to 2011

Table 1 shows that age-standardised male death rates from circulatory diseases have fallen sharply in the

**Table 1: Major causes of death in Australia, 1986-2011**

| Underlying cause of death (ICD 10 chapter in brackets) | Deaths 2012 (%) | Deaths per 100,000 males 2011 | Deaths per 100,000 females 2011 | Growth 1986-2011 pa (%) males | Growth 1986-2011 pa (%) females |
|---|---|---|---|---|---|
| Circulatory system (IX) | 29.9 | 201.9 | 144.8 | –4.0 | –3.8 |
| Cancer (II) | 29.6 | 221.1 | 138.6 | –0.9 | –0.7 |
| Respiratory system (X) | 9.0 | 61.1 | 38.8 | –2.2 | 0.0 |
| External causes (XX) | 6.3 | 53.0 | 23.9 | –1.3 | –1.0 |
| Mental and behavioural disorders (V) | 5.5 | 26.2 | 28.3 | 2.0 | 3.6 |
| Nervous system (VI) | 4.7 | 28.1 | 24.0 | 2.1 | 2.9 |
| Endocrine, nutritional and metabolic (IV) | 4.1 | 27.4 | 20.3 | 0.8 | 0.6 |
| All other | 10.9 | | | –0.7 | –0.4 |

Sources: The distribution of underlying causes of deaths in 2012 is from the Australian Bureau of Statistics (2014a). For example, there were 43,946 deaths with underlying cause attributed to diseases of the circulatory system (Chapter IX of the International Classification of Diseases version 10). This was 29.9% of the total of 147,098 deaths. Age-standardised deaths per 100,000 persons were calculated using 2001 estimated resident population (Australian Institute of Health and Welfare 2013). For example, age-standardised deaths per 100,000 males with circulatory system disease as the underlying cause of death were 564.8 in 1986 and 201.9 in 2011. An exponential curve between these endpoints shows a growth rate of -4.0%.

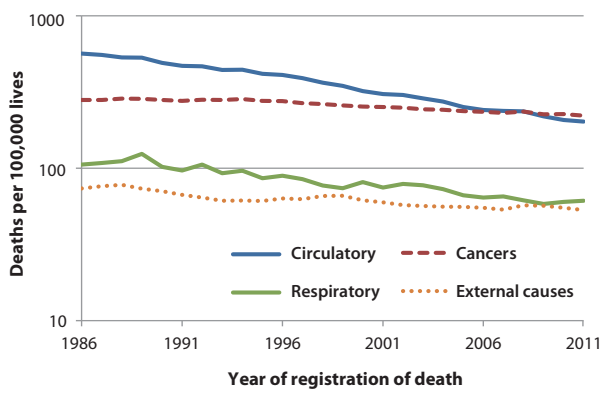


**Figure 1: Australian age-standardised deaths per 100,000 lives, males, 1986-2011 (logarithmic scale).**
Source: Australian Institute of Health and Welfare (2013).

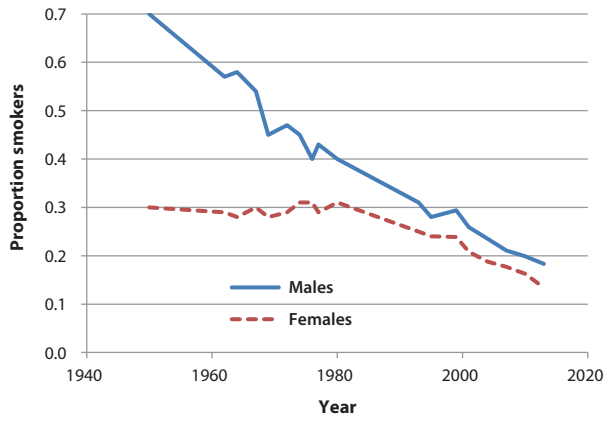


**Figure 2: Proportion of Australians who are current smokers, 1950-2013.**
Sources: Proportions up to 1980 are from Walker (1984: 93), and are for various minimum ages. Proportions from 1993 on are from Australian Institute of Health and Welfare (2014a and similar earlier reports), and are for persons aged 14+.

25 years to 2011, falling exponentially at about 4.0% per annum. Female death rates from cardiovascular death rates have fallen at a similar rate. In Section 2.4 we list possible reasons for these falls. By contrast, age-standardised female rates from mental and behavioural disorders have risen exponentially at about 3.6% per annum. In Section 2.14, we note evidence that dementia incidence has been falling, and suggest that it has become more acceptable to report dementia as the underlying cause of death.

## 2.3 The four major causes of death

The four largest causes (by ICD10 chapter) accounted for 74.8% of deaths in 2012. As shown in Figure 1, all are dropping, with circulatory dropping fastest, at about 4% per annum. Many developed countries have experienced similar falls (Ridsdale & Gallop 2010). The reasons underlying these continuing falls are complex, and we briefly discuss some of them here.

## 2.4 Deaths due to circulatory diseases

Between 1986 and 2011, age-adjusted death rates with circulatory system diseases as the underlying cause of death dropped at 4.0% per annum for males, and at 3.8% per annum for females. Access Economics (2005) noted that

- There had been large increases over the previous decade in prescribing medications to treat high blood pressure, and to lower cholesterol and triglycerides.
- There had been little change in the prevalence of high cholesterol since 1980.
- The prevalence of high blood pressure had halved over the previous two decades.
- Tobacco smoking had dropped since the 1950s.
- There had been little change in physical activity levels.
- The prevalence of obesity had doubled over the previous two decades.
- There had been widespread use of surgical procedures, including stent implantation and coronary artery bypass grafting.

Lower smoking rates (Figure 2), lower blood pressures and improved surgical procedures appear to have strongly outweighed the negative effects of higher obesity levels (Figure 3).

## 2.5 Trends in smoking

Figure 2 shows that the male smoking has fallen almost linearly since 1950, while female smoking did not begin to fall until after 1980.

## 2.6 Trends in obesity

Figure 3 shows that that the proportions of Australians who are overweight or obese have risen substantially since 1980.

## 2.7 Cancer deaths

Age-standardised deaths rates with cancers as the underlying cause of death dropped at 0.9% per annum for males from 1986 to 2011, and at 0.7% per annum for females. Cancers are usually multi-stage development processes, where 30 to 40 years can elapse between first exposure and diagnosis.

Although the health risks of asbestos inhalation had been known much earlier, Australian states did not begin legislating against the use of asbestos until

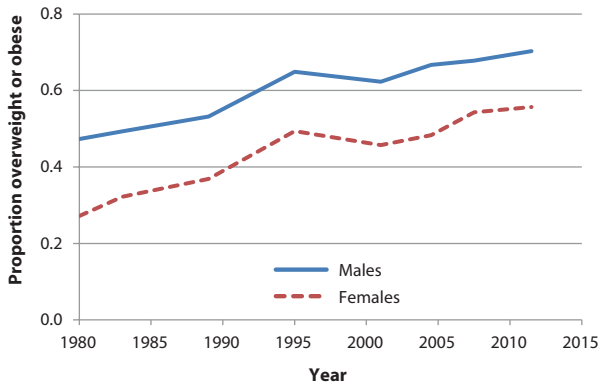


**Figure 3: Proportion of Australians overweight or obese, 1980–2012.**

Sources: Proportions up to 1989 are from Risk Factor Prevalence Surveys, and are for persons aged 25-64. Subsequent values are from National Health Surveys, and are for persons 18+. Values for 2001 and 2004-05 were increased by 8.3% or men, and 14.1% for females, to allow for underestimation caused by self-reporting of height and weight.

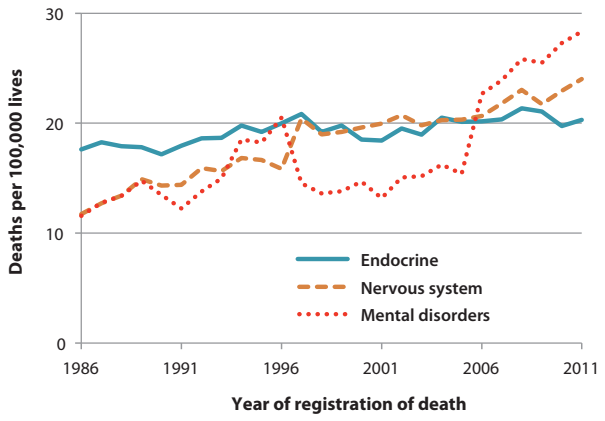


**Figure 4: Australian age-standardised deaths per 100,000 lives, males, 1986–2011.**

Source: Australian Institute of Health and Welfare (2013).

about 1982. One study of mesothelioma found a median latency period of 51 years between initial exposure and development of the disease (Bianchi et al 1997). Asbestos-related deaths may not yet have peaked in Australia. While industrial exposures to asbestos were largely amongst men, more recent exposures are likely to affect both men and women.

As with circulatory diseases, there has been considerable investment in improved forms of cancer treatment. However, the slow decline in mortality rates, even with the reductions in smoking and asbestos risk factors, suggests that progress has been slow. Given the many different forms of cancer, and the long periods required to develop and test new therapies, continued slow declines in cancer mortality rates seem likely.

Tomasetti and Vogelstein (2015) suggest that only one-third of the variation in cancer risks amongst tissues is attributable to environmental factors or inherited predispositions. If so, deaths from most cancers are likely to be only poorly correlated with risk. Most future improvements in cancer mortality rates may arise from better detection and treatment methods, together with vaccination where relevant.

## 2.8 Respiratory system deaths

Age-standardised death rates with respiratory system diseases as the underlying cause of death dropped at 2.2 % per annum for males from 1986 to 2011, but were unchanged for females. The continuing large reductions in male smoking rates may be largely responsible for the drops in male respiratory system deaths, while the smaller and more recent reductions in female smoking rates appear to have had less effect. Other mechanisms seem likely to be responsible for the failure of female rates of death from respiratory disease to drop.

## 2.9 Deaths from external causes

Age-standardised death rates with external causes as the underlying cause of death dropped at 1.3% per annum for males from 1986 to 2011, and at 1.0% per annum for females. External causes include accidents, intentional self-harm, assaults and medical misadventure. Road safety research and legislation have gradually created a capital stock of safer vehicles and safer drivers, so that by 2012 transport accidents accounted for only 16% of deaths from external causes, compared with 28% in 1993. Other accidental deaths accounted for 46% and intentional self-harm for 27%. Given the much lower proportion of transport deaths in 2012 compared with past years, past reductions in deaths from external causes may be a poor guide to future reductions.

## 2.10 The next three major causes of death in Australia

The next 3 causes (endocrine, nutritional and metabolic, nervous system, and mental and behavioural disorders) accounted for 14.3 % of deaths in 2012. All showed rising trends – see Figure 4.

## 2.11 Deaths from mental and behavioural disorders

Age-standardised death rates with mental and behavioural disorders as the underlying cause of death rose at 2.0% per annum for males from 1986

to 2011, and at 3.6% per annum for females. Vascular dementias and unspecified dementias constituted 90% of deaths in 2012 with mental and behavioural disorders as the underlying cause of death. The rising death rates are inconsistent with the evidence that dementia incidence has been slowly falling (see Section 2.14). For each case with dementia as the underlying cause of death, there were another 1.35 cases where dementia was an additional cause. It seems likely that it has become more acceptable to report dementia as an underlying cause of death.

## 2.12 Deaths from diseases of the nervous system

Age-standardised deaths rates with diseases of the nervous system as the underlying cause of death rose at 2.1% per annum for males from 1986 to 2011, and at 2.9% per annum for females. Alzheimer's disease cases constituted 48% of deaths in 2012 with diseases of the nervous system as the underlying cause of death. There may be an increasing willingness to report Alzheimer's disease as an underlying cause of death. Some of the erratic changes in mortality rates from mental disorders and diseases of the nervous system in recent years (see Figure 4) may reflect changed methods of cause of death classification.

## 2.13 Deaths from endocrine, nutritional and metabolic diseases

Age-standardised death rates with endocrine, nutritional and metabolic diseases as the underlying cause of death rose at 0.8% per annum for males from 1986 to 2011, and at 0.6% per annum for females. Diabetes cases constituted 70% of deaths in 2012 with endocrine, nutritional or metabolic diseases as the underlying cause of death. For each case with diabetes as the underlying cause of death, there were another 2.75 cases where diabetes was an additional cause. Obesity and smoking are key risk factors for diabetes, and high blood pressure is a major risk factor for the development of diabetes complications (AIHW 2014b). Long-term increases in diabetes death rates may be due to obesity effects outweighing gains from lower smoking rates and lower blood pressure levels.

## 2.14 Declining dementia incidence?

Table 2 shows the results of eight studies of dementia incidence. For example, the US National Long Term Care study estimated rates at the end of the study that were 51% of those at the start, a 3.9% rate of exponential decay over the 17 years of the study. Although the two oldest studies showed no change, the 6 most recent show rates of change from –3.9% pa to +1.1%. The risk factors for dementia include five vascular risk factors – physical inactivity, smoking, midlife hypertension, midlife obesity and diabetes (Norton et al 2014). Other risk factors are depression and educational attainment – dementia is less common in those with higher education, and education levels have been gradually rising. The substantial reductions in smoking and hypertension may outweigh the effects of greater obesity and diabetes on dementia.

**Table 2: Studies of dementia incidence**

| Study | Start | Years | Change | Rate pa |
|---|---|---|---|---|
| Sweden Lundby | 1947 | 10 | Stable | 0.000 |
| US Rochester | 1976 | 24 | Stable | 0.000 |
| US National Long Term Care | 1982 | 17 | 0.51 | –0.039 |
| UK MRCCF CFAS | 1989 | 19 | 0.76 | –0.014 |
| Netherlands Rotterdam | 1990 | 10 | 0.75 | –0.028 |
| US African Americans | 1992 | 9 | 1.10 | 0.011 |
| US Health and Retirement Study | 1993 | 10 | 0.71 | –0.033 |
| US Chicago | 1997 | 11 | 0.97 | –0.003 |

Sources: References to the 8 studies in Table 2 are in Sachdev (2014). "Change" refers to the estimated incidence rate at the end of the study period, divided by the rate at the start.

## 2.15 Obtaining expert advice

Expert advice is needed to understand the reasons for past changes, and likely future trends (as suggested by Pinnington 2008). For example, epidemiologists may be able to estimate the relative contributions of different risk factors to observed changes in mortality rates for different cause of death. Advice on latency periods – for example, the delays between mid-life obesity and dementia – could help in the analysis of past data, and in makings assumptions about the future. Specialist doctors may be able to estimate the contributions of treatment changes to observed mortality changes. Research workers may be able to comment on the possible benefits of drugs currently under development, and on how soon these drugs are likely to be widely available. Literature searches may help find relevant experts.

## 2.16 Using expert advice as a basis for mortality rate assumptions

For major causes of death, it may be possible to construct macro-models that approximately replicate past changes in death rates, taking into account age distributions, latency periods and known changes in risk factors and treatment methods. Future risk factors could be approximately estimated: for example, longitudinal data are now available on smoking and obesity, allowing approximate projections of these risk factors for each age

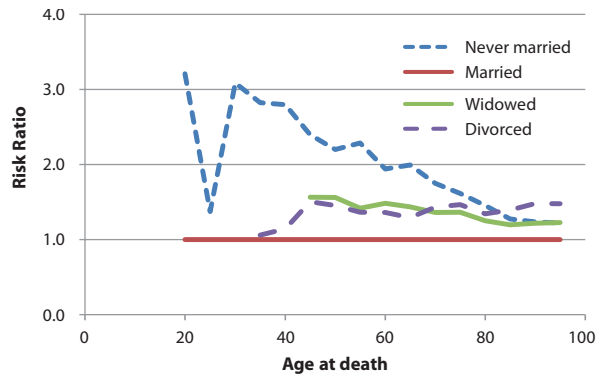


**Figure 5: Mortality risk ratios relative to married, Australian females, 2010–2012.**

Source: Mortality rates were calculated by averaging the numbers of deaths of females in 2010 to 2012 (ABS 2013), and dividing by numbers of females in each marital status reported by the 2011 Australian census. There were 213,895 female deaths from 2010 to 2012. Figure 5 shows mortality risk ratios, calculated by comparing these mortality rates to those for married females.

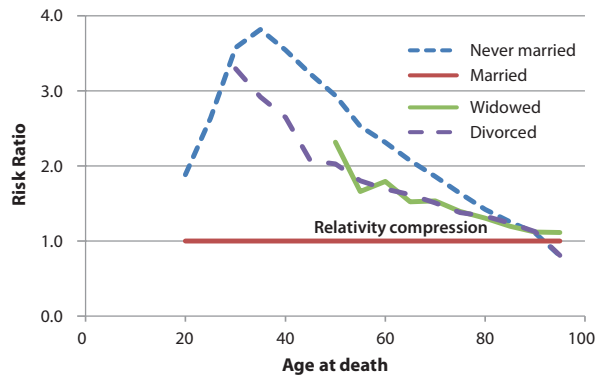


**Figure 6: Mortality risk ratios relative to married, Australian males, 2010–2012.**

Source: Mortality rates were calculated by averaging the numbers of deaths of males in 2010 to 2012 (Australian Bureau of Statistics 2013), and dividing by numbers of males in each marital status reported by the 2011 Australian census.

group. Taking into account expert advice on possible future treatment changes, estimates of future deaths could be made. Confidence limits attached to these estimates could reflect the uncertainty in the expert advice, and the quality of fit of the macro-models.

## 3 MORTALITY RISK RATIOS

We want to be able to provide individual life expectancy estimates, taking into account socio-economic circumstances. It is well known that married persons have lower mortality rates than the unmarried, and that persons in high-income occupations also have lower mortality rates. This section graphs some of these differentials, and discusses some of the underlying causes.

### 3.1 Risk ratios

Risk ratios compare the risks of two different groups. For example, in deriving Figure 5 the mortality rate for never-married females aged 50 to 54 was estimated as .00370, and that for married females in the same age group as .00168, a risk ratio of 2.20.

### 3.2 Mortality risk ratios for Australian females by marital status

Figure 5 shows mortality risk ratios for never married Australian females, relative to married females. At young ages never married females have high risk ratios, declining with age. Widowed and divorced females have risk ratios a little above one.

### 3.3 Mortality risk ratios for Australian males by marital status

Figure 6 suggests that males cope worse than females with widowhood or divorce, with mortality risk ratios not much lower than for the never married. Note the compression of relativities above age 80, where marital status appears to have little or no effect on mortality risk ratios.

### 3.4 Suggested reasons for lower mortality of married

The lower mortality rates of married persons have long been recognised. Reasons for these lower rates have been suggested, but the underlying mechanisms have not been quantified. For example, Lillard and Waite (1995) concluded that "access to financial resources is a key pathway through which marriage improves well-being and life chances".

Various forms of protective effect, as well the initial selection effect, were summarised by Gardener and Oswald:

> Marriage may reduce stress and stress-related illness … may encourage healthy types of behaviour … A spouse makes it more likely that an individual receives adequate care if ill …marriage may increase material well-being… Alternatively… it may simply be that more healthy individuals are selected into marriage (2004: 5)

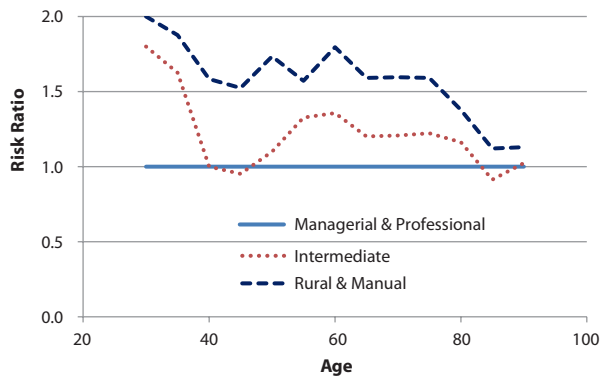


**Figure 7: UK male mortality rates relative to managerial and professional (2002–2006).**
Source: UK Office for National Statistics (2013). There were 12,245 deaths in the data. Intermediate workers are all except managerial and professional and rural and manual.

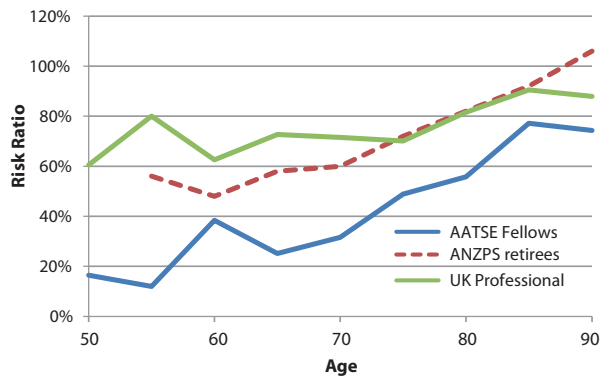


**Figure 8: Mortality risk ratios relative to national mortality for three male occupational groups.**
Sources: "AATSE Fellows" is the mortality experience of Fellows of the Australian Academy of Science, Technology and Engineering from 1977 to 2008 (Cumpston Sarjeant 2008). "ANZPS retirees" is the mortality of public service pensioners in Australia and NZ for 2009-12 (Wilson & Boyfield 2014). UK professional experience is for 2002-06 (UK Office for National Statistics 2013).

### 3.5 Mortality risk ratios by occupational class

From Figure 7, the higher mortality rates of rural and manual workers seem to persist well after retirement, so they may reflect life-style factors as well as occupational risks. Note the compression of risk ratios above age 80, with intermediate risk ratios approaching one, and manual risk ratios not much higher.

### 3.6 Mortality risk ratios of high-skill occupations in Australia and UK

Figure 8 compares the mortality experience of three male occupational groups with that of their respective national population. The mortality risk ratios, relative to all males, of retired Australian public servants seem similar to those of UK professionals. Ratios for AATSE Fellows are noticeably lower, even at the oldest ages for which data are available.

## 4 DISEASE-SPECIFIC MORTALITY RISK RATIOS

Our simulations of individual life expectancies are disease-based, as death occurs only as a result of the incidence of diseases and accidents. To help understand the relationships between diseases and death, we look here at some Danish data on mortality rates from different causes. These results may help us choose incidence, development and mortality assumptions for each disease.

### 4.1 Danish Civil Registration System

The Danish Civil Registration System was established in 1968, and provides a longitudinal record for each person living in Demark. Causes of death can be obtained by linking with the Danish Register of Causes of Death. Marital status is recorded, and cohabitation status is inferred from the number, age and sex of persons living in the household (Frisch and Simonsen 2013: 560). We quote their results for cohabitating persons here, as this allows better comparisons with Australian disease data on cohabitating persons.

### 4.2 Danish mortality risk ratios for selected diseases

The hazard ratios in Figure 9, which are relative to partnered persons, were derived from Danish Civil

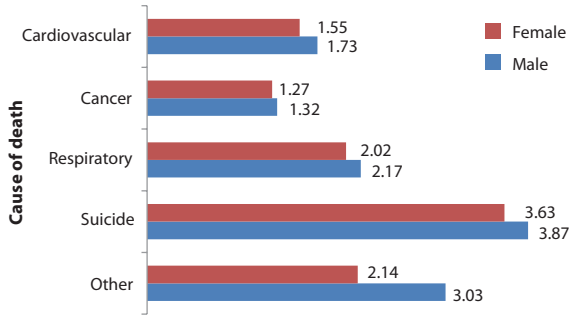


**Figure 9: Mortality hazard ratios by cause of death for lone persons relative to partnered persons, Denmark 2000–2010.**
Source: Frisch and Simonsen (2013: 573). There were 652,219 deaths in the source data.

Registration System data. For example, lone males have 1.27 times the risk of dying from cancer, compared to partnered males. By contrast, lone males have 3.63 times the risk of dying from suicide.

## 5. DISABILITY RISK RATIOS

We look here at some survey results of the disability risk ratios for persons with different cohabitation statuses, ages and educational levels. Although based on reported disabilities rather than underlying causes of death, these results show some similarities with the Danish results in Figure 9.

### 5.1 Australian data – Survey of Disability Ageing & Carers 2012

This survey (Australian Bureau of Statistics 2014b) reported personal and disability details for 77,570 persons. After omitting 10,362 persons in non-private dwellings, 12,878 under 15 and 681 with missing values, there were 25,987 males and 27,661 females for analysis.

Lone parents and lone persons were grouped as "lone adults". Children, related persons, unrelated persons in families and group members were grouped as "other". Diplomas and certificates were grouped as "technical", and year 12, bachelor, graduate diploma and postgraduate degrees as "year 12 plus". Exploratory logistic regressions were done, keeping coefficients with about 20% significance level or less. Age and age square variables were included in each regression.

### 5.2 Disability risk ratios for Australian females

Table 3 shows that lone females have 1.35 times the risk of having cancer (compared with the Danish mortality ratio of 1.32 in Figure 9). Lone and "other" females have double the risks of having mental disorders than partnered females. Females with year 12 or university qualifications are less likely to have each disability type than those with year 11 or less.

### 5.3 Disability risk ratios for Australian males

From Table 4, lone and "other" males have triple the risks of having mental disorders than partnered males. Males with year 12 or university qualifications are less likely to have each disability type than those with year 11 or less.

### 5.4 Disability risk ratios for age groups by age and cohabitation status

Table 5 shows that disability risk ratios for lone persons, compared with partnered, are generally high below age 80. For example, lone males aged 40–59 are about 4 times more likely to have a mental disorder than a partnered male. Most differentials between lone and partnered persons seem to disappear by age 80+.

**Table 3: Disability risk ratios for Australian females 2012**

| Variable | Circulatory diseases | Cancer | Respiratory diseases | External causes | Mental disorders | Nervous system diseases | Endocrine diseases |
|---|---|---|---|---|---|---|---|
| Lone | 1.17 | 1.35 | 1.48 | 2.18 | 2.52 | 1.51 | |
| Other | 1.12 | | | 1.224 | 2.02 | | 1.2 |
| Technical | | | 0.93 | | 0.82 | | 0.89 |
| Year 12+ | 0.73 | 0.77 | 0.74 | 0.73 | 0.52 | 0.81 | 0.71 |

Source: Unit records from Survey of Disability Aging and Carers (Australian Bureau of Statistics 2014b). Risk ratios for lone and "other" females are relative to partnered persons. Risk ratios for persons with technical or year 12+ education are relative to persons with year 11 or less education, where year 12+ includes university. Risk ratios significantly greater than one (at the 20% level) are shown in red., and risk ratios significantly less than 1 are shown in black.

**Table 4: Disability risk ratios for Australian males 2012**

| Variable | Circulatory diseases | Cancer | Respiratory diseases | External causes | Mental disorders | Nervous system diseases | Endocrine diseases |
|---|---|---|---|---|---|---|---|
| Lone | 1.19 | | 1.37 | 2.65 | 3.04 | 1.48 | |
| Other | 0.88 | | | 1.16 | 3.19 | 1.36 | 1.25 |
| Technical | | 1.22 | 0.84 | | | 0.89 | 0.91 |
| Year 12+ | 0.71 | 0.76 | 0.69 | 0.59 | 0.55 | 0.71 | 0.81 |

**Table 5: Disability risk ratios for lone persons compared with partnered**

| Sex/age | Circulatory diseases | Cancer | Respiratory diseases | External causes diseases | Mental disorders | Nervous system | Endocrine diseases |
|---|---|---|---|---|---|---|---|
| M15–39 | | | 1.43 | 3.22 | 3.58 | 1.60 | 1.65 |
| M40–59 | 1.21 | | 1.62 | 3.41 | 4.10 | 1.77 | |
| M60–79 | 1.17 | | 1.20 | 2.03 | 2.18 | 1.29 | |
| M80+ | 1.36 | | | | | | |
| F15–39 | 1.79 | | 1.48 | 3.27 | 2.69 | 1.89 | 1.72 |
| F40–59 | 1.28 | 1.73 | 1.70 | 2.42 | 2.91 | 1.49 | 1.45 |
| F60–79 | 1.13 | 1.39 | 1.43 | 1.77 | 2.17 | 1.26 | 1.16 |
| F80+ | | | 1.38 | 1.42 | | | |

Source: Unit records from Survey of Disability Aging and Carers (Australian Bureau of Statistics 2014b).

**Table 6: Disability risk ratios of persons with year 12 or higher education compared with year 11 or less**

| Sex/age | Circulatory diseases | Cancer | Respiratory diseases | External causes diseases | Mental disorders | Nervous system | Endocrine diseases |
|---|---|---|---|---|---|---|---|
| M15-39 | 0.55 | | 0.71 | 0.72 | 0.34 | 0.46 | |
| M40-59 | 0.65 | 0.47 | 0.68 | 0.44 | 0.49 | 0.73 | |
| M60-79 | 0.75 | 0.67 | 0.64 | 0.60 | 0.59 | | 0.73 |
| M80+ | 0.71 | | | | | 2.44 | |
| F15-39 | 0.45 | | 0.76 | | 0.45 | 0.72 | 0.5 |
| F40-59 | 1.38 | | 0.76 | 0.65 | 0.48 | 0.72 | 0.75 |
| F60-79 | 0.76 | | 0.72 | 0.83 | 0.63 | | 0.76 |
| F80+ | | | | 1.62 | | 1.57 | |

Source: Unit records from Survey of Disability Aging and Carers (Australian Bureau of Statistics 2014b).

### 5.5 Disability risk ratios for age groups by age and education

Table 6 shows that males aged 40–59 with year 12+ education are half as likely to have a mental disorder as those with year 11 or less. Most education differentials seem to disappear or reverse by age 80+

## 6 LIFE EXPECTANCY AND SURVIVAL CALCULATORS

Before creating a facility to provide individual life expectancies for Australians, it seems sensible to look at existing facilities. Can their estimation and validation techniques be usefully adopted? We look below at five general purpose life expectancy calculators, and at two mortality indices to predict short-term survival for community-dwelling adults aged 65+.

### 6.1 Five examples of life expectancy calculators

The life expectancy calculators, and the number of questions they pose to users, are:

1. www.livingto100.com/calculator (47 questions)
2. www.mylongevity.com.au (51)
3. http://gossett.wharton.upenn.edu/mortality/perl/CalcForm (45)
4. www.zurich.com.au/zurich_au/individuals/life_insurance/calculator (6)
5. www.uwic.ac.uk/shss/dom/newweb/lifestyle/age_expectancy2 (12)

These calculators are all available on the web for personal use. The underlying assumptions of the calculators are largely undocumented, and there is no evidence of any validation processes. The third calculator listed makes no allowance for future mortality changes, and the others may not make such allowances. Most of these calculators provide only a point estimate of life expectancy, with no indication of the probabilities of higher or lower results. There does not seem to be any established consensus about estimation methods, as filling out all five calculators for a 70 year old male gave a range of more than 2:1 in life expectancies.

### 6.2 Mortality indices to predict short-term survival

Table 7 shows the points added if each of the variables applies. "BMI" is body mass index, "COPD" is chronic obstructive pulmonary disease, and "IADL" is instrumental activities of daily living. Adding the points gives a validated index that predicts mortality within 9 years. The index is intended for community-dwelling adults aged 65+. Note that 2 points are added for BMI<25. A 10-year Lee index has been validated by Cruz et al (2013). Both the Schonberg and Lee indices were derived by survival analysis using extensive data sets, retaining only significant variables. Neither index allows for income, education or cohabitation status. Although socio-economic mortality differentials are lower at older ages, their omission seems surprising. No allowances are included for future mortality changes.

### 6.3 Validation of life expectancy calculators

Calculators that assume no mortality rate changes, or ignore socio-economic factors known to affect mortality, are likely to be of limited value. A more stringent validation requirement is that the calculator, if applied to a representative group of persons of each age, provides a reasonable average life expectancy for that age.

**Table 7: Schonberg index to predict 9-year survival**

| Variable | Points | Variable | Points |
|---|---|---|---|
| Age 70–74 | 1 | Diabetes | 2 |
| Age 75–79 | 3 | Cancer | 2 |
| Age 80–84 | 5 | One overnight hospital stay | 1 |
| Age 85+ | 7 | Two or more stays | 3 |
| Male | 3 | Perceived health good | 1 |
| Former smoker | 1 | Perceived health fair/poor | 2 |
| Current smoker | 3 | Dependent on at least 1 IADL | 2 |
| BMI<25 kg/m2 | 2 | Difficulty walking several blocks | 3 |
| COPD | 2 | | |

Source: Schonberg et al (2011: Appendix).

## 7 MICROSIMULATION OF INDIVIDUAL LIFE EXPECTANCIES

A young single adult has probabilities of forming a partnership, and once partnered has probabilities of leaving the partnership. Probabilities of dying from different diseases depend strongly on cohabitation status. To allow for these and other probabilities, it seems likely that we will need to make Monte Carlo simulations. Household microsimulation models may be one way to make these simulations.

### 7.1 Household microsimulation models

Cumpston, Service and Sarjeant said

> A household microsimulation model starts with a record for each person in the baseline population… During a projection, demographic events are randomly simulated – births, deaths, emigrants, immigrants, internal migrants, household entries and exits … Education, employment, earnings, other income … may also be simulated. (2014: 8)

Deaths are often simulated using national population mortality rates. By contrast, our Australian model simulates the incidence and development of 124 diseases, with deaths only arising out of these diseases (Cumpston 2014: 61).

### 7.2 Allowing for socio-economic factors in a household microsimulation model

Given a disease-based model, the changes needed to replicate the mortality and disease differentials in sections 3 to 5 of this paper may be

- adjusting the incidence, development and mortality factors for each disease to allow for socio-economic factors
- adjusting probabilities of partnership and separation to allow for diseases
- adjusting probabilities of movement in and out of employment to allow for diseases
- adjusting models of earnings to allow for diseases.

### 7.3 Validating life expectancy estimates from a household microsimulation model

We want the average life expectancy for each sex and age derived from repeated runs of the model to reasonably match estimates derived from current national mortality rates. The national rates would have to be adjusted for any mortality changes assumed in the microsimulation model. Another form of validation would be to compare mortality and disease differentials, as in this paper, with similar statistics derived from simulations using the model.

### 7.4 Adapting a household microsimulation model to provide individual life expectancy estimates

Running the model repeatedly, and recording the years until death for each person in the baseline population, gives a statistical distribution for the life expectancy of each person. To provide life expectancy estimates for a single nominated individual, that person would have to be added to a baseline population, together with any existing partner or children of that person.

## 8 CONCLUSIONS

Individual life expectancies may help persons making investment or lifestyle choices. Reasonable estimates of these expectancies require allowances for likely future mortality changes, and allowances for the socio-economic factors that affect mortality rates.

Expert advice on the causes of past changes in deaths from different causes, and on possible future changes, is needed. The paper discusses how such expert advice might be obtained, and used in macro-models and projections.

It seems likely that socio-economic variables, such as cohabitation status, education and income, affect the incidence and development of diseases, and the mortality rates associated with each disease. Microsimulation may be the only feasible method of validating models of the relationships between socio-economic variables and diseases.

However, microsimulation may not prove to be the most practical method of estimating individual life expectancies, taking into account personal situation and health. The many different aspects of health may be too complex to include in a multi-purpose household microsimulation. Multivariate survival models may be easier to construct, and be sufficiently reliable.

The research questions outlined here, on the underlying causes of mortality trends, and on the interactions between socio-economic circumstances and diseases, may lead to results that are useful in a number of fields.

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**Acknowledgements**
We are very grateful for the help provided by Richard Boyfield, Jennie Brand-Miller, Bridget Browne, Philip Clarke, Morten Frisch, Jonathan Gardner, Margaret Hartley, Chris Hatherly, Anna Howe, Kim Kiely, Marcia Keegan, Andrew Leigh, Brian Ridsdale, Mara Schonberg, Lyle Ungar, Linda Waite and David Williams, and by the reviewers of this paper.

# Australia's piece of the puzzle – why don't Australians buy annuities?

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## ABSTRACT

An individual who purchases a lifetime annuity is guaranteed to receive an income for life. As such this purchase would confer protection against investment and longevity risk for the individual in retirement. Despite these advantages, annuity sales in voluntary markets generally remain low. Reasons for this state of affairs from the current literature are reviewed, and further reasons particular to the Australian context are suggested. This contributes to an understanding of the factors that underlie the lack of popularity in contexts other than Australia as well.



## KEYWORDS

annuities, annuity puzzle, longevity risk, retirement income


AJAP 2015; 3: 47–57

## INTRODUCTION

In retirement, individuals are exposed to longevity risk, investment risk and inflation risk. Longevity risk for individuals arises from uncertainty around the length of their future lifetime, leading to the possibility that retirement savings may be inadequate to sustain the individual throughout their life. This is exacerbated by overall trends of increasing life expectancy. Investment risk is the possibility that the individual's investment will not yield the returns required to provide an adequate income in retirement. This is also related to inflation risk, whereby levels of savings or returns on investments, or both, may not be sufficient to maintain purchasing power in real terms into the future, as a result of inflationary pressures.

Additionally, the consequences of poor financial decisions and outcomes are particularly significant in retirement, as there is less opportunity to rectify or recover from serious adverse outcomes at older ages – as DiCenzo et al (2011) state: "the allowable margin of error is narrow, the time to 'make up' for mistakes short, and the potential consequences of blunders dire". The combination of all the above risks means there is much interest on how to prevent or at least mitigate the possibility of retirees running out of sufficient funds for a reasonable lifestyle in retirement.[1]

It might be argued that there are many ways to mitigate longevity and investment risks for the individual, particularly in a context such as Australia, where there is some protection against longevity risk due to the provision of a taxpayer-funded Age Pension. Indeed, various options have been proposed within the Australian context:[2]

1. provide incentives for individuals to stay in the workforce for longer, particularly beyond the eligibility age for the commencement of the Age Pension
2. introduce the option, and incentivise the ability, to take up a deferred Age Pension
3. increase Age Pension payments or the age of eligibility or both
4. increase the superannuation preservation age in line with the Age Pension eligibility age
5. introduce a universal Age Pension for individuals over age 85
6. simplify means-testing associated with the Age Pension
7. change taxation arrangements
8. broaden superannuation contributions
9. introduce a broader range of income products that account for investment and longevity risk
10. encourage greater member superannuation contributions through 'soft compulsion'.[3]

Some options have been challenged: for example, it is argued that the superannuation preservation age should always be below the Age Pension eligibility age to provide flexibility for retirement at various ages according to individual circumstances. Furthermore, aligning the two by increasing the superannuation preservation age could force more older Australians into poverty, and further entrench inequality (Schubert et al 2009).

However, and of particular note, with many individuals expected to outlive their savings and with the Age Pension in Australia providing a standard of living lower than most would consider comfortable (or even modest), there is a growing need for a new range of retirement income products that provide protection against investment and longevity risk. This need could potentially be met by incentivising the development of the Australian annuity market (McNamara & Swinhoe 2009; Patten 2011).

Despite advantages in delivering a guaranteed income in retirement, annuities are not, however, a popular choice of product. This lack of demand is termed the annuity 'puzzle' and in this paper we review the reasons for this state of affairs, which provides a complement to a recent paper presented by the Actuaries Institute's Retirement Incomes Working Group (RIWG 2013). We first summarise a recent and significant US Society of Actuaries study into this matter, to which we add some additional general

1 Establishing to what extent retirees outlive their savings, or otherwise, is not straightforward. Any conclusions are subject to significant uncertainty given poor availability of data, changing mortality, and especially the uncertainty around the level of health and long-term care costs (Max 2003; Metlife 2010). Further complicating this are changing attitudes to bequest motives and responsibilities, as many retirees now feel less pressure to leave money to the next generation (Max 2003). Such changes are colloquially summed up by the emergence of the SKI (spending kids' inheritance) club (Brown 2012). Nevertheless, one (approximate) approach could be to consider how many people receive or are expected to receive an inheritance from parents, with such an inheritance suggesting that the parents' retirement savings were reasonably sufficient. However this would assume that people either leave money to their children, or outlive their savings, which is an unreasonable assumption for many (for example, those living on a combination of Defined Benefit (DB) pensions, annuities and government pensions, may leave nothing to their children but certainly do not outlive their savings). Various Australian studies suggest that mean inheritance amounts peaked in 2006 and are now decreasing, that increased longevity and more active lifestyles mean much of retiree's savings will be spent, and that only one quarter of households felt that their superannuation savings would provide for a comfortable retirement (Brown 2012). Rather than indicate absolute levels of how many are expected to outlive their savings, this might be better viewed as indicating relative changes in expectations about the sufficiency of savings over time.

2 Sources: Actuaries Institute (2012), IAAust (2008, 2009a), Knox (2009), Nance et al (2008), NATSEM (2009), Mercer (2008, 2009, 2013), Schubert et al (2009).

3 Under 'soft compulsion' a new employee, or an existing employee who receives a wage increase, would have a percentage of their salary deducted to contribute towards superannuation savings, with the ability to opt out of these additional contributions under certain circumstances.

possibilities that are not necessarily specific to any one context. We then offer some further thoughts relating more specifically to the Australian context.

## 1 ANNUITIES AND THE ANNUITY 'PUZZLE'

A wide range of annuity products are available across various markets. Payments arising from an annuity may be level (payments fixed in nominal terms), inflation-indexed (payments fixed in real terms), or 'graded' (where they increase or decrease at a pre-specified rate). The types of annuities that have been developed include:

- *Conventional (lifetime) annuities:* provide an income with payments at regular periods for life.
- *Temporary annuities*: provide an income stream, with payments ceasing on the earlier of death or when a maximum number of payments is reached.
- *Deferred annuities:* provide an income stream commencing at some point in the future provided the annuitant is still alive at that time.
- *Guaranteed (or term-certain) annuities:* provide payments that are guaranteed for a pre-specified term, regardless of death or survival.
- *Value-protected annuities:* in the event that the accumulated sum of annuity payments is less than the initial premium when death of the annuitant occurs, still pays the difference to the annuitant's estate.
- *Participating annuities:* the profit experience of the insurer is shared with annuitants (but subject to a minimum of payments equal to the principal plus a minimum investment return).
- *Investment-linked annuities:* payments are directly related to the underlying investment fund value, but the mortality risk is still borne by the insurer.
- *Variable annuities:* essentially savings vehicles that allow investment of funds in a range of investment options, with the policyholder in return receiving the accumulated value of funds as periodic payments, guaranteed or otherwise, or as a lump sum.
- *Guaranteed lifetime withdrawal benefits:* allow annuitants the right to withdraw as a regular payment a (capped) percentage of their total investment, thereby providing guaranteed payments for life and offering some protection against investment losses.

An individual who purchases a life annuity is guaranteed to receive an income for life. For an individual who would otherwise outlive their retirement savings, the main advantage of purchasing a life annuity over other retirement income products is therefore protection against longevity risk. The iconic life-cycle work of Yaari (1965) established that, under certain conditions, a rational investor faced with longevity risk is best (in terms of maximising utility) to use an annuity to sustain their standard of living throughout retirement, and that, in the absence of a bequest motive, annuities should actually form the entirety of an individual's retirement portfolio.[4] In addition, purchasing an annuity provides protection against investment risk by transferring this risk to the annuity provider.

As well as the protection against longevity and investment risk, other benefits also exist with annuities: for example, the guaranteed nature of the income can relieve some concern and stress in retirement, as the management of financial planning and budgeting is helped with the guaranteed stability of income. A further benefit could be that an annuity allows individuals more freedom to take a more aggressive investment approach with other assets or wealth, or to plan for bequests or philanthropic endeavours with more certainty (MacDonald et al 2011).

### 1.1 The Annuity Puzzle

Despite the apparent strengths of annuities, although some exceptions exist, they are generally not popular other than in markets where annuity purchase is compelled, such as in Singapore and the United Kingdom (Cannon & Tonks 2008). Indeed, in the United States, less than 10% of retirees receive guaranteed income for life from private annuities (LIMRA, SoA and InFre 2009), and in Japan and New Zealand the annuity markets are also small, stemming from relatively generous state-provided pension systems (Rusconi 2008). In Australia the number of companies providing regular quotes on life annuities fell from eleven in 1998 to four in 2008 (Brunner & Thorburn 2008; Ganegoda 2007), with the RIWG (2013) also pointing out that almost all retirement income streams come from account-based pensions, across both the retail and industry fund sectors.

The lack of demand for annuities, known as the 'annuity puzzle', is the significant difference between expected annuity purchase behaviour based on a fully rational model, such as that proposed by Yaari (1965), and actual annuity purchase behaviour (DiCenzo et al 2011).

4 Yaari's lifecycle model and conclusions have been challenged, tested, extended and varied by many subsequent researchers. For example, extending the mortality assumption from deterministic, as used by Yaari, to stochastic, as considered by Milevsky et al (2011).

## 2 GENERAL REASONS FOR THE PUZZLE

The US Society of Actuaries (SoA) recently released a comprehensive review of the reasons why people do not purchase annuities to the extent expected (MacDonald et al. 2011).[5] These reasons fell into three main categories:

1. rational decisions arising from personal preferences and circumstances
2. rational decisions arising from environmental limitations
3. decisions arising from behavioural biases.

We summarise the SoA report's main reasons for the annuity puzzle, in tables 1 to 3.

5 This was also more recently published in the *North American Actuarial Journal* (MacDonald et al 2013).

**Table 1: Rational decisions arising from personal preferences and circumstances**

| Reason | Explanation |
|---|---|
| Loss in liquidity | An annuity, once purchased, cannot be cancelled, regardless of financial need. |
| Loss of bequest | Annuitised wealth cannot be left as a bequest as, by design, unused premium subsidises other annuitants in the pool. |
| Benefit to delay | Annuitisation may be delayed to older ages, with the perception that this provides better value or a better price for benefits received. |
| Low risk aversion | Some retirees may be willing to accept a volatile income stream, so less value is placed on the stability offered by an annuity. |
| High personal discount rate (hyperbolic discounting) | Higher priority is placed on some consumption (e.g. travel, or considerations due to health/practical issues prioritised) in the short and medium term, rather than longer term. |
| Short life expectancy | Those in poor health, or perceived poor health, view annuities as expensive. |
| Risk pooling within families | Families (whether couples or intergenerational) can pool their risk, with consequently lower utility to be gained by annuitisation. |
| Confidence in personal financial abilities | Those with high financial literacy are less likely to choose to annuitise and more likely to choose to self-manage their retirement funds. |
| Other sources of guaranteed income | Other guaranteed income streams may be present, such as employer pension plans or social security or both. |
| Illiquid wealth | Some assets may be illiquid (e.g. business ownership) and not easily made available for annuitisation. |
| Discouraging level of income | Low levels of savings may discourage individuals from annuitising as the income stream is perceived as too low to be of any practical use. |
| Debt | A better use of retirement funds may be to pay off immediate debt, rather than consider longer term income streams. |

**Table 2: Rational decisions arising from environmental limitations**

| Reason | Explanation |
|---|---|
| Expensive pricing | The premium exceeds the actuarial present value of the benefits, giving rise to the perception of expensive pricing. |
| Poor financial market environment | Purchasing at a point in time locks in the investment rate assumption prevailing at that point in time. |
| Incomplete annuity market | There may be a mismatch between the desired pattern of payments for consumption purposes and the payments arising from an annuity (for example, level versus decreasing payments, or nominal versus real). |
| Access | In the US the process to purchase an annuity can be complicated and it is rare for retirement savings plans to offer an annuity. |
| Distrust of annuity providers | With no government guarantee, even a minor risk of a provider's default would be expected to have a significant impact on annuity purchases. |
| Sex-distinct mortality assumptions | Annuities are generally priced using sex-distinct mortality tables, so that a male pays less than a female for an equivalent payment stream. This may discourage women from annuitising. Conversely, the introduction of unisex rates would discourage males from annuitising. |
| Tax treatment | The extent of encouragement or discouragement of annuitisation varies significantly across countries according to their taxation policies, but this is often ignored in the literature. |

**Table 3: Decisions arising from behavioural biases**

| Reason | Explanation |
|---|---|
| Decision framing | The annuity decision can be framed as a means to guarantee an income for life (a 'consumption' frame) or an option that could result in loss of all assets due to early death (an investment frame). An example of a pure framing effect in the UK, for example, is that members of defined benefit schemes who receive a pension and a tax-free lump sum appear to be relatively happy with this arrangement, while members of defined contribution schemes who are subject to compulsory annuitisation appear to resent this requirement (Cannon & Tonks 2008). |
| Longevity gamble | Some may view an annuity as a gamble regarding time to death, with the odds in the favour of the insurance company. |
| Perception of insurance | Individuals may perceive insurance as covering "bad" events only, and since living a long time is not considered "bad", the longevity aspect of an annuity is not valued. |
| Absence of comprehensive plans | Rules of thumb or intuition, rather than something more comprehensive, which includes all assets, income sources and potential expenditure, may dominate wealth management plans. |
| Control | Greater control may be perceived in holding wealth rather than receiving income. This is particularly relevant in the context of financial needs varying over time, especially with respect to health-related costs in retirement (Auty 2014). |
| Buyer's remorse | The fear of not getting an optimal price or missing out if changing investment conditions lead to an aversion to annuities. |
| Regret aversion | The possibility of regretting a purchase (through, for example, diagnosis of a fatal disease soon after purchase) is avoided permanently by not annuitising. |
| Misinformation | Most individuals are likely to have little knowledge of how annuities work and the benefits they offer. |
| General financial illiteracy | Even if access to information was readily available and shared, the appreciation of investment and longevity risks is likely to be intangible for many. |
| Individuality | The predominance of individual perceptions and interests rather than collective solutions does not lend itself to the concept of risk pooling in retirement. |
| Default options | Where annuities are not the default option in a pension or savings plan, the choice of annuitising is lessened. |
| Historical view on personal retirement savings | Savings not tied into traditional defined benefit pension schemes may be seen as extra, discretionary wealth, rather than something needed for longevity protection purposes. |
| Other | People are simply averse to thinking about unpleasant events such as dying or being old and poor.<br>People are ignorant of the probability of survival, with most people underestimating how long they are likely to live for (Auty 2014).<br>Procrastination reigns for important decisions: it's easier to do nothing than something. |

The reasons outlined in the SoA report could arguably be extended, to also include the following issues that may apply generally and not necessarily specifically to any one particular context.

**Table 4: Additional reasons for not taking an annuity**

| Reason | Explanation |
|---|---|
| Ambiguity aversion | The familiar is preferred to the unfamiliar. This might also be exacerbated by 'optimism bias', which is akin to 'confidence in personal financial abilities' listed in Table 1 above. |
| Mental accounting | MacDonald et al (2011) also suggest mental accounting as a factor when taking a 'longevity gamble' (see table 3 above), which includes asking whether one will live long enough to make an initial investment worthwhile. Other aspects to mental accounting include (Thaler 1999):<br>1. How situations are perceived—for example, choosing between a 500 mL can of coke for $1.50 and a 1.5 L bottle for $1.75: does the decision depend on a comparison of price and volume, or actual need at the time?<br>2. Assigning certain activities to certain accounts.<br>3. How frequently these separate accounts are evaluated, and whether their separation and intent has a short or long time horizon.<br>Various implications of such categorisation of financial needs may impact how an individual ascertains and assigns value between 'future income' and 'immediate needs'. |
| Peer influence | Many investment decisions are influenced by peer choices (Duflo & Saez 2002), so given that annuities are not popular, negative opinions of others regarding annuity purchases may be influential on potential purchase decisions. This also relates to behavioural biases of 'herding', social norms and groupthink. |
| Conditioning | The focus is usually on option-taking at retirement, but the period to influence annuity purchase is potentially during an individual's working life, as attitudes to annuities may be in place well before retirement (DiCenzo et al 2011). |

## 3 REASONS IN THE AUSTRALIAN CONTEXT

In this section we discuss further some reasons that may add to an understanding of the annuity puzzle, based on some of the factors more specific to the Australian context. We focus on four issues of potential influence: the structure and some regulatory aspects of the Australian system of retirement provision; the perception of expense; issues relating to marketing and distribution of annuities; and societal trends to individualisation.

### 3.1 The Australian System of Retirement Provision

The Australian retirement income system consists of three major pillars:[6]

1. a means-tested Age Pension that is financed from general taxation revenue
2. a mandatory private retirement savings component with minimum employer contributions (9.5% as of 1 July 2014)
3. a voluntary private retirement savings component, with additional contributions made at the discretion of employers or individuals or both.

We highlight two issues that arise from this system – the impact of the Age Pension, and the lack of encouragement for using superannuation and other savings to purchase an annuity.

#### 3.1.1 The impact of the age pension

The Commonwealth of Australia first introduced a means-tested 'flat-rate' Age Pension that was financed from general tax revenue in 1909, paid to men from age 65 and women from age 60, subject to a residency qualification (ABS 1988). Many changes have occurred since then, relating to eligibility criteria, the adequacy or level of payments, and the level of coverage across all those of entitlement age. Such changes have occurred in line with cost pressures, public policy goals and political will, highlighting that the Age Pension is not and is not likely to be a limitless source of outlay for government that is independent of other public needs. In fact, the current means testing of the Age Pension places Australia relatively lightly in terms of Age Pension spending when compared with other OECD countries, especially those whose pensions are based on pre-retirement income (Treasury 2007).

By default, the Australian Government ends up insuring many individuals against longevity risk through the provision of the Age Pension. However, it is not just longevity risk that the Age Pension provides some mitigation against – as Gribble (2012) highlights, additional benefits arising from the fact the pension is government-provided includes the mitigation of investment, inflation, and counter-party risks. As such, it is possible that some 'crowding-out' of the need for annuitisation occurs (RIWG 2013).

However, although the full Age Pension rate provides an income close to a rate that could provide for a modest lifestyle (RWA 2012), it does fall short of what is perceived as a comfortable income according to various measures, such as the Westpac ASFA Retirement Standard and the OECD (2009) poverty threshold. Furthermore, given the observation that many retirees continue to draw on significant assets in retirement, a need for annuitisation of some significance should still be apparent, with any crowding out effects more likely to be applicable for those with lower levels of assets (RIWG 2013).

#### 3.1.2 Lack of encouragement for annuity purchase

The introduction of the Superannuation Guarantee Charge (SGC) in 1992 made the provision of superannuation savings compulsory for virtually all employees. Previously, superannuation was only provided for a more select group, including higher paid white collar staff in large corporations, financial sector employees, public servants and defence force members (APRA 2007). The legislation initially required employers to make tax-deductible superannuation contributions of 3% of salary to their employees, which gradually increased to 9% in 2002–03 (APRA 2007), and again to the current level of 9.5%. The RIWG (2013) highlighted two issues with this system of superannuation savings: first, superannuation is generally framed in terms of wealth accumulation rather than a provision of income; and second, the incentives for the derivation of an annuity income are limited.

In terms of the framing issue, pre-retirement savings and post-retirement planning have tended to be treated separately, so that what an individual sees accruing over their working life is not placed in the context of what that could provide in retirement as an income. This is curious, given that the major aim of the SGC was to provide a mechanism for individuals to fund their retirement (FaHCSIA 2009; IAAust 2009b), which infers the derivation of income. Given this separation, it is perhaps unsurprising that the most popular retirement income product in Australia, an allocated pension, is one in which the policyholder

6 Some industry experts also describe home ownership as a fourth pillar of the Australian system (for example, Knox 2010).

essentially carries both longevity and investment risks.[7]

As well as the issue of 'framing' pillar 2 as a savings scheme, there are or have also been regulatory disincentives to annuitise. For example, the attractiveness of annuities in Australia suffered when their exemption from the Centrelink assets test was phased out between 2004 and 2007 (Korporaal 2011). Additionally, the Actuaries Institute itself has made recommendations to have deferred lifetime annuities, in particular, made more readily available. It has suggested that a deferred lifetime annuity be treated as a pension, so it is exempt from income tax in its payment phase after the deferment period (Actuaries Institute 2012). The RIWG (2013) highlighted that in response to this and other advocacy from various sources, the government has agreed that deferred lifetime annuities would receive the same taxation concessional treatment as other income streams which arise from superannuation.

## 3.2 Pricing and perception of expense

Although it is likely that no single reason can explain the annuity puzzle in a given market, of particular interest is the perception that expense is a barrier to annuity purchase. Indeed, it does seem to be a relatively widely held view that annuities are expensive, or represent poor value for money,[8] and that the demand for annuities is sensitive to pricing (Brown 2008). A further explanation for the annuity puzzle may, therefore, reside in how the supply side of the equation drives the pricing of annuities, with various factors suggested as unsupportive of the marketing and development of more attractive annuity products.

One factor is the size of the Australian market. In terms of potential purchasers, the market is limited in numbers and hence raises difficulties in pooling longevity risk. In terms of the very small number of annuity providers, the lack of competition could potentially lead to monopolistic-type behaviour (Cannon & Tonks 2008). With limited choice, consumers are not able to shop around for options, as would be the case in larger markets, such as the United Kingdom (see, for example, Gosden 2014).

A major influence on pricing is the influence of adverse selection. This occurs when individuals with longer life expectancy, or higher levels of self-perceived health status, are more likely to purchase an annuity than those who have lower life expectancy or perceive themselves as being in poorer health. Given that the insurer has less information about the health status of applicants than the applicants themselves, insurers therefore assume that it is the healthier group that purchases annuities (in a voluntary market) and hence would likely account for this within their pricing. This results in the annuity becoming poorer value for those perceiving themselves to be of poorer health. A cyclical effect can kick in as higher premiums are charged to protect against adverse selection, which in turn deters potential customers and decreases purchases, thus creating an even more select group of purchasers, and so on. The cost of adverse selection in annuity markets in the Australian context is considered significant (Ganegoda 2007).

Another factor relating to mortality is that mortality risk cannot be totally diversified away, no matter how large the exposure is. Systematic mortality improvements are those that impact the entire population, and insurers also have to account and price for this (Brown 2008; Rashbrooke 2008). This may also result in insurers adopting relatively conservative assumptions, which again would increase the premium.

A further factor in pricing and perceptions of expense is the claim that the limited availability of inflation-linked securities and long-term government bonds to match the long-term nature of annuity liabilities is impeding the ability of insurers to hedge inflation, interest rate and longevity risks (Cannon & Tonks 2008). There have been attempts internationally to develop mortality and longevity-based capital instruments to allow successful management of investment and longevity risks in retirement. However, the success of instruments such as mortality and longevity bonds, and mortality swaps has been mixed to date (Blake et al 2006; LIWMPC 2009; Nance et al 2008). It seems that unless relevant capital instruments are developed and available to annuity suppliers, there is likely to be limited potential for annuity market growth in the Australian context.

In terms of the resultant perceived high cost of annuities, many researchers employ the concept of 'money's worth' to quantify the value of an annuity, which is the ratio of the present value of annuity

7 Allocated pensions make up 85% of the retirement income market (IFSA 2007). Colloquially, an allocated 'pension' is so called when it is purchased from superannuation savings (pillar 2), otherwise it is an allocated 'annuity'. There are many reasons to invest in such a product: it allows single premiums from which regular withdrawals can be made to provide an individual with an income; favourable tax treatment applies compared with other products, by providing tax-free earnings on the assets backing the investment and potentially providing a tax-free portion of overall income. Individuals also have flexibility to decide how to invest their funds (IAAust 2009b). Nevertheless, the longevity and investment risks are significant: for example, for a starting retirement savings account balance of $360,000 which is invested in an allocated pension with 30% in domestic equities, Rawlinson and Cater (2008) project a 46% chance that the retirement savings of a 60-year-old male will be depleted by age 86. The seriousness of investment risks has also been highlighted by the recent volatility of equity investments stemming from the global financial crisis (GFC).

8 For example, see Blake (1999), Blight and Longden (2007), Brown (2008), Ganegoda (2007), Harmer (2009), Heijdra and Mierau (2009), Henry (2009), Heyman and Hickey (2007), Mitchell and McCarthy (2002), Orszag (2000), and RIWG (2013).

payments to its current price. A money's worth ratio less than 1 implies that annuitants will receive less in future payments than they pay to buy the annuity, on an expected present value (EPV) basis. This is not only due to the required conservatism around mortality as described above, but also due to the need for insurers to cover expenses, tax, profit and the cost of reserves. Evidence from Australian experience has found money's worth ratios consistent with international norms, the majority of ratios lying between 0.85 and 0.95 for level annuities (Knox 2000). More recent evidence however finds a significant fall in the money's worth of level annuities to between 0.75 and 0.80, and ratios as low as 0.66 for index-linked annuities purchased by males (Ganegoda 2007). It should be noted in this context, too, that arguably it is doubtful whether the public's aversion to annuities would be eliminated, even if the money's worth ratio was much higher. Commonwealth employees, for example, upon reaching preservation age are offered a lifetime pension (in essence an annuity) that has an actuarially fair value of 1.6 times the lump sum value offered. Despite this, almost half of employees opt to take a lump sum (Mercer 2009).

### 3.3 Marketing and distribution

However, all is arguably not lost in terms of generating demand in a situation where an individual has a choice to invest or not invest in an annuity. Indeed, an annuity having an EPV of premiums greater than the EPV of benefits makes it little different from other insurance products. For example, consider a yearly renewable term (YRT[9]) product in terms of its 'money's worth' value. In the Australian market this would typically be in the range of 0.40 to 0.70 after taking into account expenses, profit, commission and tax. Clearly the psychological aspect of paying a regular and relatively small premium versus a large single premium plays a part in comparing the two products, but nevertheless the 'value' of a YRT product is arguably lower than the lower estimate for an annuity, and yet levels of YRT sales are very significant in Australia.

Therefore, when discussing the merits or otherwise of annuities, it might be informative to turn the concept of a 'money's worth' ratio on its head: if an adviser has a client who has been a YRT policyholder, then a comparison of respective money's worth ratios of that product with that of an annuity may help show that a key decision for the client is one of 'value', not necessarily 'expense'. In other words, if the client has been happy to pay YRT premiums for a number of years on a product with a money's worth ratio of 40% to 70%, then informing them of options around an annuity contract with a far higher money worth's ratio may be helpful. Perhaps this could even be more easily presented in the context of a product like a Guaranteed Lifetime Withdrawal Benefit (GLWB), whereby the longevity insurance is paid for via regular fees, thereby slightly circumventing the issue of parting with a large single premium. Indeed, it would be interesting to compare consumers' perceptions of combinations of various ways to pay for longevity insurance, through regular payments for life, regular payments for a fixed term (for example, through a deferred annuity), or payment of a single premium. This may give interesting insights into the trade-offs made by consumers (probably unknowingly) between the 'palatability' of parting with premiums or fees, or both, of a certain magnitude, and the consequent impact on either actual or perceived 'value'.

Nevertheless, if the cost of annuities is indeed perceived as expensive relative to the value embedded in the product, then perhaps a way to encourage annuity sales is to adopt a similar approach as that used for popular risk products (such as YRT). Other than for tax and issues around the entitlement to the Age Pension, two major issues may be highly relevant in the Australian context: the framing of the product and the incentive for the adviser to sell or recommend an annuity. An annuity framed in an insurance context is clearly a different proposition to one framed in an investment context – an interesting study would be to investigate advice and marketing in this regard. Furthermore, have the levels of remuneration for advice or recommendations on annuities been at the required level to encourage this market? Indeed, Macdonald et al (2011) also raise 'seller incentives' as a 'rational decision arising from environmental limitations' (Table 2) and suggest that perhaps annuities also need to be 'sold and not bought'. However, advisers may be averse to sell single premium immediate annuities due to the lack of financial incentives, such as a lack of renewal commission or future asset advice (DiCenzo et al 2011). Yet, it has also been suggested that, in the United States, variable annuities are perceived as being pushed by agents looking for a large commission, which is offputting for consumers (Mills & Mills 2011). Quite clearly the contrapositive and logically equivalent claim that high levels of sales implies that commissions are low is not particularly illuminating, yet in the Australian context the relationship between adviser remuneration and annuity sales has not been explored

9 YRT is a "death only" product that pays out upon the death of the policyholder. The premium paid for YRT increases with age of the policyholder to reflect the increasing probability of death, and the policyholder is guaranteed the right to renew his or her policy without any proof of health as long as the premium is paid (IAAust 2009b).

in great detail. With the Australian financial advisory business moving from a commission-based system to a fee-for-service model (now mandated for new investment products, and for some but not yet all life insurance products), the impact of this regulatory and cultural change on the sales of annuities remains to be seen – but may be particularly enlightening.

### 3.4 Individualisation

A societal trend to greater individualisation may also be a factor in annuity demand being low. Many baby boomers no doubt perceive a push to become more self-sufficient in retirement as their superannuation balances grow and as means tests and age of entitlement for the Age Pension increase, as just two among many trends that suggest a culture of self-interest rather than community interest being paramount. However, self-sufficiency is not necessarily synonymous with having no other help: indeed, many people rely partly on their family to help and provide for them in retirement, given the role of families to provide some pooling of resources in a financial and practical context (MacDonald & Moore 2011). Nevertheless, having to enter into more involved financial decisions and strategies as individuals has also been unwittingly forced upon people through other trends in recent years, including deregulation of the financial services industry and, in particular, the availability of significant sums of money and options for shareholding in demutualised institutions for individuals who have not previously been concerned with such things.[10]

As a result, risk in providing for an individual's retirement has been transferred, by and large, from employers and the government to individuals. This is perhaps even more pointed in the Australian context because of the compulsion, magnitude and growth in superannuation across all employees. The lack of a link between such growth and significant funds with any income derivation as such is, to reiterate an earlier point, potentially a strong conditioning aspect of the system that is not given enough credit. Individuals are not attuned to the concept or worth of pooling mechanisms, particularly for the purposes of income derivation, and familiarity with such mechanisms declines even further as defined benefit superannuation schemes diminish as well. In effect, a push to greater individualisation and self-sufficiency leaves less scope and interest in the collective pooling of financial welfare.

## 4 CONCLUSION

In this paper we have reviewed various reasons that have been suggested for the apparent 'puzzle' that the demand for annuities in voluntary markets falls significantly short of what might be expected. Many of these reasons apply to general contexts that are not specific to any market in particular, but some aspects of these and other potential reasons may be highly relevant in the Australian context. These include the provision of an Age Pension, which provides some mitigation against longevity, investment, inflation and counter-party risks; the nature of Australia's superannuation system, which predominantly focuses on the attainment of savings rather than the provision of a retirement income; a lack of incentive for retirees to annuitise; the perception that an annuity's value is low; issues around marketing and distribution; and implications of societal trends to greater individualisation and self-sufficiency.

With longevity risk, investment risk and inflation risk being tangible and significant factors that retirees should be cognisant of and accordingly plan for, an understanding of these reasons may help inform a stronger market in the future for products that mitigate against these risks.

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10 Others such as John Brogden (CEO of IFSA) have highlighted that "we have had a whole generation of people forced to be investors. We have had a whole generation of people who have had shares arrive in the mailbox through government actions or demutualisations and the like" (Canberra public hearing of 28 August 2009 of the Parliamentary Joint Committee on Corporations and Financial Services, p.57 of transcript at http://www.aph.gov.au/~/media/wopapub/senate/joint/commttee/J12378_pdf.ashx).

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# Life expectancy improvement with a cure distribution for a cause of death

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## ABSTRACT

In many circumstances, the increase in life expectancy when a certain cause of death is eliminated is sought. Traditionally, these calculations have been based on the assumption that the cause in question is simply omitted, which is equivalent to the cause being taken out of consideration, from the outset, with certainty. In this paper, we propose continuous and discrete models whereby a probability distribution for the cure of a specific cause of death over time can be incorporated so as to more accurately predict the increase in life expectancy. The theoretical results are applied to a real data set involving HIV-related deaths from the State of Colorado, United States of America, between the years 2000 and 2012.



## KEYWORDS

life expectancy, multiple decrement, hazard function, cure distribution, mixture model, survival analysis

## 1 INTRODUCTION

Modelling the increase in life expectancy when a certain decrement[1] is eliminated is an important actuarial indicator and, as noted by Beltran-Sanchez et al (2008), is also an active area of demographic research in general. Actuaries, statisticians, demographers, engineers, sociologists, and econometricians all employ this concept when assessing the degree of influence certain causes of death (or failure, in a broader context) have on different populations (be they biological or not). The topic has been addressed in the literature from a wide array of different perspectives. Manuel et al (2003) consider the issue of cause-deleted life expectancy that is modified to reflect what they call *health-related quality of life factors*. Somerville & Francombe (2005) study the elimination of heart disease and cancer on mortality, as well as some of the accompanying consequences for life insurance. Mackenbach et al (1999) investigate the gains in life expectancy after a cause of death is removed in light of the effect of related competing causes of death, and tackle several issues involved in the modelling and interpretation of these gains in life expectancy. Lai et al (1997) specifically consider the expected lifetime gains from the elimination of the human immunodeficiency virus (HIV), or HIV/AIDS. In Section 5 of this present article, a case study will be provided that applies the subsequent theory to a data set consisting of HIV-related deaths from the state of Colorado, USA, between the years 2000 and 2012 inclusive.

The concept of a *cause-deleted life expectancy improvement* (CDLEI), as found in Brown (1997) and Adamic (2008), is a statistic designed to quantify the increase in life expectancy if a certain cause of death is removed. The traditional approach to calculating the CDLEI is to remove the deaths caused by the failure in question from the life table (using an assumption or two, such as uniform distribution of decrements, or UDD, and mutual independence between risks, as these random variables are not directly observable) and then to recalculate the life expectancies. One of the main drawbacks of this approach is that it is an either-or proposition: either the cause of death is allowed to remain perennially present, or it is taken out of consideration completely from the outset. Neither of these two extremes will necessarily correspond well with reality. To remedy this impasse, we will propose models that will incorporate a probability distribution for the cure of the cause in question over time.

Accounting for a possible cure in cause-deleted life expectancy calculations has several real-world applications. For example, if all of the life expectancies are known for each age, it is a fairly straightforward task to construct the entire life table from that information alone. Thus, if there are reasons to surmise that life expectancies will increase due to the emerging possibility of a cure for one or more causes of death, a new life table can be immediately created to reflect this reality. This could, for example, be beneficial for pricing insurance or annuity products, or both, in a competitive insurance industry so that the respective premiums reflect the most up-to-date information. Another application would be calculations related to the funding of pension plans. Furthermore, if the cure probability is directly related to a decrement involved in a specialised line of insurance (such as critical illness insurance), the benefits from incorporating the probability of cure can be even more pronounced. In short, any actuarial application that utilises a life table (single or multiple decrement) or a morbidity table could benefit from more accurate and current table values by incorporating cure models.

Another example can be found in public health initiatives. Suppose a decision has to be made by public health officials regarding which cause of death should be granted research funding for a cure (and for how long). Although the cure of one risk, say cancer, would produce a life expectancy improvement well above a risk such as HIV/AIDS (since cancer accounts for so many more deaths), it may be the case that AIDS research has shown far more promising results in the interim than cancer research. This could very well imply that a cure for AIDS is substantially more likely than for cancer. If that were true, then a model that accounts for this would provide for a better basis of comparison between the two proposals in terms of expected lifetime gains. These provisions would be useful to the insurance industry as well, either if the insurance company (or companies) are overseeing the research themselves, or if, as is often the case, they are working in tandem with researchers in the health sciences.

It should be noted from the outset that our approach to modelling the cure of the cause itself is quite distinct from what is known as cure *modelling*, which is well established in the survival literature. For example, Tsodikov (1998, 2001) espouses a parametric cure model to estimate the proportion of long-term survivors. Dickman et al (2004) consider regression models pertaining to relative survival. Li & Taylor

1 In this paper, we will use the terms decrement, cause, competing risk and risk interchangeably and treat them as being mutually equivalent.

(2002), Lu & Ying (2004), and Lu (2008) consider semi-parametric cure models, with Peng & Dear (2000) proposing a nonparametric mixture model. Overviews of various cure models utilised to date can be found in Friis & Chernick (2003) and Othus et al (2012). The subdiscipline of *cure fraction analysis* (cf. Lambert 2007; Andersson et al 2011) also attempts to model survival based on the proportion cured as derived from an actual data set. Generally speaking, however, we may state that all of these methods involve fitting models, be they parametric or not, regression based or not, to data sets that include the actual times for which the subjects involved never experience the event of interest (Lu 2010). But these methods are all different from modelling the probability of a cure of the cause of death itself, which, although much more difficult to do, is necessary in order to ultimately calculate the improved CDLEI.

Attempting to model an entire distribution for a future cure that has not yet occurred, is, admittedly, a task that is difficult and inherently imprecise. We may address this concern from a variety of different perspectives. First we note that, despite the difficulty inherent in the task, the revised CDLEI calculation allows for the possibility of a better estimator of the true CDLEI than when it is assumed a cure is certain and applied immediately. In other words, more information can be utilised. Second, experts in the field may be privy to knowledge regarding progress made for a specific risk, how long it took other risks at a similar stage of development to realise a full cure, or even the likelihood of a patent (or some other criteria) being approved to treat the particular risk (if the research has already progressed to that stage). The superiority of the new CDLEI estimator will very much depend on the nature and the quality of the information that is available regarding a cure. Third, it is entirely possible that a complete distribution for the time until cure need not be specified very precisely anyway: rather, a range of values for the cure distribution parameters may emerge within which, or outside of which, the CDLEI is not likely to change much. Or, as in the case where a comparison needs to be made (such as in the cancer/HIV example above), it may suffice to estimate the relative cure (analogous to the concept of *relative risk* in survival analysis) between the decrements instead of having to completely specify two distinct distributions.

Although the general results that are derived in this paper do not assume any specific distribution for the cure, we will find it opportune to focus on the implementation of a "memoryless" distribution of cure over time: that is, one that exhibits an exponential form. There are at least four salient advantages for this assumption: first, a simple function that makes calculations (integrations specifically) easier; second, the presence of only one parameter, which makes it easier to assess how sensitive the CDLEI is to changes in the parameter value and therefore the probability of a cure; third, makes it easier for experts in the field to express their best predictions for when a cure is most likely; and fourth, an asymptotic distribution that reflects the fact that a cure may never actually be realised. At worst, an exponential assumption might lead to a CDLEI figure that is slightly too conservative. However, we believe this assumption to be mild compared with the typical independence assumptions between risks (which is maintained here as well).

## 2 PRELIMINARY DEFINITIONS AND NOTATION

The purpose of this section is to furnish a concise nomenclature so as to provide a reference for theory expounded in subsequent sections, as well as to make the paper more self-contained.

We begin by defining $T$ to be the future lifetime random variable for a subject who is currently age $x$. The probability of death (or, more generally, failure) at any future time $t$ can be described using a continuous probability density function (PDF) of $f(t)$, where $f(t) = P(T = t)$ and $T$ is the future lifetime after age $x$. The *hazard function* (or *hazard rate* or *force of mortality*) at time $t$ will be denoted by $h_x(t)$ or simply $h(t)$, as appropriate. Let ${}_tp_x = P\{\text{survival to time } (t+x) \mid \text{subject is currently age } x\}$ and let ${}_tq_x = P\{\text{death prior to time } (t+x) \mid \text{subject is currently age } x\}$. By the Law of Complement, ${}_tp_x = 1 - {}_tq_x$. When $t = 1$, it is customary to omit the subscript. Thus, for example, ${}_1p_x = p_x$. The following standard relationships are also given without proof:

$$h_x(t) = \frac{f(t)}{{}_tp_x}, \qquad {}_tp_x = e^{-\int_0^t h_x(u)du}, \qquad {}_tp_x = \prod_{i=x}^{x+t-1} p_i,$$

for $0 \le t \le \omega - x$, if it is necessary to assume that the life table ends by age $\omega$. In this case, $S(\omega) = 0$. When the failure time random variable is continuous, $\omega$ is often replaced with infinity.

Cause-deleted life calculations require the use of multiple decrement theory and notation. A superscript in brackets will be used to identify which specific risk is being considered. For example, $h_x^{(j)}(t)$ would represent the hazard rate for risk $j$ at time $x + t$, given a current age of $x$. Again, we will sometimes drop the subscript $x$ for notational convenience, but it will always be assumed that time starts at age $x$. Also note the implicit assumption that only one distinct cause can be responsible for any particular death. This assumption is germane to all of the theory presented in this paper. The negation of $j$, denoted $-j$, will refer to all risks other than $j$. The superscript $\tau$ will be used to represent the set of all of the risks taken together, in aggregate. For example, ${}_tp_x^{(\tau)}$ would represent the probability of surviving all risks up to time $t$. The following standard relationships are also given without proof:

$$h_x^{(j)}(t) = \frac{f(t,j)}{{}_tp_x^{(\tau)}}, \qquad h_x^{(\tau)}(t) = \sum_i h_x^{(i)}(t) = h_x^{(-j)}(t) + h_x^{(j)}(t), \qquad {}_tq_x^{(\tau)} = \sum_i {}_tq_x^{(i)},$$

where $f(t, j)dt \approx P\{(t < T \leq t + dt) \cap (J = j)\}$ and where $j$ is one of the $i$ competing risks. For example, ${}_tq_x^{(j)}$ would represent the probability of failure for some subject aged $x$ prior to time $x + t$ by cause $j$ in the multiple risk forum.

The *complete life expectancy* (or simply the life expectancy) for an individual currently aged $x$ quantifies the number of years the individual is expected to survive beyond $x$. This life expectancy will be denoted by $\mathring{e}_x$, with

$$\mathring{e}_x = E[T] = \int_0^{\omega-x} t \cdot f(t)\, dt = \int_0^{\omega-x} t \cdot {}_tp_x \cdot h_x(t)\, dt = \int_0^{\omega-x} {}_tp_x\, dt,$$

where the last expression can be derived using a simple recursive formula (cf. Bowers et al 1997).

If the calculations are being carried out in the discrete setting, we would use the *curtate life expectancy*, denoted $e_x$. The curtate life expectancy quantifies the number of full years the subject is expected to survive beyond age $x$. If R denotes the future lifetime in full years only, then the standard results are:

$$e_x = E[R] = \sum_{r=1}^{\omega-x-1} r \cdot {}_rp_x q_{x+r} = \sum_{r=1}^{\omega-x-1} {}_rp_x.$$

To calculate the life expectancy when cause $j$ is deleted, we use the well-known formula,

$$\mathring{e}_x^{(-j)} = \int_0^{\omega-x} {}_tp_x'^{(-j)} dt,$$

where ${}_tp'^{(-j)}_x$ is the "associated" survival function if cause $j$ is eliminated as a competing risk, which can be expressed in terms of the cause-deleted hazard function:

$${}_tp_x'^{(-j)} = \exp\left(-\int_0^t h_x^{(-j)}(u)\, du\right).$$

Following the notation of Brown (1997), when cause $j$ is eliminated, the CDLEI for any age $x$ equals $\mathring{e}_x^{(-j)} - \mathring{e}_x$ in the continuous realm, or $e_x^{(-j)} - e_x$ in the discrete context. We emphasize here that a CDLEI calculation assumes that each of the multiple decrements are independent of one another, or, at a minimum, that the decrement being deleted is independent of all other decrements. If this were not the case, and the cause being deleted was highly correlated with some other decrement(s), then the gain in life expectancy could potentially be higher than calculated.

## 3 CONTINUOUS TIME MODEL

We begin by defining a new random variable, $T_c$, to be the future cure time of risk $j$. By cure, we mean that risk $j$ is no longer a potential candidate risk that can be responsible for failure. Note that the time until cure can itself be described using a survival function, since we would be modelling the time until some event of interest, in this case cure, occurs. Let $\tilde{F}(t) = P(T_c \leq t)$. As such, $\tilde{F}(t)$ would quantify the probability that a cure has been found for cause $j$ by time $t$. The complement of $\tilde{F}(t)$ could be $\tilde{S}(t)$, the probability of "surviving" (in this case, evading) the cure event up to time $t$.

With the probability distribution for the cure of cause $j$ specified, we can define a new hazard function for this process. The new hazard function, $h^*(t)$ say, must be a mixture of the hazard function without $j$, $h^{(-j)}(t)$, with the hazard of all risks, $h^{(\tau)}(t)$, as follows:

$$h^*(t) = \tilde{F}(t)h^{(-j)}(t) + \left[1 - \tilde{F}(t)\right] h^{(\tau)}(t), \tag{1}$$

since $\tilde{F}(t)$ is the probability that cause $j$ is in a cure state at the future time $t$. For simplicity, we suppress the subscript $x$ for the hazard terms, as time is implied to begin at age $x$. Equation (1) is an exact relationship, although the actual $\tilde{F}(t)$ that is chosen will depend on what assumptions are employed regarding the probability of cure. This equation is also intuitive. As $\tilde{F}(t) \to 0$, the probability of cause $j$ being cured tends to zero, with the result that $h^*(t) \to h^{(\tau)}(t)$. Furthermore, as $\tilde{F}(t) \to 1$, the probability of cause $j$ being cured tends to one, with the accompanying result that $h^*(t) \to h^{(-j)}(t)$, as it should. In general, we may summarise by stating that $\tilde{F}(t)$ represents the probability at any future time point $t$ that cause $j$ will no longer be a candidate for the cause of failure, as well as the degree to which $h^{(-j)}(t)$ is a more accurate reflection of the new hazard versus $h^{(\tau)}(t)$.

Equation (1) may be expressed in several equivalent ways, depending on which form is more appropriate. Since $h^{(\tau)}(t) = h^{(j)}(t) + h^{(-j)}(t)$, it follows that,

$$h^*(t) = \tilde{F}(t)\left[h^{(\tau)}(t) - h^{(j)}(t)\right] + \left[1 - \tilde{F}(t)\right] h^{(\tau)}(t), \text{ or}$$

$$h^*(t) = h^{(\tau)}(t) - \tilde{F}(t)h^{(j)}(t). \tag{2}$$

Equation (2) is particularly helpful when the distribution of $-j$ is not known. However, our experience has suggested that it is somewhat easier to work with $\tilde{S}(t)$ rather than $\tilde{F}(t)$ when performing integrations. As such,

$$h^*(t) = \left[1 - \tilde{S}(t)\right] h^{(-j)}(t) + \tilde{S}(t)\left[h^{(-j)}(t) + h^{(j)}(t)\right], \text{ or}$$

$$h^*(t) = h^{(-j)}(t) + \tilde{S}(t)h^{(j)}(t), \tag{3}$$

might prove to be a better option, depending on the situation and what information is available.

The revised life expectancy can now be determined. For any age $x$ and cumulative probability distribution of cure $\tilde{F}(t)$, the following sequence of arguments engender a single equation for the revised CDLEI for any age $x$:

$$\mathrm{CDLEI}(x) = \mathring{e}_x^* - \mathring{e}_x,$$

$$= \int_0^{\omega-x} e^{-\int_x^{x+t} h^{(\tau)}(u) - \tilde{F}(u)h^{(j)}(u)du} dt \;-\; \int_0^{\omega-x} e^{-\int_x^{x+t} h^{(\tau)}(u)du} dt,$$

$$= \int_0^{\omega-x} e^{-\int_x^{x+t} h^{(\tau)}(u)du} \cdot e^{\int_x^{x+t} \tilde{F}(u)h^{(j)}(u)du} \;-\; e^{-\int_x^{x+t} h^{(\tau)}(u)du}\, dt,$$

$$= \int_0^{\omega-x} {}_tp_x^{(\tau)} \cdot \left(e^{\int_x^{x+t} \tilde{F}(u)h^{(j)}(u)du}\right) \;-\; {}_tp_x^{(\tau)}\, dt.$$

We may rearrange this last expression to make it more compact and state our first primary result:

$$\mathrm{CDLEI}(x) = \int_0^{\omega-x} {}_tp_x^{(\tau)} \cdot \left(e^{\int_x^{x+t} \tilde{F}(u)h^{(j)}(u)du} - 1\right) dt \tag{4}$$

Apart from the various functions in the integrand satisfying basic regularity conditions, Equation (4) is completely generic. However, we will find it useful to also consider a few simplifying assumptions. The first pertains to the probability of cure for the decrement in question.

### 3.1 Force of cure assumption

*Assume there is a constant force of cure, $\lambda > 0$; for cause j at each and every time point.*

In other words, the force of cure for cause *j* is a constant hazard function. Under this assumption, the probability of cure over time follows the classic memoryless property of the exponential distribution.

For example, suppose a researcher wishes to postulate that there is a 40% chance of a cure for cause *j* over the next 20 years. Since the CDF of the exponential is $F(t) = 1 - e^{-\lambda t}$, a reasonable value for $\lambda$ in this context would be: $4 = 1 - e^{-20\lambda}$; which solves for $\lambda = 0.02554$.

### 3.2 Proportional hazard assumption

*Assume that the hazard rate for cause j is proportional to the hazard rate for all risks taken collectively for all future time points. Symbolically, this means that:*

$$\frac{h^{(j)}(t)}{h^{(\tau)}(t)} = m, \;\; \forall\, t.$$

In this case, it follows from Equation (2) that,

$$h^*(t) = h^{(\tau)}(t) - \tilde{F}(t) m h^{(\tau)}(t), \;\; \text{or}$$

$$h^*(t) = h^{(\tau)}(t)\left[1 - m\tilde{F}(t)\right]. \tag{5}$$

This assumption is sometimes called Chiang's (1961) proportional hazards assumption, although it is often applied in only a piecewise fashion over each time interval. Gupta (1981) provides useful details regarding this assumption, with Bongaarts & Feeney (2003) illustrating some of its importance in modern applications. The presupposition here that the hazards are proportional for all *t* is fairly strong, and so it should first be verified that the assumption is not seriously violated before applying it. This assumption does not really help to make the integrations of Equation (4) any easier, but it does have the advantage that only one distribution has to be fit instead of two. The case study at the conclusion of this paper will demonstrate why this is an important point.

## 4 DISCRETE TIME MODEL

In this section, we develop a discrete time cure model for the CDLEI. In this discrete context, we assume a memoryless model with a constant probability of cure $k$ used geometrically for each future year, but applied at the *beginning* of each year for the sake of mathematical convenience. Thus, for the first year, there would be a probability of $k$ for a cure for cause $j$. For the second year, there would be a cumulative probability of cure of $k + (1 - k)k$, for the third year, $k + (1 - k)k + (1 - k)^2k$, and so forth. A succinct way to summarise the cumulative probability of cure, which can be denoted $\ddot{F}(t)$ in the discrete case, would be to use a simple recursion:

$$\ddot{F}(t) = (1-k)^t k + \ddot{F}(t-1), \text{ for } 0 \le k \le 1, \ t = 0, 1, 2, \ldots \tag{6}$$

with $\ddot{F}(-1)$ defined to equal 0. Now, for any future year $t$ beyond age $x$ (recalling the simplifying assumption that the cure event is applied at the beginning of the year), the revised probability of survival, $p^*_{x+t}$, will be a mixture of the probability of survival due to all causes other than $j$ and all causes taken collectively, as follows:

$$\begin{aligned} p^*_{x+t} &= \ddot{F}(t) p'^{(-j)}_{x+t} + [1 - \ddot{F}(t)] p^{(\tau)}_{x+t} \\ &= \ddot{F}(t) \left( p^{(\tau)}_{x+t} \right)^{q^{(-j)}_{x+t}/q^{(\tau)}_{x+t}} + p^{(\tau)}_{x+t} - \ddot{F}(t) p^{(\tau)}_{x+t}, \\ &= p^{(\tau)}_{x+t} + \ddot{F}(t) \left[ \left( p^{(\tau)}_{x+t} \right)^{q^{(-j)}_{x+t}/q^{(\tau)}_{x+t}} - \ p^{(\tau)}_{x+t} \right], \end{aligned}$$

using a standard result when assuming uniform distribution of decrements over each year (cf. Adamic 2008). Note that it is initially necessary to use the $p'^{(-j)}_{x+t}$ term, since if there is a cure for cause $j$, it is no longer allowed to compete with all of the other risks for the $t^{th}$ year and beyond. Since the expected curtate future lifetime is

$$e_x = \sum_{t=1}^{\omega-x-1} {}_tp_x = \sum_{t=1}^{\omega-x-1} \left( \prod_{i=x}^{x+t-1} p_i \right),$$

it follows that the cause-deleted life expectancy improvement at age $x$ is,

$$e^*_x - e_x = \sum_{t=1}^{\omega-x-1} \left\{ \prod_{i=x}^{x+t-1} \left( p^{(\tau)}_i + \ddot{F}(t) \left[ \left( p^{(\tau)}_i \right)^{q^{(-j)}_i/q^{(\tau)}_i} - \ p^{(\tau)}_i \right] \right) \right\} - \sum_{t=1}^{\omega-x-1} {}_tp^{(\tau)}_x,$$

which can be re-expressed in a way that is perhaps more convenient when calculations are carried out on a spreadsheet:

$$e^*_x - e_x = \sum_{t=1}^{\omega-x-1} \left\{ \prod_{i=x}^{x+t-1} \left( p^{(\tau)}_i + \ddot{F}(t) \left[ \left( p^{(\tau)}_i \right)^{q^{(-j)}_i/q^{(\tau)}_i} - \ p^{(\tau)}_i \right] \right) - \prod_{i=x}^{x+t-1} p^{(\tau)}_i \right\}. \tag{7}$$

Equation (7) is particularly useful when data are already in the form of a life table where decrement probabilities are given for each age and when there is no need to fit a parametric model.

## 5 CASE STUDY

In this section we illustrate the models proposed in this paper using a real data set. The data set gives the number of deaths (at each age) that result from contracting the human immunodeficiency virus (HIV) for the citizens of Colorado, USA, between the years 2000 and 2012 inclusive. The data were obtained from the Colorado Department of Public Health and Environment. Although the data are available for each age, in the interest of space, we present it here in decennial intervals only. The data are summarised in Table 1. Some ages have such a small number of deaths that the results were not made available for reasons of anonymity. A noteworthy statistic is that HIV-related deaths in this data set account for 0.25% of the total number of deaths, or 1 in every 400.

**Table 1: Summary of the Colorado HIV data**

| Age interval | No. of deaths | No. of HIV caused deaths |
|---|---|---|
| 0–9 | 6,697 | ns |
| 10–19 | 3,242 | ns |
| 20–29 | 7,870 | 37 |
| 30–39 | 10,506 | 213 |
| 40–49 | 22,887 | 422 |
| 50–59 | 39,286 | 225 |
| 60–69 | 51,575 | 56 |
| 70–79 | 79,594 | 12 |
| 80–89 | 111,906 | ns |
| 90–99 | 53,991 | ns |

ns: negligibly small number

To model the CDLEI for these data, we will employ three different approaches. First, we will fit two continuous parametric distributions to the associated survival functions of *j* and –*j*. Second, we will fit one continuous parametric distribution to the associated survival function of all risks, while assuming proportional hazards. Last, we will fit the non-parametric discrete model outlined in Section 4. The first two approaches turn out to be inappropriate for this data set, and are provided primarily for illustrative purposes. The non-parametric model is appropriate and produces good estimates of the CDLEI.

The first approach is to fit two continuous parametric distributions to the associated survival functions of *j* and –*j*, using a UDD assumption over each age interval. The specific parametric form we will use to model survival will be that of a bivariate Gompertz Distribution, which is an important distribution used to describe the pattern of adult deaths (Gavrilov & Gavrilova 1991). Also, Kunimura (1998) is a useful reference on how to derive parameter estimates for a Gompertz Distribution.

To estimate the CDLEI, Equation (3) will be used in addition to the following three parametric assumptions:

$$1:\ \tilde{F}(t) = 1 - e^{-\lambda t},\ \text{for } t \geq 0, \lambda > 0$$

$$2:\ h^{(-j)}(t) = e^{\alpha+\beta t},\ \text{for } t \geq 0, -\infty < \alpha < \infty, \beta > 0$$

$$3:\ h^{(j)}(t) = e^{\gamma+\theta t},\ \text{for } t \geq 0, -\infty < \gamma < \infty, \theta > 0,$$

where $\alpha$ and $\gamma$ are shape parameters and $\beta$ and $\theta$ are scale parameters (note that $\omega = \infty$). We first need to solve the following integral:

$$\begin{aligned}\int_x^{x+t} h^*(u)du &= \int_x^{x+t} e^{\alpha+\beta u} + e^{\gamma+\theta u}\cdot e^{-\lambda u}du \\ &= \int_x^{x+t} e^{\alpha+\beta u}du + \int_x^{x+t} e^{\gamma+(\theta-\lambda)u}du \\ &= \frac{e^{\alpha}}{\beta}e^{\beta u}\Big|_x^{x+t} + \frac{e^{\gamma}}{\theta-\lambda}e^{(\theta-\lambda)u}\Big|_x^{x+t} \\ &= \frac{e^{\alpha+\beta x}}{\beta}\left(e^{\beta t}-1\right) + \frac{e^{\gamma+(\theta-\lambda)x}}{(\theta-\lambda)}\left(e^{(\theta-\lambda)t}-1\right)\end{aligned}$$

Let $A(x) = \frac{e^{\alpha+\beta x}}{\beta}$ and $B(x) = \frac{e^{\gamma+(\theta-\lambda)x}}{(\theta-\lambda)}$. Then, the revised life expectancy with a force of cure of λ for the HIV cause of death is,

$$\mathring{e}_x^* = \int_0^{\infty} e^{A(x)\left(1-e^{\beta t}\right)+B(x)\left(1-e^{(\theta-\lambda)t}\right)}dt.$$

A closed form expression for this integral is not available and so it will need to be computed via numerical integration. Evaluating the integral for select values of λ with $x = 0$ provides for the plot of Figure 1.

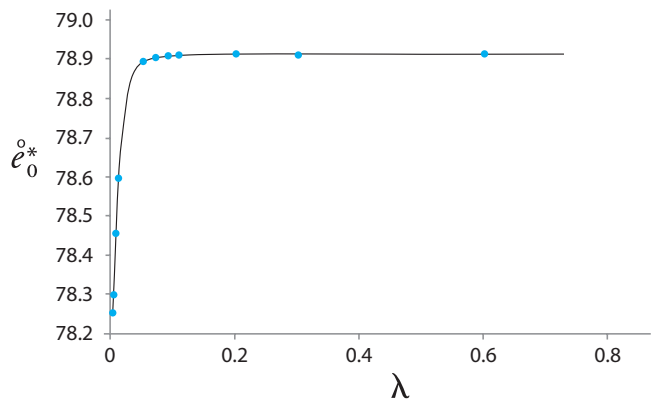


**Figure 1: Life expectancy for different λ (two Gompertz).**

Several attributes of Figure 1 are revealing. First, note that the predicted life expectancy from birth is 78.2557, and increases to 78.9134 if HIV were immediately eliminated as a possible cause of death. Second, notice how rapidly the maximum CDLEI is reached. When λ reaches a value of about 0.05, the life expectancy from age 0 essentially reaches its maximum and will not appreciably increase with a larger force of cure above this value. A value of 0.05 for λ would correspond to statements such as:

- about an 80% chance of a cure within the next 32 years
- about a 50% chance of a cure within the next 14 years.

These statements may seem entirely plausible to experts in HIV research. If that were true, then it would be justifiable to use the traditional cause-deleted approach of simply taking this cause of death out of consideration. If these two statements are deemed overly ambitious, then the CDLEI will very much depend on what value of  is chosen.

One drawback of the preceding model was that two Gompertz curves were fit to the data: one to model the failures of cause *j* (the HIV cause) and the other to model the failures due to all other causes, –*j*. Since the

number of HIV-related deaths is so small compared with all non HIV deaths, the CDLEI that is obtained will be extremely sensitive to the quality of the respective fits. Fitting a two-parameter distribution in this case may mask the unique "HIV effect", since this effect is so small. This appears to be the case here, as a maximum CDLEI of 0.6577 years is much too large. This figure reflects more the differences in the model fits, rather than the unique contribution of potential HIV omission.

Another approach would be to assume proportional hazards while using a Gompertz Distribution. The advantage of this approach is that only one distribution needs to be fit to the data, which can greatly help to reduce the potential for competing model fits to mask the real changes brought about by a different force of cure. However, a cursory inspection of Table 1 reveals that a proportional hazards assumption would not be ideal: most of the HIV-related deaths are in the age 30 to age 70 range, and are virtually non-existent outside of this range. Nevertheless, for illustrative purposes, we can use an equation such as Equation (5) and assume proportional hazards. The data suggested a proportionality constant of $\hat{m} = 0.0056$. The results are shown in Figure 2.

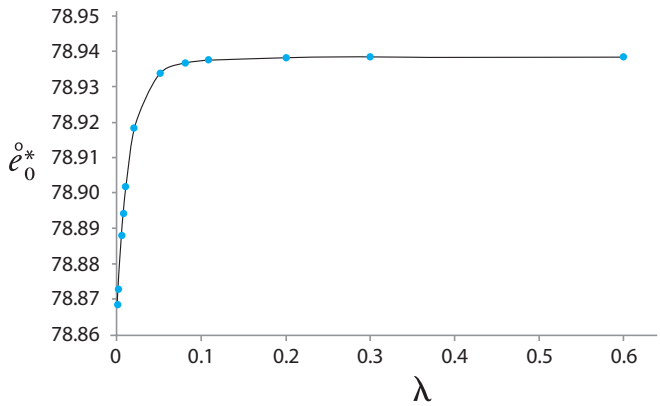


**Figure 2: Life expectancy for different λ (one Gompertz, $\hat{m} = 0.0056$).**

A juxtaposition of Figures 1 and 2 highlights two main differences. First, the CDLEIs obtained for the second model, as shown in Figure 2, are much smaller and far more realistic for a cause of death that only accounts for 1 in 400 deaths. This can be appreciated by considering the relative magnitude of the values found on the vertical axis. Second, the curve reaches its peak at a higher value for , much closer to 0.1. This also seems more plausible than what was suggested by the first model. In summary, although the proportional hazards assumption is not valid, the resulting model fit brought the CDLEI values much closer to the correct range, owing greatly to the fact that only one distribution fit was required.
The final model to attempt is the discrete model and the use of Equation (7). The use of this model is entirely appropriate, as the number of deaths related to HIV, the total number of deaths from all causes, and the mid-year populations are all available by age. Figure 3 shows the results.

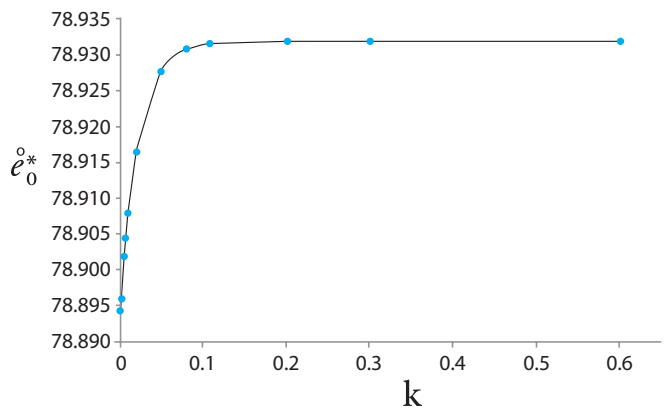


**Figure 3: Life expectancy for different *k* (discrete model).**

The third model shows that the CDLEI approaches its maximum as $k$ nears 0.1. A value of 0.08, say, for $k$ would correspond to statements such as the following:

- about an 80% chance of a cure within only the next 19 years
- about a 50% chance of a cure within only the next eight years.

These time frames are more stringent than the ones obtained for the first model. However, they may still be considered plausible by experts in the field. Table 2 summarises the results for our final model at select ages for different values of $k$. Although plots analogous to Figures 1 to 3 could be made for ages other than 0, we believe that comparisons should be done at age 0 rather than at any other age so that the potential benefits of a cure would apply to the largest possible set of people. However, there may be special circumstances when it might make sense to use a different age as the reference point.

**Table 2: Life expectancy results for different *k* (discrete model)**

| $\mathring{e}^{*}_{x}$ | $k = 0$ | $k = .02$ | $k = .07$ | $k = max$ |
|---|---|---|---|---|
| $\mathring{e}^{*}_{0}$ | 78.8943 | 78.9166 | 78.9303 | 78.9321 |
| $\mathring{e}^{*}_{10}$ | 69.5059 | 69.5249 | 69.5402 | 69.5439 |
| $\mathring{e}^{*}_{20}$ | 59.7404 | 59.7552 | 59.7708 | 59.7785 |
| $\mathring{e}^{*}_{30}$ | 50.2428 | 50.2525 | 50.2657 | 50.2786 |
| $\mathring{e}^{*}_{40}$ | 40.7588 | 40.7634 | 40.7707 | 40.7837 |
| $\mathring{e}^{*}_{50}$ | 31.6314 | 31.6329 | 31.6354 | 31.6410 |
| $\mathring{e}^{*}_{60}$ | 22.9844 | 22.9848 | 22.9854 | 22.9870 |
| $\mathring{e}^{*}_{70}$ | 15.1174 | 15.1175 | 15.1176 | 15.1180 |
| $\mathring{e}^{*}_{80}$ | 8.7031 | 8.7031 | 8.7031 | 8.7032 |
| $\mathring{e}^{*}_{90}$ | 5.2190 | 5.2190 | 5.2190 | 5.2190 |

## 6 CONCLUSION AND FUTURE WORK

In this paper we have proposed continuous and discrete time models that can incorporate a distribution for the probability that a cure for a specific cause of death can be realised over time, for the purpose of estimating a more accurate cause-deleted life expectancy improvement. Despite the fact that it is difficult to model a cure event that has not yet happened, the proposed methodology is a vast improvement over the prevailing practice of simply assuming the cause in question is removed with certainty. Various factors, including stage of development in research for a cure, interim successes, and even the overall amount of scholarship that is being invested in the cure of a specific cause of death, can all influence the postulated probability of a cure that experts in the field could realistically consider.

There are a couple of avenues of research that flow from this present work. First, a natural extension of the theory presented in this paper would be to generalise the results for more than one cause of death, with unique cure distributions for each cause. Although not as important in the public health realm, this could be particularly advantageous for actuaries and others who are interested in constructing life tables based on the latest cure research. Another important enhancement to the theory presented thus far would be to consider cases where there is a "partial cure". By partial cure, we mean that there are treatments available that prolong life, even though a full cure is not yet realised. A partial cure will translate into a higher life expectancy, effective immediately. As noted by Manton et al (1980), a cause-delay model provides a mechanism for incorporating the likely effects of medical innovation on survival, and this could prove useful for computing a superior CDLEI statistic. Finally, incorporating a cure distribution when the causes of death themselves are mutually dependent would be a valuable enhancement. Indeed, there has been a good deal of contemporary research utilising copula-based dependent competing risks models (cf. Zheng & Klein 1995; Somerville & Francombe 2005; Lo & Wilke 2010), sometimes specifically dealing with the gains from cause elimination (cf. Dimitrova et al 2013).

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**Acknowledgements**
I wish to thank Dr Bruce Jones, FSA, FCIA, from Western University, Canada for his suggestions. The numerical integrations were performed online using the definite integral calculator found at www.wolframalpha.com. I am most thankful to *WolframAlpha* for providing this excellent resource!

# Repercussions: the impact of the AIG crisis on its insurance subsidiaries

SHAUNA FERRIS

Shauna Ferris


## ABSTRACT

Numerous studies have shown that insurance companies can be adversely affected by problems at a parent company or an affiliate – indeed, over the years, affiliate-related problems have been severe enough to cause the insolvency of many insurance companies. This paper provides a case study of affiliate risk, based on the experience of insurance companies that were part of the American International Group, Inc (AIG) during the global financial crisis of 2007/08. This case study raises many questions about the effectiveness of risk management and prudential supervision of large, complex, financial conglomerates.



## KEYWORDS

systemic risk, affiliate risk, liquidity risk, AIG, global financial crisis, GFC


AJAP 2015; 3: 71–91

## 1 INTRODUCTION

Numerous studies have shown that insurance companies can be adversely affected by problems at a parent company or an affiliate – indeed, over the years, affiliate-related problems have been severe enough to cause the insolvency of many insurance companies.[1]

This paper provides a case study of affiliate risk, based on the experience of insurance companies that were part of the American International Group, Inc (AIG) during the global financial crisis of 2007/08.

In September 2008, the US government announced an $85 billion bailout of American International Group, Inc. (AIG). Over the next few months, the size of the bailout increased to about $180 billion.[2]

At that time, AIG was one of the largest companies in the world, with over $1 trillion in assets, and more than 76 million customers spread across 130 different countries. The parent company had about 230 subsidiaries, including life insurance companies, general insurance companies, asset management companies and other financial services providers (COP 2010: 255). As shown in Figure 1, the insurance companies provided more than 90% of AIG's net revenue.

However, AIG's business activities also included the Financial Products Group (AIGFP). In the years leading up the Global Financial Crisis, the Financial Products Group had built up an enormous portfolio of credit default swaps and other derivatives (Moriarty 2010).

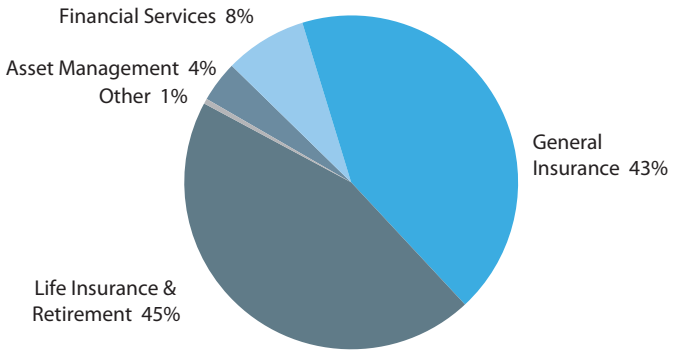


**Figure 1: AIG's revenue by segment, 2004–2006**
Source: COP (2010: 16)

Although this trading was initially quite profitable, mark-to-market losses began to emerge during the subprime debt crisis of 2007. As the unrealised losses accumulated, AIGFP's counterparties began to demand billions of dollars in additional collateral to cover their risk exposures. The parent company was guarantor for AIGFP's liabilities, but it simply did not have enough cash to cover the margin calls. As a result, by September 2008, AIG was facing a liquidity crisis – indeed it was on the verge of declaring bankruptcy when the government came to the rescue.

When the bailout was first announced, media reports focussed on the losses at AIGFP and the associated liquidity problems at the parent company. State insurance regulators insisted that AIG's insurance subsidiaries were solvent, and claimed that the subsidiaries were "walled off" from the parent company's problems.[3] On 22 September 2008 Eric Dinallo, the Superintendent of Insurance for New York, issued a press statement to reassure policyholders:

> AIG's insurance companies are financially sound, with substantially more in assets than they need to pay all valid present and projected claims …
>
> Dinallo explained that the trouble with AIG is largely with AIG's non-insurance parent company, which is not regulated by the states and therefore not held to the same investment, accounting, and capital adequacy requirements as its state-regulated insurance subsidiaries. The insurance companies are solvent and able to pay their obligations …
>
> As an example, unlike the troubled parent company, the property and casualty insurance company New York regulates has significantly more in assets over and above the reserves required to cover all valid current and future claims. As regulators, we make sure the assets of the insurance companies are walled off, protected from the parent company's troubles and available to pay all your covered claims (Dinallo 2008: 1-2).

Other state regulators published similar statements, as did the National Association of Insurance Commissioners (NAIC 2008a).

1 For example, AM Best study of American life-health insurers (cited in Best's Review 1999); The Institute of Actuaries of Australia Working Group Study of Australian general insurance insolvencies (IAAUST 1999); Müller Group's study of European life and non-life insurers (CISS 1997); IAIS *Guidance Paper on the Treatment of Non-Regulated Entities in Group Wide Supervision* (IAIS 2010).

2 The first loan to AIG was a Revolving Credit Facility from the Federal Reserve Bank of New York, for up to $85 billion, announced on 16 September 2008. Government assistance was subsequently provided in a number of different forms, from both the Federal Reserve Bank of New York and later the Troubled

3 In the United States, insurance companies are regulated by the states. State insurance commissioners work together to supervise insurers which operate in multiple states. Texas was the lead regulator for AIG's life insurers; Pennsylvania was the lead regulator for AIG's property casualty insurers; New York was the lead regulator for personal lines; and Delaware was the lead regulator for specialised lines ("surplus lines"). The lead regulators co-ordinated the activities of the other state regulators (COP 2010: 22)

No doubt this was reassuring to the general public. But was it true? Were AIG's insurance companies really "walled off" from the parent company's problems?

Government reviews of the AIG bailout cast some doubt on such claims. Since AIG's rescue required an enormous infusion of government funds, several Congressional Committees have conducted investigations into the causes of AIG's problems and the measures adopted during the crisis period. These Committees and other government agencies have published voluminous reports on these events.

These reports do not paint quite such a rosy view of the management, regulation and solvency of some of AIG's insurance subsidiaries.

As the story unfolded, it became clear that AIG's life insurance companies had also suffered quite substantial losses through their involvement in AIG's Securities Lending Program (described in more detail below), and also as a result of disastrous intra-group investments. As a result, some of these insurance subsidiaries required billions of dollars of financial support in order to maintain solvency. This support was available only because the government was funnelling money into the parent company, which in turn recapitalised the insurers. Figure 2 shows AIG's use of the $81 billion of federal funds provided before the end of 2008. Out of this sum, approximately $25 billion was used to provide support to AIG's insurance subsidiaries, both directly and indirectly.[4]

As soon as the government announced the bailout of AIG, there was a great deal of adverse publicity. Over the next two weeks, this created severe liquidity problems for AIG's life insurance companies, particularly in relation to their Securities Lending Program. The insurers needed liquidity support, as well as capital infusions. In October 2008, the Federal Reserve Bank of New York set up a special program called the Securities Borrowing Facility in order to provide approximately $20 billion in additional liquidity to AIG's life insurance companies.

During the crisis, government regulators seriously considered using the assets of AIG's insurance subsidiaries to provide assistance to the parent company. However the regulators realised that this might create additional risks for the insurers.

After the immediate emergency eased, the insurance subsidiaries continued to suffer the effects of reputational damage; new business plummeted, while cancellations and surrenders soared. The parent company sold off several of its insurance companies, in order to raise funds to repay bailout loans.

This paper describes the development of affiliate-related risks within the AIG group. Section 2 describes the Securities Lending Program. Section 3 describes AIG's liquidity crisis in September 2008, and the government's response. Section 4 describes non-arm's length transactions between AIG (the parent company) and its insurance company subsidiaries. Section 5 provides opinions about contagion risks and systemic risks. Section 6 examines the evidence about the potential effect of an AIG bankruptcy: if the parent company had failed, would the subsidiaries have survived? Section 7 looks at the consequences of the bailout: namely, the forced sale of AIG subsidiaries. Section 8 provides evidence about the effect of the crisis on AIG's property and casualty insurers (growth, pricing, and profits).

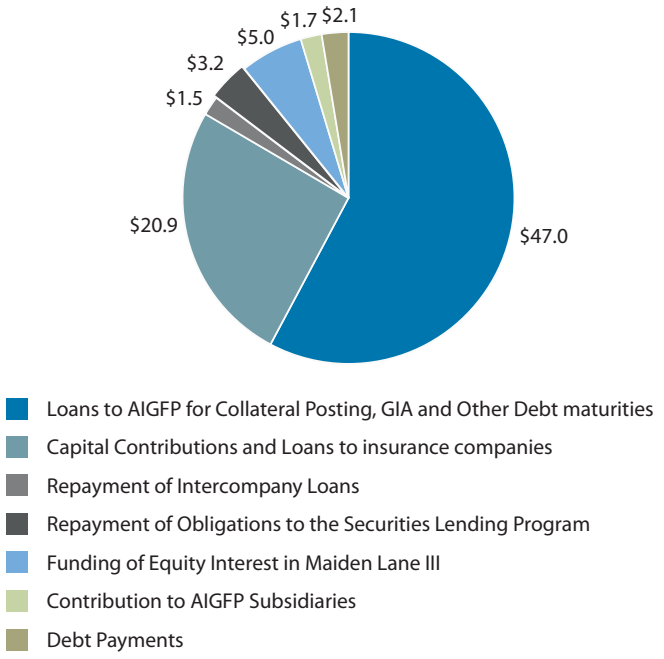


**Figure 2: AIG's use of government assistance in 2008 ($US billions)**
Source: COP (2010:2)

## 2 THE SECURITIES LENDING PROGRAM PRIOR TO THE CRISIS

Over the years prior to the GFC, AIG's life insurance companies had developed a Securities Lending Program, which was designed to improve portfolio returns.

How did this work?

4 $20.9 billion was provided as capital contributions and loan to insurance companies; $3.2 billion was used to cover AIG's guarantees to the Securities Lending Program which held the assets of the life insurers; AIG also repaid $1.5 billion which it had borrowed from the insurers (GAO 2009a).

The life insurance companies owned securities. They would lend these securities to counterparties, which were generally major banks and brokerage firms (COP 2010: 44). [5]

The counterparties would provide cash collateral to the life insurance companies. Initially, the collateral was 102% to 105% of the value of the borrowed securities.[6] The life insurance companies could invest this cash collateral to earn additional income.

The counterparties would eventually return the borrowed securities, and reclaim the cash collateral. Typically, the counterparties could do so at any time, at very short notice. Therefore the cash collateral was normally invested in very liquid securities, such as short-term Treasury bonds. This was a very low-risk strategy, which was expected to provide relatively small increments in returns.[7]

However, this low-risk investment program later morphed into a much more risky operation. This raises a question: who was responsible for making the decision to change strategy?

AIG's insurance subsidiaries did not manage their own securities lending program. AIG set up the AIG Securities Lending Corporation (AIGSLC), which acted as an agent for the insurers. AIGSLC managed two separate pools: one held assets for twelve US-based life insurers, and the other held assets for non-US companies.

> Several of AIG's life insurance subsidiaries participated in the securities lending program, which essentially aggregated the securities lending (and collateral investment) operations of these subsidiaries … This effectively centralised decisions relating to securities lending collateral within AIG's asset management operations group, and away from individual life insurance subsidiaries. By appointing an affiliated agent to manage the securities lending program, the subsidiaries provided AIG's asset management operations team with some measure of control of the securities lending program. (COP 2010:33)

In 2005, AIGSLC decided to change the investment strategy. According to Boyd (2011), the AIG subsidiary that managed the securities lending program did not bother to inform the life insurance companies when they changed the asset allocation strategy in 2005. The fund managers simply made a change in their prospectus, which gave them the freedom to invest in a riskier range of assets. When officers from one of the life insurance companies asked questions about any exposure to subprime mortgages, they were allegedly given reassuring (but misleading) answers about the excellence of the portfolio's risk management controls (Boyd 2011: 169, 27, 246).

Under the new investment strategy, cash collateral would no longer be invested in low-risk liquid securities: instead, the cash collateral would be invested in Residential Mortgage-Backed Securities (RMBS).

This was not a good time to be investing in mortgage-backed securities. By the end of 2005, even AIG's own Financial Products Group had decided that this line of business was too risky. AIGFP had already decided to stop underwriting subprime debt securities. The Congressional Oversight Panel later commented that:

> the life insurance subsidiaries were ramping up the purchase of RMBS at the same time that AIGFP had decided to stop writing swaps on subprime mortgage backed securities because of the riskiness of the underlying bonds, highlighting the failure of enterprise risk management at the company (COP 2010: 34).

Over the next two years, AIG's securities lending program aggressively expanded its investment in subprime debt. By late 2007, AIG's securities lending portfolio held $76 billion in liabilities, with 60% in RMBS (Dinallo 2009). To put this into perspective, the total assets of all the AIG domestic life insurance companies amounted to about $400 billion; so about 11% of the life insurance company assets were invested in RMBS in 2007 – just as the market for these securities was crashing.

By 2007, AIG's securities lending program had developed an asset-liability mismatch. The counterparties could return the securities with very little notice and demand a return of their cash collateral. But their cash was invested in soon-to-be-very-illiquid Residential Mortgage-Backed Securities. The securities lending portfolio held 16% in cash, 33% in securities with less than two years to maturity, 34% in securities with two to five years to maturity, 15% in securities with five to ten years to maturity, and 2% in securities with two to five years to maturity (COP 2010: 24 [footnote]; see also Dinallo 2009).

5 A list of all the counterparties is given on page 88 of the COP (2010) June Oversight Report. .
6 This was in line with NAIC guidelines on collateral requirements.
7 Sjostrom (2009) provides a fuller description of the securities lending program.

**QUESTION FOR DISCUSSION**

A life insurance company with sound risk management would normally scrutinise any investment management agreements, and in particular would impose controls on the asset allocation of managed funds. Did the AIG insurers relax their vigilance and/or lower their standards because they were dealing with an affiliated company?

Initially, it seems, the state insurance regulators did not have any major concerns about the securities lending program; they were not aware of the increasing risk in the investment strategy. (GAO 2011c: 12-15).[8]

However, by mid-2007, state regulators had become aware of the high proportion of RMBS in the securities lending portfolio.[9] These securities were still AAA-rated, but by this time the housing market had already begun to decline and the credit rating agencies were downgrading many mortgage-backed securities. The insurance regulators were concerned, and they insisted that AIG should take action to reduce the risks to the life insurers.

First, the regulators asked AIG (the parent company) to provide guarantees to the life offices. In autumn 2007, AIG provided a guarantee to cover up to $500 million of realised losses. As losses increased, the guarantee was increased to $1 billion on 1 May 2008, and then to $5 billion on 17 June 2008.[10]

Second, the regulators asked AIG to wind-down the securities lending program. The regulators required AIG to provide monthly reports on the securities lending program. However, during 2007–08 it was difficult to sell off increasingly illiquid RMBSs.

Over the next year, the size of the RMBs portfolio in the US pool was indeed reduced. It is difficult to tell whether this reduction was achieved by the deliberate sale of assets, or whether this simply represented a fall in the market value of the subprime assets.

> "By the end of September 2008, the securities lending portfolio held about $40 billion of RMBSs with a fair value of approximately $23.5 billion, i.e. an unrealised loss of about $16.5 billion" (COP 2010: 46, footnote 112).

Even after the bailout, the situation continued to deteriorate. By the end of 2008, AIG's life insurance companies had lost about $21 billion as a result of their investment in the securities lending program. This led to the need to recapitalise the insurers (described below) (US Senate Committee on Banking, Housing, and Urban Affairs 2009).

## 3 THE LIQUIDITY CRISIS IN SEPTEMBER 2008

Investment losses at AIGFP and in the securities lending program damaged AIG's reputation. Reputational damage inevitably created liquidity risk.

### 3.1 Losses, collateral calls, and downgrades

The subprime debt crisis began to seriously affect AIGFP in late 2007.

Initially, AIG's Financial Products Group did not expect to suffer any losses due to the subprime debt crisis. AIGFP held "super senior" tranches of collateralised debt obligations (CDOs). According to their own models, it was very unlikely that defaults would be severe enough to affect the super senior tranches. When reporting earnings in the second quarter of 2007, Joe Cassano, the head of AIGFP said that: "It is hard for us, without being flippant, to even see a scenario within any kind of realm or reason that would see us losing $1 in any of those transactions" (FCIC 2011: 268).

However, the market value of CDOs continued to fall – and as a result, AIG's counterparties began to make collateral calls against AIG. Initially AIG resisted meeting these collateral calls. According to AIG's models, these collateral calls were quite unnecessary.

8 State insurance regulators are supposed to review any transactions between insurance companies and affiliates. It appears that they did indeed approve the Securities Lending Program when it was first established, but they were not aware of shift in the asset allocation in 2005. The Senate Committee on Banking, Housing, and Urban Affairs, was quite critical of the State insurance regulators for allowing the life insurance companies to invest so much money in this program. See US Senate Committee on Banking, Housing, and Urban Affairs (2009).)

9 According to COP 2010 footnote 168 on page 56, the Texas state regulators made this discovery during its examination process in mid- 2007. The National Association of Insurance Commissioners has said that AIG should have disclosed this change in asset allocation to the regulator. The regulators complained that AIG was disclosing relatively little information about the Securities Lending Program in its regulatory filings – but the losses were disclosed in SEC filings (GAO 2011c p15-17).

10 COP (June 2010; 44 footnote 107, based on information provided by the NAIC). Although newspaper reports suggest that AIG was contributing cash to the Securities Lending Program to absorb the losses, the regulatory reports only refer to a guarantee, i.e. the subsidiaries became creditors of the parent company GAO (2011c: 18). As a result of this arrangement, the insurance subsidiaries were exposed to the risk that the parent company might default on its obligations. This seems consistent with the data which shows that AIG paid $3.16 billion into the Securities Lending subsidiary AFTER the bailout in September 2008.

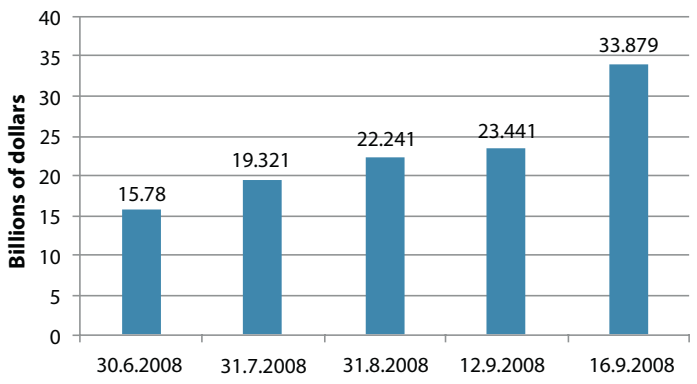


**Figure 3: Collateral calls payable by AIG, 30 June 2008 to 16 September 2009**
Source: COP (2010:40)

But the counterparties had their own models, which produced lower valuations for the CDOs. Ratings agencies downgraded some of the CDOs, and some market participants began to report losses. Eventually, in early 2008, AIG was forced to write down the value of its portfolio, recording an unrealised loss of $11.25 billion.

These write-downs led to collateral calls from counterparties, creating a drain on AIG's cash resources (COP 2010: 38).

The ratings agencies realised that these write-downs and collateral calls were weakening AIG's financial position. AIGFP's losses led to downgrades for the parent company. Before the crisis, AIG had a credit rating of AA from Standard and Poors (S&P). In February 2008, S&P put AIG on a negative watch.

Ratings downgrades created a downwards spiral. The counterparties to the CDO contracts were entitled to call for additional collateral whenever AIG was downgraded. So every downgrade created more liquidity problems for AIG. Collateral calls increased by billions of dollars every month (see Figure 3).[11] By 16 September 2008, the collateral calls at AIGFP exceeded $33 billion (COP 2010: 40).

The securities lending program was also suffering losses during 2008. The credit agencies became increasingly concerned about these losses, and these concerns led to more downgrades in May and June 2008.

The securities lending counterparties became worried about the ratings downgrades and began to close out their securities lending contracts, asking for a return of their cash collateral. Since a high proportion of the collateral had been invested in illiquid RMBSs, it was difficult to meet the demand for cash.

In response, AIG decided that it needed to offer very attractive terms to the securities lending program borrowers. When the program had first been set up, AIGSLC required the borrowers to post collateral equal to at least 100% of the market value of the borrowed securities (often 102% to 105%). But as the market became more competitive, AIGSLC had relaxed its standards, and offered to accept lower levels of collateral. If the collateral was less than 100%, the parent company made up the difference.

> The situation [liquidity crisis] was further complicated by AIG's aforementioned subsidisation of below-market terms to its securities borrowers, as the company in desperate need for cash, began to accept collateral in some cases as low as 90 percent of the value of the securities borrowed. By the end of August 2008, AIG had provided $3.3 billion in the form of financing terms and investment sales to its insurance subsidiaries to help plug the shortfall (COP 2010: 45, footnote 110).

The Texas Department of Insurance estimated that by July 31 2008, roughly one-quarter to one-third of the securities lending counterparties were asking to provide less than 100% collateral. Since the parent company was required to make up the difference, this increased the strain on the parent company (COP 2010: 121, footnote 468).

In any event, these desperate measures were ultimately NOT successful in preventing cash flow problems. The situation deteriorated sharply in August–September 2008. AIG's share price fell sharply, and credit default swap spreads on AIG increased sharply (COP 2010: 60).[12]

The entire financial system was in turmoil at this time: the government had arranged to take over Fannie Mae and Freddie Mac on 7 September; Lehman Brothers collapsed on 15 September 2008; money market mutual funds "broke the buck" soon afterwards. The commercial paper market was locked up, creating liquidity problems for many companies – including some AIG subsidiaries – which were unable

11 A timeline about collateral calls was included as evidence to the Financial Crisis Inquiry, available at http://fcic-static.law.stanford.edu/cdn_media/fcic-docs/2010-07-01%20Goldman%20Sachs-AIG%20Collateral%20Call%20Timeline.pdf

12 Credit Default Swap Spreads on AIG rose from 300.7 basis points on August 15 2008, up to 1527.6 basis points on September 2008 (GAO (2009) p 17-18). AIG's share price fell from $22.76 on September 8 to $12.14 on September 12 and then to $4.76 on September 15.

to roll over their commercial paper. AIG's parent company provided funds to these subsidiaries, which created yet another drain on resources.

By early September, government authorities were aware of serious liquidity problems at AIG, and they were desperately seeking a solution. Initially, AIG hoped to find a private sector solution to the problem, but the situation was deteriorating very quickly, as counterparties abandoned AIG.

- On Friday 12 September, AIG estimated that it would need $20 billion to meet its liquidity needs.
- By the evening of Saturday 13 September, the estimate had increased to $40 billion.
- By Sunday night, the estimate had increased to $60 billion – with a worst-case scenario estimate of more than $120 billion (COP 2010: 64 and footnote 220).

On 15 September 2008, the major credit rating agencies all downgraded AIG (by three notches) (Williams 2009). This triggered more collateral calls, for several billion dollars, from AIGFP's counterparties. As a result, AIG was likely to run out of cash within 24 hours.

At this stage, the government agreed to provide an emergency bailout for AIG. On 16 September 2008 the Federal Reserve Bank of New York (FRBNY) provided $85 billion in assistance, through a revolving credit facility.[13]

## 3.2 Interactions

Theoretically, AIGFP's derivatives trading business was separate from the life insurers' securities lending program, but it is clear that there were correlations in the risks facing both businesses:

> In the words of Marshall Huebner of Davis Polk & Wardwell, a law firm that represented FRBNY, the securities lending problems contributed to a "double death spiral." The problems in AIGFP exacerbated the problems in securities lending, and vice versa, as collateral demands from both sets of counterparties quickly imperilled the company's liquidity position as it struggled to meet its cash demands (COP 2010: 24).

This correlation of risks was probably exacerbated by the overlapping of counterparties. The same investment banks and hedge funds were the counterparties in both lines of business, including Barclay's, Deutsche Bank, Goldman Sachs, Bank of America, Merrill Lynch and UBS (for a list of counterparties, see COP 2010 : 88). It seems likely that the securities borrowers would have been well aware of AIGFP's losses.

The Congressional Oversight Panel commented on AIG's inability to assess risks across all its many subsidiaries:

> It is important to realize that since AIG was both insuring RMBS through their sale of CDS and also purchasing RMBS through their investment of securities lending collateral, in order to assess the risk to the company, one would need to know how these products moved together, or co-varied. And since AIG did not fully grasp the details of the securities underlying the CDS, it would be almost impossible to estimate the covariance, and therefore truly understand the risk they were facing in their aggregate exposures across AIGFP and the company's securities lending operations (COP 2010: 35 footnote 108).

This is consistent with the views of credit rating agencies and share analysts. Prior to the crash, several observers had criticised AIG's enterprise risk management, for example one analyst wrote:

> "The central tenet of our 'Don't Buy AIG' argument is simple: the intricacies of AIG's business are so complex that management may not even know the extent of the company's ultimate exposures, let alone losses" (Goldman Sachs 2008: 3).

**QUESTION FOR DISCUSSION**

Is it possible to evaluate the risks facing an insurance company subsidiary, without knowing a great deal about the business of the parent company and its affiliates? Are some groups simply too big and too complex to manage (or regulate) effectively?

13 At the same time, FRBNY received Preferred Stock which was convertible into 79.9% of AIG's issued ordinary shares. Government assistance was restructured several times over the next year or two, in a variety of ways, in order to provide more support to AIG and help the insurers to retain satisfactory credit ratings. The details of these restructures are given in various GAO reports listed in the references at the end of this paper.

### 3.3 Liquidity support from the Federal Reserve Bank of New York

By the end of September 2008, AIG's securities lending program was collapsing. Between 12 September 2008 and 30 September 2008, securities lending counterparties returned their borrowed securities and demanded approximately $24 billion in cash (COP 2010: 45; see also GAO 2011c: 30). AIGSLC did not have enough liquid assets to pay these counterparties.

The Federal Reserve Bank of New York stepped in to assist, by becoming a substitute securities borrower, replacing the counterparties who were dropping out of the program.

0n 8 October 2008, the Federal Reserve Bank of New York borrowed $17.5 billion in investment-grade fixed-income securities from AIG in exchange for cash collateral. This arrangement was called the Securities Borrowing Facility (SBF) (COP 2010: 12).

The Securities Borrowing Facility was just a stop-gap measure. On 10 November 2008, the Federal Reserve Bank of New York (FRBNY) set up Maiden Lane II, a limited liability company.[14] The FRBNY lent $19.5 billion to Maiden Lane II, which then used the money to buy RMBS from AIG's insurance subsidiaries. The Securities Borrowing Facility was then terminated

The purpose of the Maiden Lane II deal was "to get contingent liabilities off AIG's balance sheet" (COP 2010:71). The elimination of these contingent liabilities would reduce the insurers' risk-based capital requirements and would also make it easier to sell the life insurance subsidiaries (and in turn, the sale proceeds would enable AIG to repay the government bailout loans).

Maiden Lane II purchased securities with a face value of about $39 billion, but paid only fair market value for these securities, that is, $20.8 billion (COP 2010: Annex VI). This crystallised losses for the insurance companies.

Maiden Lane II was managed by Blackrock. Over the next few years, Maiden Lane II received income and maturity proceeds from the securities. The remaining securities were sold off in 2012. Over time, the loans to the FRBNY were fully repaid; indeed, the FRBNY made a profit (FRBNY 2012).[15]

## 4 DEALING WITH THE CRISIS: TRANSACTIONS BETWEEN AIG AND ITS INSURANCE SUBSIDIARIES

Affiliate risks may arise from related party transactions which are not conducted on an arm's-length basis. How did such transactions affect AIG and its subsidiaries?

### 4.1 Conflicting regulatory objectives

During the crisis, regulatory authorities were facing a dilemma. State insurance regulators had an obligation to protect the policyholders of AIG's insurance companies. But there was also some pressure to use the insurance subsidiaries' assets to provide support for the parent company, that is, to rescue AIG.

Theoretically, policyholders are protected by state-run guaranty funds. If any insurer becomes insolvent, the guaranty fund provides protection for the policyholders. However, the guaranty funds rely on levies from all the other insurance companies in the state. AIG's insurance subsidiaries were relatively large, and these levies might have imposed a significant burden on the rest of the insurance industry: the imposition of levies might have endangered the solvency of other insurers, creating a systemic risk. Therefore the state insurance regulators had a strong incentive to protect AIG's insurers.

At the same time, other government officials (from the Federal Reserve and the Treasury) were desperately trying to rescue AIG.

### 4.2 Loans from insurance companies to the parent company

In September 2008, when AIG was facing a severe liquidity crisis, it started to pull down all of its lines of credit. At that time it had a revolving credit facility that allowed the parent company to borrow money from the insurance subsidiaries. On 12 September AIG moved about $1 billion from its life insurance companies to the parent company.

AIG was downgraded on September 15.

On 15 September the lead insurance regulator "called a halt to further transfers, saying it needed to better understand the situation" (GAO 2011c:24 footnote 40). (Note that the state insurance regulators have the power to approve or disapprove transactions with affiliates).

However, AIG told the regulator that it urgently needed to borrow another $5 billion to $7 billion from the life insurers. Otherwise, AIG might be forced to

14 Maiden Lane refers to the address of the Federal Reserve Bank of New York. The first Maiden Lane arrangement was created to deal with the problems at Bears Stearns in March 2008. The second Maiden Lane arrangement, Maiden Lane II, dealt with AIG's securities lending program. The third Maiden Lane arrangement, Maiden Lane III dealt with AIG's Financial Products Group liabilities. Maiden Lane III was the most controversial, since it effectively provided financial benefits for AIG's CDS counterparties as well as AIG.

15 Although the FRBNY made a notional profit, the size of any profit would depend on the interest rate charged on the loan from the FRBNY to Maiden Lane II. Was the loan made at commercial rates?

default. On 16 September the regulator reluctantly agreed to allow the parent company to take another $5 billion in assets from the life insurers. The regulator said that "this transfer provided AIG with several hours of relief while arrangements on the Federal Reserve System assistance were being finalized" (GAO 2011c: 24 footnote 40).

The federal bailout package was approved by the AIG Board of Directors on the evening of 16 September and the $5 billion loan was returned from the parent company to the insurers.

**QUESTION FOR DISCUSSION**

Was it reasonable to allow the parent company to borrow $5 billion from the life insurance companies in these circumstances? Apparently no-one else was willing to lend AIG money at this time.

After 16 September the state insurance regulators refused to allow AIG to borrow any more money from the subsidiaries, and also insisted that the prior loans (amounting to more than $1 billion) should be repaid (GAO 2009a:6). The money provided to AIG by the Federal Reserve Bank of New York (i.e. the money from the bailout package) was used to repay these loans.

## 4.3 Proposed asset swaps

The National Association of Insurance Commissioners (NAIC) set up a task force to co-ordinate the efforts of all the state regulators. New York State Insurance Superintendent Eric Dinallo was the chairman of the task force and was involved in the crisis talks with AIG management and the Federal Reserve Bank of New York.

During the second week of September, before the bailout, there were desperate attempts to find a private sector solution to AIG's problems. Several different private sector deals were considered.

One of the proposed deals included an asset swap. AIG's property and casualty subsidiary companies would be asked to swap their liquid assets for some of the illiquid assets owned by the life insurance companies. This would have provided much-needed liquidity to the life insurers (GAO 2011c: 28).

The New York State Insurance Department was involved in discussions regarding this swap, and apparently Superintendent of Insurance Dinallo was in favour of approving the deal. Internal documents record the decision-making process:

> Dinallo outlined the same plan that AIG gave us earlier – i.e. move muni's [municipal bonds] from P&C [property casualty] subs to parent, and parent send equity in life insurance subs to the P&C subs in return. There are a number of multi-state regulatory hurdles to this, but Dinallo thinks it is possible to do. Dinallo described P&C companies in NY and PA [Pennsylvania] as having very large capital cushions, and so he thinks that they can accommodate this. He also noted negative consequences in insurance markets in general if AIG goes down (i.e. cost of insurance is likely be much higher if they file) and negative consequences in muni bond market if GICs default, so regulatory forbearance can be justified politically … My impression is that while they are comfortable with the capital dilution at the P&C companies, they are less knowledgeable and comfortable about the equity value of the life companies, so they have work to do on that front (Mosser 2008: 1).

Dinallo recommended this swap to the governor of New York, David Paterson (COP 2010: 245). On 15 September 2008 the governor issued a press release announcing the deal (Paterson 2008:1).[16]

> **Governor Paterson announces New York will facilitate financing plans for world's largest insurance provider**
> **AIG financing plan only possible following approval from insurance department**
> **No state or federal money will be used; plan will cost New York taxpayers nothing**
> Governor David A. Paterson today announced a multi-billion dollar financing plan to stabilize American International Group (AIG), the world's largest insurance provider, at no cost to New York taxpayers. The plan calls for AIG to transfer some assets to provide necessary cash for short-term liquidity, a move that requires regulatory oversight approval from the New York Insurance Department. AIG will undertake a series of transactions that are expected to raise about $20 billion, solving the company's immediate liquidity problem. Additionally, Governor Paterson has sent Insurance Superintendent Eric Dinallo to work with the Federal Reserve on a plan to help AIG.

The National Association of Insurance Commissioners issued a press release, which said: "State insurance regulators will only approve this type of action if they are assured it is part of a total resolution of the liquidity issue at the parent company and fairly compensates its insurance company subsidiaries" (NAIC 2008: 1).

16 A few months later the Republican Party pointed out that AIG had made a $100,000 donation to the New York State Democratic Party on August 29, 2008, just a few weeks before the AIG bailout was announced. A spokeswoman for the Democratic Party said that neither the governor nor the insurance superintendent knew about the donation when they were negotiating the bailout (Gormley 2009).

This plan was never implemented. The private sector deal fell through after it became apparent that AIG's situation was worse than expected. A deal to raise $20 billion would not be enough to save the company.

**QUESTION FOR DISCUSSION**

Was this a sensible proposal? AIG's property and casualty companies were often accused of under-reserving, and just a few years previously these companies had been forced to strengthen their reserves by billions of dollars.[17] The parent company was at risk of declaring bankruptcy, which would, no doubt, have created serious problems for the property and casualty insurers – so perhaps any spare capital would be needed to survive the crisis. And why would a property and casualty insurance company want to own shares in undercapitalised life insurance companies that were suffering liquidity problems? Was this proposal in the best interests of the property casualty policyholders?

More generally: under what circumstances should the assets of insurance subsidiaries be available to support a troubled parent company? If the answer is "it depends on the circumstances", then who should decide? Should the regulator act in the best interests of the group of policyholders as a whole (allowing the strong company to help the weaker one) or should each company be treated as a separate entity, with limitations on non-arms-length intra-group transactions?

## 5 THE IMPACT OF PARENT COMPANY PROBLEMS ON INSURANCE SUBSIDIARIES

For regulators who are interested in assessing contagion risks and systemic risks, it may be worthwhile to consider a hypothetical question. Suppose the government had decided against a bailout. Suppose that AIG had defaulted on its obligations. How would this have affected AIG's insurance subsidiaries, and other insurers around the world?

This question is difficult to answer, because different authorities have given different opinions.

### 5.1 Views of state insurance regulators

The state insurance regulators have been keen to assure the public that the insurance subsidiaries would have remained solvent, no matter what happened to the parent company. During the crisis, several state insurance commissioners put out reassuring press releases, as did the National Association of Insurance Commissioners. The New York Superintendent of Insurance, Eric Dinallo, later testified that:

> The main reason why the federal government decided to rescue AIG was not because of its insurance companies. Rather, it was because of the systemic risk created by Financial Products. There was systemic risk because of Financial Products relationships and transactions with virtually every major commercial and investment bank, not only in the U.S., but around the world …(Dinallo, 2009:4)
>
> …even if there had been a run on the securities lending program with no federal rescue, our detailed analysis indicates that the AIG life insurance companies would not have been insolvent. Certainly, there would have been losses, with some companies hurt more than others. But we believe that there would have been sufficient assets in the companies and in the parent to maintain the solvency of all the companies …
>
> The dependable moat of state regulation that protects policyholders remains solid (Dinallo 2009: 6-7).

The National Association of Insurance Commissioners also assured policyholders that AIG's insurance subsidiaries would remain solvent, despite the problems at the parent company:

> The 71 state-regulated insurance companies within AIG did not receive a bailout; they are financially solvent. The federal bailout of the non-insurance portions of AIG does not negatively change the solvency strength of its insurance subsidiaries (NAIC 2008b:7).

As explained below, this statement was somewhat misleading. According to subsequent government reports, several of the AIG's life insurers and retirement companies benefitted from federal assistance. Some of AIG's life insurers would certainly have been in difficulties if they had not received capital infusions

17 See COP (2010: 49ff) for a discussion of under-reserving at AIG's property and casualty insurers.

from the parent company (and the money needed to provide these capital infusions came from the government bailouts). (GAO 2011a:43; COP 2010: 116 footnote 445).

No doubt the state insurance commissioners wanted to maintain public confidence in the insurance industry, in order to limit contagion effects.

## 5.2 Views of the Federal Reserve Bank and Treasury officials

Officials from the Federal Reserve Bank of New York and the Treasury had an entirely different view of the situation. They asserted that an AIG bankruptcy would have had dire financial consequences for the insurance industry.

The Fed's own internal memoranda, written during September 2008, suggest that in the early stages of the crisis, the Federal Reserve and Treasury officials were primarily concerned about the impact of AIG's failure on financial markets: if AIGFP defaulted on trillions of dollars of credit default swaps, the systemic impact would be severe. The Fed officials did consider the impact that AIG's bankruptcy might have on its insurance subsidiaries. But the FRBNY did not have reliable information on the solvency of the insurers, so they could only speculate. They believed that the subsidiaries would survive if they were financially healthy, but they also expressed some doubts about the health of the life insurance subsidiaries (FRBNY 2008; LaTorre 2008).

According to the Congressional Oversight Panel (COP), the government's justification for the AIG bailout evolved over time. Testimony from Federal Reserve and Treasury officials that was provided to Congressional Committees many months after the crisis tends to put much more emphasis on the insurance-related risks, and the flow-on effects to ordinary American policyholders. For example, Treasury Secretary Henry Paulson provided the following testimony to a Congressional committee:

> **Testimony of Treasury Secretary Paulson to the House Committee on Oversight and Government Reform on 27/1/2010. How would the failure of AIG affect the financial system and the broader economy?**
> The team concluded that AIG's failure would be catastrophic. AIG was much larger than Lehman, it was spread across more countries than Lehman, and while it posed many of the same basic risks as Lehman, they were actually greater because of AIG's role as an insurance company.
>
> AIG was one of the largest life and health insurers in the United States … if AIG had failed, the crisis almost certainly would have spread to the entire insurance industry. Life insurance posed a particular threat. Many life insurance products are effectively a form of long-term savings. In the wake of a failure of AIG, policy holders could have sought to liquidate life insurance policies underwritten by AIG. Doubts about the value of AIG life insurance products could have generated doubts about similar products provided by other life insurance companies, opening up an entirely new channel of contagion…
>
> Without assistance, the AIG parent holding company would have been forced to file for bankruptcy protection like Lehman Brothers, resulting in default on over $100 billion of debt, as well as trillions of dollars of derivatives. Such a filing would have caused insurance regulators in the United States and around the world to take over AIG's insurance subsidiaries, potentially disrupting households' and businesses' access to basic insurance. And since many of the insurance products that AIG sold were a form of long-term savings, the seizure by local regulators of AIG's insurance subsidiaries could have delayed Americans' access to their savings, potentially triggering a run on other institutions. (Paulson 2010: 4-5).

The Federal Reserve Bank of New York has also described the dire consequences of an AIG bankruptcy. This is an extract from the FRBNY website:

> The failure of AIG, a company with more than 76 million customers in approximately 140 countries – more than 30 million customers in the United States alone – posed a direct threat to millions of policyholders, state and local government agencies, 401(k) participants, banks and other financial institutions in the United States and abroad, and would have shattered confidence in already fragile financial markets.
>
> If AIG had been allowed to fail and the parent company had filed for bankruptcy, the consequences and effects could have been severe:
>
> >

- Many of AIG's insurance subsidiaries could have been seized by their state and foreign regulators, leaving policyholders facing uncertainty about their rights and claims.
- Seizure of AIG subsidiaries would likely have put a moratorium on claims and withdrawals and could have impaired those claims in the longer term.
- A run on AIG, in the form of a massive cashing in of insurance policies and annuities, would have strained the company's ability to meet its obligations to millions of policyholders.
- State and local government entities that had lent investment funds to AIG would have been exposed to losses in an already difficult and deteriorating municipal budget environment.
- Workers whose 401(k) plans had purchased guarantees in the form of stable-value contracts from AIG could have lost that insurance.
- Pension plans would have been forced to write down their AIG-related assets, resulting in significant losses in participants' portfolios.
- The resulting losses to money market mutual funds, to which millions of Americans entrust their savings, would have had potentially devastating effects on confidence and would have accelerated the run on various financial institutions.
- Global commercial banks and investment banks would have suffered losses on loans and lines of credit to AIG and on derivatives contracts and other transactions, potentially causing even greater constraints on the availability of credit to homeowners and businesses.[18]
- Confidence in other insurance providers could have been impacted, leading to a possible run on the industry (FRBNY 2013: *Actions Related to AIG: Consequences of an AIG Failure*).

The Congressional Oversight Panel (COP) has suggested that some officials might be reinterpreting the past in order to make the bailout decision more palatable to the public. The decision to bail out AIGFP led to financial benefits for AIGFP's counterparties, such as Goldman Sachs; this was not at all politically popular. The Congressional Oversight Panel has suggested that "regulators tried to respond to public displeasure with the AIG bailout by looking for more sympathetic beneficiaries of their decision to intervene than financial institutions" (COP 2010: 136).

During Congressional investigations, AIG's executives repeatedly argued that "AIG's Rescue was as much about Main Street as it was about Wall Street" (Liddy 2009: Addendum page 55).

In fact, it was very difficult for anyone to predict the potential consequences of AIG's bankruptcy. The Congressional Oversight Panel later concluded that:

> It is unclear how a bankruptcy filing would have affected the business or solvency of the insurance subsidiaries, the actions of various insurance regulators, or the decisions of current and prospective insurance customers regarding insurance cover (COP 2010: 78).

**QUESTION FOR DISCUSSION**

Are some insurers "too big to fail"? If so, how does this affect prudential regulation of these entities? How can we assess the systemic risks of insurance company failures?

## 6 FACTORS AFFECTING THE SOLVENCY OF AIG'S INSURANCE SUBSIDIARIES

In order to assess the impact of an AIG bankruptcy on its insurance subsidiaries, we would have to consider:

1. The reaction of state insurance regulators – would they seize the insurance companies?
2. The solvency of the insurance companies – would they be strong enough to survive?
3. The inter-relationships between the insurance subsidiaries and other AIG entities – how closely were they intertwined?
4. The impact on credit ratings – would the credit rating agencies downgrade the insurers?
5. The reaction of the policyholders – would there be a run on the insurers?

### 6.1 The reaction of state insurance regulators

If the government had decided against rescuing AIG, it seems likely that state regulators would have seized AIG's insurance subsidiaries (GAO 2011c: 36 and footnote 53).

18 The bankruptcy of AIGFP would have had flow-on consequences for European financial institutions. AIGFP had sold credit derivatives to European banks which "allowed them to reduce the amount of capital they needed to set aside to cover potential losses on certain asset portfolios of residential mortgages and corporate loans by buying protection against losses on the underlying assets." The notional amount of AIGFP's regulatory capital book was about $250 billion in the fall of 2008. GAO(2010, p 32)

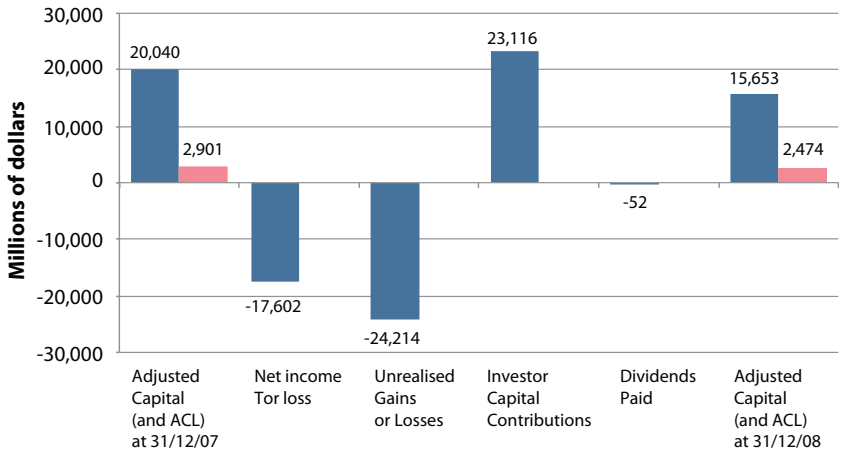


**Figure 4 Regulatory Capital for AIG's domestic life and retirement companies (2007/08).**
Source: GAO (2011a:47)

Each insurance commissioner has the responsibility to protect his own constituents: a commissioner can seize an insurer's assets if this is necessary to protect the policyholders. When making this decision, each state regulator would need to consider the reaction of all the other state regulators, and also the reactions of regulators in other (international) jurisdictions. This is particularly likely to be an issue when the financial affairs of one insurer are intertwined with other companies in other jurisdictions – for example, by way of guarantees, reinsurance, and service agreements. Such situations may well lead to legal disputes about the ownership and control of assets. Historically, when insurance companies have failed, state regulators have not always worked well together. Under such circumstances, regulators might be motivated to take action promptly. And as soon as one regulator started to seize assets, others would be likely to follow suit. The Congressional Oversight Panel suggested that "one seizure could have led to a cascading effect of other seizures" (COP 2010).

According to Boyd, in September 2008, while AIG was teetering on the brink of insolvency, the Texas Department of Insurance had already instructed legal counsel to draw up the legal documents necessary to seize four AIG subsidiaries (Boyd 2011: 280).

## 6.2 The solvency of the insurance companies

If the insurance companies were indeed financially strong, then they would have had a much better chance of surviving the bankruptcy of the parent company. But were they really so strong?

During the crisis, state insurance regulators repeatedly provided assurances to the public, claiming that there was no cause for concern about the solvency of AIG's insurance subsidiaries. For example, the NAIC issued an unequivocal press release on 16 September 2008:

> "We have a very strong message for consumers: If you have a policy with an AIG insurance company, they are solvent and have the capability to pay claims" (NAIC 2008a:1).

Over the next few months, there were several Congressional investigations into the AIG bailout. Witnesses repeatedly claimed that the AIG insurance subsidiaries were solvent. In fact the state insurance commissioners referred to the insurance companies as the "bars of gold" that would be sold to repay AIG's debt to the government (Ario 2009).

Of course, by this stage, the government was the majority shareholder in AIG. The government was planning to recoup its investments by selling off many of the insurance subsidiaries. Under the circumstances, it would have been counterproductive to cast aspersions on the solvency of these companies.

However, the Government Accountability Office (GAO) provides a more objective assessment of the insurance companies' solvency. When the government became a major shareholder and creditor of AIG, Congress asked the GAO to monitor the government's exposure to financial risks. The GAO produced several reports on AIG over the period 2009 to 2012. These do not paint a very rosy picture of AIG's life insurers. Figure 4 shows the deterioration of the companies during 2008, based on the GAO's analysis of the insurer's statutory returns (GAO 2009b: 77; GAO 2011a: 53).

**Table 1: Losses from securities lending operations for selected AIG subsidiaries**

| Subsidiary | Surplus at start of 2008 ($millions) | Realised losses on securities lending during 2008 ($millions) | Losses as a percentage of start-of-year surplus |
|---|---|---|---|
| American General L&A Insurance Company | 471 | 977 | 207% |
| AIG Life Insurance Company | 440 | 871 | 198% |
| AIG Annuity Insurance Company | 3729 | 7110 | 191% |
| American International Life Insurance Company of NY | 553 | 771 | 139% |
| First SunAmerica Life Insurance Company | 501 | 653 | 130% |
| Variable Annuity Life Insurance Company | 2838 | 3562 | 126% |
| American General Life Insurance Company | 5704 | 3790 | 66% |
| SunAmerica Life Insurance Company | 4716 | 2281 | 48% |

Source Merkel (2009)

The life insurers had more than $20 billion in regulatory capital at the start of 2008 – much higher than the authorised control level (ACL) of risk-based capital of $2.9 billion.[19] During the year, the combined net losses for the year were about $17.6 billion. The companies also suffered unrealised capital losses of more than $24 billion.

The losses might have been even worse. Harrington has noted that AIG's capital position at the end of 2008 was boosted by a change in the accounting standards. On 1 October 2008, there was a change in the permissible method under statutory accounting for "other than temporary impairments for bonds, loan-backed and structured securities". This increased the 2008 year-end statutory surplus for the domestic life insurers and retirement services entities by $7 billion (Harrington 2009).

The regulatory capital at the end of 2008 was just $15.653 billion – after the company received a capital infusion of $23.116 billion. Clearly, at least some of AIG's life insurers must have needed a capital infusion in order to meet regulatory solvency standards by the end of 2008.

The GAO pointed out that AIG's domestic life companies were only able to maintain their capital ratios with federal assistance (GAO 2010: 37). AIG's financial statements show that a substantial component of the government's emergency funding was used to provide financial support to AIG's insurance subsidiaries.

The report from the Congressional Oversight Panel (COP) confirmed these facts:

> Through 2008 and 2009, AIG provided capital contributions to its subsidiaries. In total, AIG provided $27.2 billion to its subsidiaries in 2008 and $5.7 billion in 2009. Of the 2008 capital contributions, $22.7 billion went to the domestic life insurance companies, primarily to cover losses in the securities lending portfolio. In 2008, the parent company contributed $4.4 billion to the foreign life insurance subsidiaries after they experienced 'significant capital needs following publicity of AIG parent's liquidity issues and related credit downgrades and reflecting the decline in equity markets' (COP 2010: 51 citing AIG 2009b:116).
>
> These entities [AIG's life insurance subsidiaries] were direct beneficiaries of the government rescue. By receiving capital contributions from the government, the foreign and domestic life insurance subsidiaries were able to meet their obligations under the securities lending program and avoid liquidity or solvency concerns and potential ratings downgrades (COP 2010: 106).
>
> The need for capital infusions suggests that securities lending obligations could have resulted in liquidity or solvency concerns for some of AIG's insurance subsidiaries (COP 2010: 116 footnote 445).

The regulators stated that the insurance companies, as a whole, had sufficient capital to maintain solvency. However, this statement is rather misleading. It is not

19 When regulatory capital falls below the Authorised Control Level (ACL), the regulator can seize control of the insurer.

reasonable to consider the combined position of all the AIG subsidiaries, because money cannot be easily transferred from one insurance company to another. Some companies might have been relatively healthy, whereas others were in a very weak position.

An American actuary, David Merkel, provides a breakdown of the statutory returns for individual companies in the AIG group (Merkel 2009) (see Table 1). His research shows that some insurers suffered very large losses from their securities lending investments – losses that were large enough to wipe out their capital. Many of these insurers also suffered additional losses from investments in the parent company or affiliates.

Many of these companies received large capital contributions during 2008 – presumably to cover their losses and restore solvency.

Based on the GAO data, and Merkel's assessment of the statutory returns, it seems that the regulators were rather optimistic in their assessment of the solvency of AIG's life insurance subsidiaries as at September 2008.

**QUESTION FOR DISCUSSION**

When an insurance company requires a bailout from the government, should there be greater transparency about the solvency of the insurer? Or would this simply create panic and policyholder runs? Should the regulators make reassuring (but misleading) statements about the solvency of the insurers?

## 6.3 Inter-relationships between AIG affiliates

The solvency of AIG's insurance subsidiaries was also threatened by cross-shareholdings.

> Intercompany transactions and cross-holdings complicated AIG's financial position. Many of AIG's insurance subsidiaries held common stock in other AIG subsidiaries. This stock was counted towards regulatory capital of the insurance subsidiaries. In addition to common stock, some subsidiaries provided guarantees for smaller subsidiaries (COP 2010: 50).

As an example, consider ALICO, an AIG subsidiary, which in turn owned several other subsidiaries (life and general insurance companies that operated outside the United States). ALICO had investments in more than 46 different affiliated companies, and had more than 100 inter-company agreements. ALICO suffered substantial losses as a result of its investments in the parent company. At the start of 2008, ALICO had about $3.5 billion invested in AIG common stock valued at $54.53 per share. During 2008, AIG's price plummeted to $1.89 per share. This wiped out about one-third of ALICO's capital. In addition, ALICO also suffered losses through the securities lending program (Delaware Department of Insurance 2009).

Merkel has pointed out the problems causes by "capital stacking". Capital stacking occurs as a result of cross-investments by companies within the same group. This strategy increases the reported capital levels for each company, but it also increases systemic risk (Merkel 2009). The International Association of Insurance Supervisors has identified "intra-group creation of capital" as an issue affecting regulation of insurance groups (IAIS 2010).

## 6.4 The Impact on Credit Ratings

What would have happened to the insurance subsidiaries' credit ratings, if the parent company had declared bankruptcy?

Representatives of the Credit Rating Agencies answered this question in their Congressional testimony.

Standard and Poor's (S&P) managing director, Rodney Clark, testified as follows:

> With respect to the effect of AIG's current financial situation on the creditworthiness of its subsidiaries, we believe that the subsidiaries are to some extent insulated … This is because the insurance subsidiaries' capital is generally insulated by state insurance laws and regulations.
>
> Nevertheless when S&P lowered its credit rating on AIG to "A–" on September 15, we also lowered the ratings on most of AIG's insurance subsidiaries to "A+" from "AA+"…While AIG's financial problems have no direct effect on the solvency of its insurance subsidiaries, we believe that the creditworthiness of those subsidiaries is nevertheless affected in two primary respects. First, in our opinion financial pressures at AIG generally make it less likely that AIG will be able to provide additional capital to its subsidiaries in the event the subsidiaries suffer investment losses of their own or otherwise require recapitalisation … The second issue we see affecting the creditworthiness of AIG's insurance subsidiaries relates more generally to overall reputational risk resulting from the parent company's financial problems. For example it may be more difficult for subsidiaries to retain and attract new customers where there is uncertainty surrounding the parent company (Clark 2010: 7).

In the months and years after the initial bailout, the government restructured the bailout package several times – generally swapping debt for equity, that is, government loans were swapped for equity-type assets. These restructures were largely motivated by the need to maintain AIG's credit ratings. As a result of this government support, the credit rating of the AIG parent company was five or six notches higher than it would otherwise have been.

According to the GAO, a reduction in financial strength ratings for the insurers would have had dire consequences. Life insurers would have suffered surrenders and a loss of new business (especially for high net worth customers who relied on advice from financial advisors). For the property and casualty companies, the GAO predicted that "a financial strength rating downgrade would result in a loss of approximately 50 percent of the net premiums written and operating losses for the domestic business … staff retention could become a key issue" (GAO 2011a: 80-81).

## 6.5 Policyholder reactions

A number of regulators testified that the AIG bailout was necessary in order to prevent policyholder runs on AIG's insurance subsidiaries (Millstein 2010).

In September 2008, after all the adverse publicity about AIG, some of AIG's competitors recognised a marketing opportunity – targeting AIG policyholders, persuading them to surrender their AIG policies and buy a replacement policy from another insurer. State insurance regulators issued a number of press releases urging AIG's life insurance customers to think carefully before surrendering their policies. However, these press releases were not entirely successful in preventing a flood of surrenders, in both domestic (US) insurers and overseas. During the fall of 2008, total surrenders at AIG's Retirement Services division hit $800 million per week (Millstein 2010).

Figure 5 shows the premium income and withdrawal outgo for AIG's life insurers, based on data provided by the Government Accountability Office (GAO 2011a: 47).

The fourth quarter of 2008 shows a massive outflow of funds from AIG's domestic life insurers. Newspaper reports indicate that AIG's international subsidiaries also suffered from "runs" during this period. AIG's policyholder withdrawals continued to exceed additions to policyholder deposits throughout 2009 and 2010, but this probably reflects the effect of the recession as well as reputational damage. (AIG was also selling off some subsidiaries, which would partially explain the decline in new business inflows shown in Figure 5.)

In some cases, the policyholder runs had severe consequences for the policyholders. For example, in the United Kingdom, an AIG life insurance subsidiary (ALICO) sold single premium investment bonds. The policyholders' money was invested in a mix of assets, including some rather illiquid mortgage-backed securities. When the crisis occurred in September 2008, there was an immediate policyholder run, which created liquidity problems for the insurer. ALICO suspended withdrawals and eventually closed the fund to new customers (FSA 2013a).

This caused some distress to the customers: many of them had been told that their money had been invested in a "money market fund" which offered "immediate liquidity" and "instant access". The Financial Services Authority imposed a penalty on the financial advisers who had provided such misleading advice (FSA 2013a).

**QUESTION FOR DISCUSSION**

AIG's insurers clearly suffered reputational damage, leading to a loss of business and liquidity problems. Is it possible to measure and manage reputational risk? If so, how should this be done?

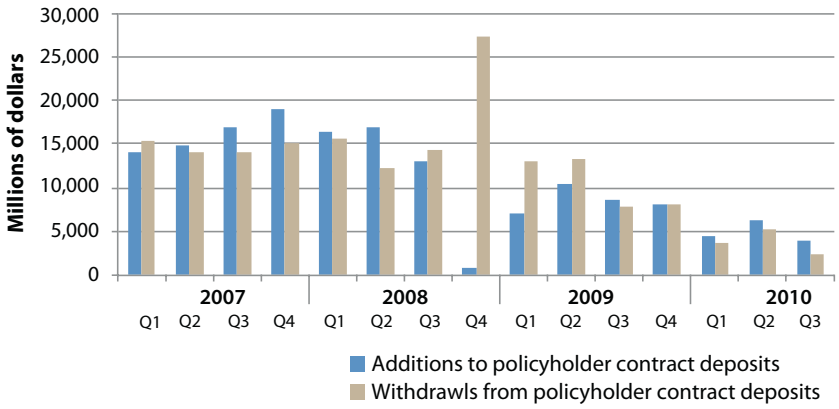


**Figure 5: Additions and withdrawals from policyholder contact deposits for AIG life and retirement services, 2007–2010.**
Source: GAO (2011a:47)

## 7 CONSEQUENCES OF THE BAILOUT: FORCED SALES

As a result of the bailout, the government became a major AIG shareholder and creditor. In order to repay its debt to the government, AIG was expected to sell off many of its subsidiaries, including insurance companies. However, during the GFC it was difficult to find buyers.

Historically, the sale and purchase of insurance companies has been a risky business, for two reasons:

1. The company might be sold to a financially weak or poorly regulated company; this would undermine the policyholders' security.
2. The buyer might pay too high a price for the insurance company, endangering the solvency of the buyer; this is more likely to be a problem if the purchased insurance company has unreliable accounting or poor record-keeping (or both), so that the buyer underestimates the risks underlying the purchase.

In most countries, legislation imposes some controls over transfers and amalgamations of insurance portfolios: typically, the approval of the regulator is required.

The AIG bailout created some difficulties for US government regulators. On the one hand, as shareholders and creditors, they were keen to sell AIG's subsidiaries quickly, and at a high price. But as regulators, they were also keen to ensure that any sales would not simply transfer solvency problems to another financial institution. For example, in 2010 MetLife sought to acquire AIG's ALICO unit. Since MetLife was a bank holding company, the FRBNY was responsible for considering the merits of this proposal:

> Officials saw the matter as a serious potential conflict because FRBNY had an interest in seeing the acquisition being completed, as that would aid repayment of federal lending, while at the same time it had supervisory responsibility for MetLife (GAO 2011c: 119).

The Americans dealt with this by separation of duties, that is, through an "information barrier" between two different units within the FRBNY.

The sale of an insurance company creates additional risks when the deals cross international boundaries. Regulators might be less concerned about protecting policyholders if those policyholders live outside their jurisdiction. Regulators might not be concerned about any risks to the solvency of the buyer, when the buyer is a foreign company.

In 2010 AIG attempted to sell its Asian insurance business (AIA) to a British life insurance company (the Prudential), for $35.5 billion. The US Treasury supported this proposal. The price was more than they could expect to receive from other alternatives, and the proceeds of the sale could have been used to pay down AIG's debt to the US government. The FRBNY would have received the first $16 billion from the sale, with the remainder going to the US Treasury (Walsh & de la Merced 2010).

However, this was a risky deal for the Prudential. The Prudential would need to raise $20 billion in additional capital in order to pay for the acquisition, which would have made it the largest-ever rights issue in the UK. Normally, the UK's Financial Services Authority (FSA) would be asked to give prior approval of any acquisitions. However, the Prudential was reluctant to disclose the proposed deal to the FSA (and in fact failed to mention the deal during normal supervisory meetings held during the bargaining period). The FSA only found out about the deal when they read about it in the newspapers, just a couple of days before the share purchase agreement was signed. Since the FSA had not been given advance notice of the deal, the regulator had very little time available to assess the impact on the Prudential's policyholders. The FSA complained that the delay in notification "resulted in a significant risk that the wrong regulatory decision would be made and hampered the FSA's ability to assist overseas regulators with their enquiries in relation to the transaction" (FSA 2013b: 3).

In the end, the UK's prudential regulator, the FSA, was unwilling to approve the proposed deal.

> Prudential was unable to satisfy [the FSA] that the enlarged group would have a sufficiently resilient financial position, including whether it would have a robust regulatory capital position and whether regulatory capital surpluses held in certain jurisdictions could be applied to meet potential capital demands which might arise in other areas of the group (FSA 2013b: 10). [20]

This was a deal that would have been beneficial to the US government, in its role as AIG's creditor. So the US regulators had an incentive to promote the deal. But was this in the best interests of AIA's policyholders and the Prudential's shareholders?

20 The FSA imposed a £30 million fine on the Prudential for its failure to act in an "open and co-operative manner" when reporting to the regulator.

**QUESTION FOR DISCUSSION**

When a government-owned insurance company is sold, are there adequate protections for policyholders? Who bears responsibility when the insurance company operates internationally, with policyholders in one jurisdiction, a vendor in a second jurisdiction, and a buyer in a third jurisdiction? To what extent should regulators co-operate across jurisdictions? Or should each regulator simply protect its own citizens?

## 8 AIG'S PROPERTY CASUALTY COMPANIES

So far, we have focused on AIG's life insurance subsidiaries. Although AIG's life insurers were facing financial difficulties as a result of losses arising from the securities lending program, the GAO reports suggest that AIG's property and casualty companies were "basically sound". The property casualty subsidiaries did not participate in the securities lending program, and the domestic property and casualty insurers did not require large capital infusions during 2008. By the end of 2008, the domestic property and casualty companies had combined total capital of about $24 billion, much higher than the minimum capital requirement of $6 billion (GAO 2010: 38).[21]

But AIG's property and casualty insurers did suffer some ill effects as a result of problems in the parent company. The property and casualty companies suffered a sharp fall in premium income in 2008–09. Of course, the whole industry was suffering from the effects of the GFC, but AIG's property and casualty premium income fell by more than the industry average (Harrington 2010).

It seems likely that the premium income fell because AIG's subsidiaries had to cut premium rates in an attempt to hold onto market share. Soon after the government bailout, AIG's competitors began to complain. They claimed that AIG was pricing very aggressively in an attempt to maintain market share:

> Some insurers said that they had observed instances, in some cases numerous instances, where AIG had sold commercial property/casualty coverage for a price that the insurers believed was inadequate for the risks involved. They cited examples where AIG Commercial's prices had decreased significantly from the previous year's price, when circumstances appeared to indicate that higher prices were warranted (GAO 2009a: 13).

AIG's competitors claimed that AIG had an unfair advantage, arising from an implicit government guarantee (i.e. because customers believed that the government would not allow AIG's insurers to fail).

In 2009, the GAO was asked to investigate these claims. It spoke to a variety of market participants – brokers, customers, regulators and actuaries – but they could not reach any firm conclusion about the validity of these allegations. The GAO pointed out that:

- It was difficult to make comparisons of premium rates for large policies, since the terms and conditions for each policy are individually negotiated.
- Pricing is subjective, depending on the judgement of the underwriters; therefore it is difficult to determine whether pricing will be adequate to cover losses.
- For long-tail business, it may be necessary to wait for several years in order to tell whether premiums were adequate.

The GAO's inconclusive report on under-pricing allegations was published in March 2009. The GAO continued monitoring the performance of AIG's property and casualty insurers over the next three years. The evidence shows that AIG's loss ratios and combined ratios were noticeably higher than the average for their peers in the same industry (see Figure 6).[22]

In Figure 6, the spikes in the loss ratios for the fourth quarter of 2009 and 2010 reflect adverse loss development. AIG's property casualty insurers strengthened their reserves by billions of dollars in both 2009 and 2010 (AIG 2011). The combined ratio in the fourth quarter of 2009 also includes an expense charge of $1.2 billion resulting from a write-down of goodwill valuations.

21 Note that a realistic assessment of surplus would probably have been lower – AIG increased its outstanding claim liabilities by several billion dollars over the next few years.

22 See GAO (2012) page 50 for a description of the method used to identify a peer comparison group. A "peer" was defined to be a company with more than $1 billion in direct premiums written, with at least 90% of its premiums coming from business lines that accounted for more than 60% of AIG's premium income.

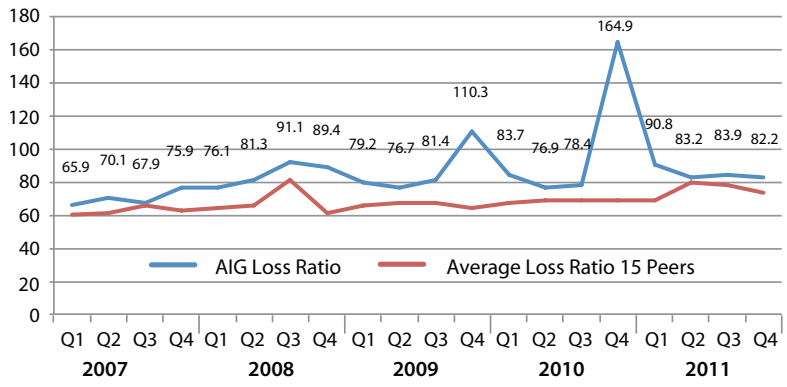


**Figure 6: AIG combined ratios for property casualty companies (Chartis domestic and foreign property/ casualty insurance companies) versus peers, 2007–2011**
Source: GAO (2012: 52).

**QUESTION FOR DISCUSSION**

One arm of government (Treasury) was a major shareholder in AIG's property and casualty companies: Treasury had an interest in maximising the sale price of the insurers. Another arm of government (state regulators) was responsible for monitoring under-pricing risks in the insurance industry. Does this create a conflict of interest? Did the implicit government guarantee give AIG an unfair advantage over its competitors? How could AIG's competitors be assured of fair treatment?

## 9 CONCLUSION

Before 2007, AIG's insurance subsidiaries seemed to be financially strong, with excellent credit ratings and capital reserves well in excess of the minimum statutory requirements. There was little awareness of the off–balance sheet risks to the insurers arising from affiliate transactions and contagion risks. Within a very short time, however, these risks would necessitate one of the largest government bailouts in history. We hope that this case study contributes to the discussion of better identification and management of these hidden risks.

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# Retirement incomes – issues and next steps

DR ANTHONY ASHER

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The Actuaries Institute has made the development of an appropriate retirement incomes market a major policy priority. It is therefore pleasing to see how the issue has been picked up by the Financial Systems Inquiry (FSI) Final Report,[1] and by many others in government and industry. As the FSI summarises:

> The superannuation drawdown phase of Australia's retirement income system provides limited choice for managing risk in retirement. It also gives little guidance to retirees in navigating complex and important financial decisions. Retirees do not efficiently convert superannuation benefits into income streams in retirement.

This note mentions some recent developments, and sets out a view on priorities for the years ahead. Although I am convenor of the Institute's Retirement Incomes Working Group (RIWG), the views expressed here are personal.

## RESEARCH

As is widely known, retirement incomes are of international concern as defined contribution funds have become dominant in English-speaking countries particularly. MacDonald et al (2013), a review produced by the Society of Actuaries, provides perhaps the most comprehensive summary of the academic research and the practical issues. The RIWG discussed the Australian context in Asher et al (2013). Two major retirement research initiatives are also underway at Australian universities.

CEPAR, the ARC Centre of Excellence in Population and Aging Research, based mainly at the University of New South Wales, has an important retirement incomes component headed by actuary Michael Sherris. It has

**KEYWORDS**

annuities, regulatory impediments, consumer protection, research



1 http://fsi.gov.au/publications/final-report/.

published numerous papers covering the design and modelling of mortality and disability for annuities, reverse mortgages and long-term care products. The papers cover considerations of policy design, capital requirements and hedging, as well as systematic and systemic mortality and investment risks. Sherris and Evans (2009) also produced a report for the Henry Tax Review on the issues involved in private sector supply of annuity guarantees.

The CSIRO-Monash Superannuation Research Cluster, based at the Australian Centre for Financial Studies, has also entered the field. A particularly interesting project, involving actuary Colin O'Hare uses the Australian Tax Office (ATO) database to examine the drawdown behaviour of retirees. This project does address one of the current priorities, which is to know more about what Australian retirees are actually doing with their assets.

I am collaborating on an analysis of Centrelink data[2] that we hope to be finished shortly, while the RIWG and Simon Solomon have been given a Research Grant by the Institute to collect data from funds and insurers on the rate at which members draw down their allocated pensions and annuities.

The other priority, it seems to me, is the need to set standards for financial advice. Our preliminary findings from the Centrelink data confirm that there is significant heterogeneity in the way people are drawing down assets. Hubener et al (2013), for instance, have produced a comprehensive model of savings and investment over people's lifespan allowing for almost all the factors that might be expected to matter, but are not able to attain an R-squared of more than 14% in their US data.

Much of the unexplained behaviour may, of course, be well-informed and intentional, but there it also seems that many people are making poor decisions and need more help. MacDonald et al (2013) report on a number of US surveys that they say have "concluded, with considerable supporting evidence, that retirees and prospective retirees are not sufficiently financially literate, and are under-appreciative of the value of annuities and of financial advisers". They note, however, that these studies have not addressed the deeper questions between "financial literacy, the choice of drawdown strategy, and life satisfaction". Other studies, however, indicate that the financial advice is itself unreliable. Apart from the recent ASIC (2014) findings on egregious conflicts of interest, Kotlikoff (2006) finds numerous logical flaws in the standard approach to advice. He suggests the primary mistake is that advisers let their clients set their own consumption goals, and then take greater investment risks rather than modifying their behaviour to match achievable outcomes. This approach is also evident in Australian superannuation calculators – including that provided by ASIC's Moneywise website. The RIWG is working on a project to better understand the advice given to retirees, and I am collaborating on another project[3] that is intended to produce a coherent financial planning calculator for use by superannuation members and financial planners. In particular, we intend to focus on sensible patterns of retirement spending and aim to find ways of engaging members in making choices based on a real understanding the risks.

There is also a gap between common practices in investment modelling and the more sophisticated academic research. The frequency of negative returns currently required by APRA reporting standards do not obviously map onto the risk of lengthy periods of poor performance as in Japan over the past two decades.

## REGULATORY INITIATIVES

In Asher et al (2013), the RIWG identified two major obstacles to innovation in this market, which are being addressed by Treasury and ASIC respectively.

The first is in the definition of annuities that are permissible, as covered in Regulations 1.05 and 1.06 in Superannuation Industry (Supervision) Regulations 1994, that inhibit or prevent the development of investment-linked, with-profit and deferred annuities. Treasury's (2014) discussion paper "Review of retirement income stream regulation" asked for proposals as to how these might be amended. The RIWG paper, produced mainly by Graham Kelly, and discussed at the Research Colloquy on 31 July 2015, formed the basis of the Institute's response.[4] The main Treasury concern appears to be to limit the loss of tax revenue on investment income in the drawdown phase. Our response therefore suggested minimum payment standards that are intended to provide a level income in real terms throughout life – if conservative investment and mortality assumptions are borne out. If experience that deviates from that expected is shared with members, this will lead to deviations in repayments, but there would be no artificial tax avoidance. In order to prevent deferred life annuities from being used for overly generous tax deferral, we suggested that there could either be restrictions on the amount invested, or on the amount payable on commutation or death. It is hoped

2 With Shang Wu, Ramona Meyricke, Susan Thorp.
3 With Adam Butt, Gaurev Khemka and Ujwal Kayande.
4 http://www.actuaries.asn.au/Library/Submissions/Superannuation/2014/140922TreasuryRetirementIncomeStream.pdf

that our suggestions can be implemented quickly.

The second obstacle is the difficulty in redefining the purpose of superannuation funds as being for the provision of retirement incomes rather than lump sums. An ASIC regulation (Class order 11/1227 and Regulatory Guide 229) governs illustrations of retirement incomes quite tightly, and has just been amended to permit the inclusion of the Age Pension in illustrations. Illustrations must refer to ASIC's Moneywise calculator, which expects members to die at age 90, provide for a limited discussion of risk, and suggest that higher risk investments will increase the amounts that can be drawn down. It is to be hoped that ASIC will develop a more principles-based approach to this area and permit more meaningful information to be provided. Perhaps the most innovative recommendation of the FSI is that funds should aim to provide online calculators that consolidate all members' superannuation assets to give them a full picture of the retirement income that they might expect. The FSI suggests that the ATO could provide details of members' other superannuation assets for the calculators, but the ATO also has information on bank deposits and loans that could be incorporated.

Apart from these obstacles, there has been some debate on whether some form of annuitisation should be compulsory (O'Meara & Bruhn 2013), but the FSI has taken up the Institute's suggestion of sensible retirement income defaults. This may prove more difficult to implement than expected. Members have to inform the fund of their retirement date and bank account details, and so they must be engaged at the time when benefits are paid (or earlier as suggested by the FSI). They also have to be given information about their options by their fund. In the 1990s, I served as a trustee of a university fund and we made annuities the default option at that time. Recently I was given access to some statistics comparing the proportion of retirees choosing lump sums across different university funds, and it did not appear that our efforts had had any impact. From my experience of taking my own benefit (to transfer to another account), the people administering the retirement process need to be persuaded of the advantages of annuitisation. Government endorsement of minimum features, as suggested by the FSI, will provide some persuasive power, but the impact is likely to be reduced if there are mixed messages from other parties.

## COMMERCIAL PRODUCT INITIATIVES

On the longevity-risk front, while commercial innovation is constrained by the regulations, a number of companies have introduced "guaranteed minimum lifetime withdrawal benefits" over the past few years, but with apparently limited success. In a new development, Mercer has introduced a "group self-annuitisation"[5] investment option that will pay survival bonuses from the age of 75. Its market acceptability will be followed with considerable interest.

Challenger's indexed lifetime annuity sales have, however, reached record levels after extensive efforts to educate intermediaries. Annuity sales represent only 2% of total rollover into retirement products,[6] but do indicate that higher annuity sales can be achieved with the right marketing message.

On the investment-risk front, this is not the place to discuss the lifecycle approach,[7] which is more relevant to the later stages of the accumulation phase. The lifecycle approach may, however, overflow into retirement, and Asher (2012) suggests ways of smoothing the payments made so that an equity risk premium can be earned for longer. Some funds[8] are offering high-income portfolios that offer a little more stability and benefit more from franking credits.[9] I continue to believe that there is a role for alternative instruments that effectively securitise medium-term inflation-linked cash flows (Asher 2011).

## INVESTOR PROTECTION

Retirees need protection on a number of fronts.

In the first place, there are no universally agreed templates for appropriate strategies for retirement incomes, and financial advisers, product providers and regulators can make mistakes. Some errors made by advisers and regulators have already been mentioned, but Asher (2012) also notes the artificial volatility that can be created by a product design that allows for the capitalisation of assumptions in pooled schemes to be changed. The capitalisation rate of the Swedish PPM unit-linked pensions was – for instance – changed from 4% to 3% in 2003, and changed back in 2007 (Vittas 2011). This would have meant an unnecessary reduction in payments of about 10% in 2003. Other mistakes involve programmed drawdown strategies that do not

5 http://investmentmagazine.com.au/2014/10/mercer-launches-game-changer-for-annuity-market/
6 My calculations: they have reported over $600m in life annuity sales (http://www.challenger.com.au/group/AGM_addresses_Chairman_and_CEO.pdf) and Asher et al (2013). Figure 2 shows $35 bn invested in retirement products.
7 See, for instance, http://www.sunsuper.com.au/lifecycle/.
8 See, for instance, http://www.cfsgam.com.au/au/insto/Microsites/Equity_Income_Five_Year_Milestone/Research/.
9 Raewyn Williams, Increasing tax efficiency for retirees. Presented to the Post-retirement Australia 2014 conference, Sydney, October 21–22.

adjust when poor investment performance makes them unsustainable.

There is also the need to ensure that investors understand the investment, inflation and mortality risks involved in their retirement decisions. A recent[10] article complained about the declining nominal values of with-profit annuities in the UK, which had apparently been sold with bonus illustrations that showed increasing payments. In my view retirees should be provided with graphs that illustrate the variety of possible consumption patterns over their remaining lifetimes and asked questions such that the answers show that they understand the risks. Companies are clearly vulnerable to accusations of mis-selling, whether the accusations are reasonable or not. My preference would be for a video record to be kept, as memories get shorter, and possibly more selective, with age. This would provide proof that the risks were carefully explained – and also ensure that advisers were scrupulous in explaining the risks in a comprehensible way.

This brings us to the third area in that older people need protection as their cognitive capacity declines. In Earl et al (2013), we looked at self-managed superannuation fund members to find evidence of greater credulity among those with some self-reported dementia symptoms. Possibly a quarter of people will die with dementia symptoms, and they will become increasingly vulnerable to exploitation. Evidence cited in that paper suggests that family members and care-givers represent a source of risk.

The FSI's recommendation that ASIC should be given "proactive product intervention power" will address these issues, but require them to develop very much greater capability to distinguish between the innovative and the exploitative without discouraging innovation.

## CONCLUSION

In summary, developing appropriate retirement income products and advice will keep many busy for some time:

- There is much research to be done on what people are doing in retirement, and the constitution of the financial elements of a satisfactory retirement.
- There is space for considerable development of products and advisory techniques, many of which require changes to restrictive regulations
- There is a need to develop consumer protection mechanisms that ensure that retirees, increasingly vulnerable as they age, are appropriately assisted and not exploited.

Actuaries are well placed to play a central role in these developments. They will undoubtedly involve much debate some of which will be reported in this journal. The RIWG would also welcome those who are interested in contributing to some of our projects.

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# Recent Australian insured lives mortality: a review of the Actuaries Institute/Financial Services Council 2004–2008 Lump Sum Graduation

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In 2012 the Graduation Taskforce of the Actuaries Institute published a report "Graduation of the 2004–2008 Lump Sum Investigation Data". This is now the most recent publicly available report on Australian insured lives' mortality experience. The tables in that report are compared with, on the one hand, contemporary Australian population mortality, and on the other, the preceding Australian insured lives tables, IA95-97. Thus the paper reports and comments on the level of insured lives' mortality compared with that of the total population as well as changes in both of these over the period from 1996 to 2006. It appears that insured lives mortality has improved less than population mortality over the 10 years.

## 1 INTRODUCTION

In Australia insured lives mortality experience data is currently collected by a collaborative arrangement between the Financial Services Council, the industry representative body, and KPMG, a professional services firm. The Australian Institute of Actuaries has used these data to produce graduated (smoothed) mortality rates.

In this paper we will consider only lump sum risk business sold to individuals, both stand-alone and rider, that covers death risk. This paper will provide an overview of the report of the Actuaries Institute Graduation Taskforce, "Graduation of the 2004–2008 Lump Sum Investigation Data" in Section 2, including commentary on the key features of the underlying data and the tables themselves. In Sections 3 and 4 the tables will be compared with contemporary population mortality rates and previous insured-lives mortality tables respectively. Further comparisons will be made in Section 5, and Section 6 provides conclusions.

## 2 "GRADUATION OF THE 2004–2008 LUMP SUM INVESTIGATION DATA" REPORT AND TABLES

This work was performed by the Graduation Taskforce of the Australian Institute of Actuaries on a dataset that is collected and analysed by a

**KEYWORDS**

Australian insured mortality, experience study, ALT05-07, IA95-97, ALT95-97

AJAP 2015; 3: 99–106

proprietary collaboration between the Australian Financial Services Council and KPMG, a professional services firm. The interested reader should refer to that report for more detail (Graduation Taskforce, 2012).

As the Death with Rider business covers only the mortality component of the combined death and disability experience it cannot be viewed in isolation, but can only be understood when appropriately combined with the relevant disability rider experience. For this reason Death with Rider business will be excluded from some dimensions of this analysis.

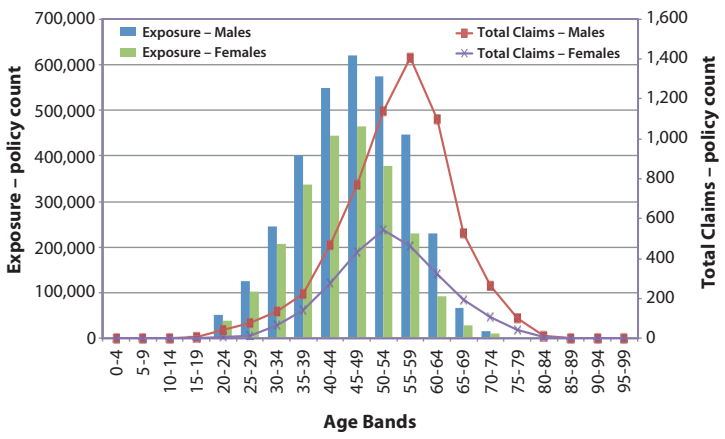


**Figure 1: Death Only by policy count – exposure and claims for males and females.**

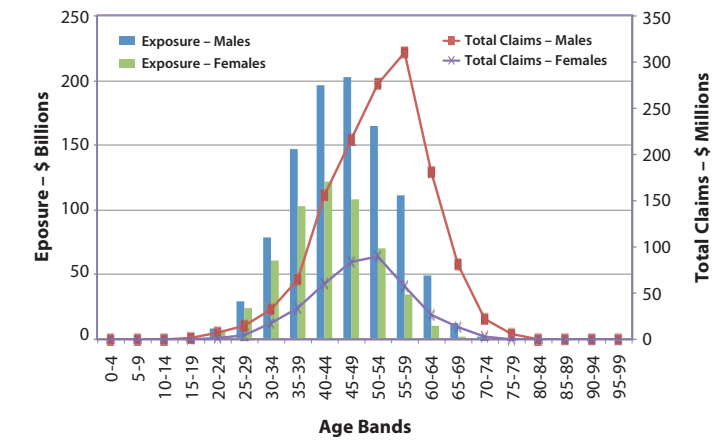


**Figure 2: Death Only by amounts – exposure and claims for males and females.**

## 2.1 Data and adjustments

The data provided consisted of fully underwritten, standard lives which were either term insurance with reviewable premiums (noting that premiums for most life insurance in Australia are not guaranteed) or insurance riders to investment platforms. The exclusion of traditional business (whole of life and endowment type policies) means there is little exposure for insureds aged over 65. Additional dimensions were gender, age, smoker status and duration in force.

The period covered was 31 December 2003 to 31 December 2008, five calendar years of exposure, measured on a census method at each 31 December. Claims included notifications only until 31 March 2009, an IBNR allowance increased death claims by about 2% overall.

The age definition was adjusted to be age last (attained) at last policy anniversary. This is not directly comparable to the other tables used in this paper and thus the other tables will be adjusted in later sections to ensure subsequent comparisons are on a like-for-like basis. This adjustment will be made consistently with the Taskforce approach.

Figure 1, Figure 2, Figure 3 and Figure 4 show the

**Table 1: Total exposure and claims for males and females by product type and measure**

| | Male | Female |
|---|---|---|
| **Total exposure** | | |
| Death Only – Policy Count | 3,337,311 | 2,343,240 |
| Death Only – Dollar Amount | $1,003 bn | $543 bn |
| Death with Rider – Policy Count | 2,272,646 | 1,673,707 |
| Death with Rider – Dollar Amount | $798 bn | $431 bn |
| **Total claims** | | |
| Death Only – Policy Count | 6,277 | 2,631 |
| Death Only – Dollar Amount | $1,367 m | $391 m |
| Death with Rider – Policy Count | 1,437 | 514 |
| Death with Rider – Dollar Amount | $423 m | $109 m |

**Table 2: Average sum insured for males and females for exposure and claims**

| Average sum insured | Male | Female |
|---|---|---|
| Death Only – Exposure | $300,518 | $231,777 |
| Death Only – Claims | $218,835 | $148,927 |
| Death with Rider – Exposure | $351,003 | $257,538 |
| Death with Rider – Claims | $294,671 | $213,239 |

exposure and the claims for males and females by both the policy count and the dollar amount of sum insured, separately for Death Only and Death with Rider business.

The peak of the exposure by age is in the forties for almost all age groups, indicative of the ages when this cover is most sought. The very low levels of exposure below the mid-twenties and above age 60 to 65 is also a feature of this type of insurance, and will have implications for the graduated tables in those age ranges. It can also be seen that the peak age for claims is universally higher than that for exposure.

As is frequently the case, female exposures are lower than those for males, as can be seen in Table 1. Sums insured for females are on average lower than those for males as shown in Table 2, which is also typical. It is also clear that Death with Rider business is a substantial proportion of total mortality insurance cover.

Table 3 shows that female claim rates are lower than those for males, as expected. For example, the female claim rate for Death Only business by policy count, at 1.12 per 1000 policies, is 60% that of males at 1.88 per 1000. Female claim rates for Death with Rider business are lower again, at 50% that of males. This may be connected to the often higher rates of disability amongst females, as a disability claim would terminate the death cover in the Death with Rider portfolio. It should be noted that while these rates are not standardised; the results by age band are fairly similar.

A lower mortality rate for the sub-population with higher amounts of insurance can be discerned in Table 3, where the claims rates when measured using dollar amount of sum insured are lower than those weighted by policy count across the board. This effect is noticeably stronger for females than males for Death Only business.

In order to refer to the tables efficiently, this paper will adopt the naming convention shown in Table 4. Further discussion will be limited to the main tables for all durations combined only.

**Table 3: Female exposure and total claims as a percentage of male by product type and measure**

| Claim rates per 1000 (Claims/Exposure × 1000) | Male | Female | Female/ Male |
|---|---|---|---|
| Death Only – Policy Count | 1.88 | 1.12 | 60% |
| Death Only – Dollar Amount | 1.36 | 0.72 | 53% |
| Ratio | 72% | 64% | |
| Death with Rider – Policy Count | 0.63 | 0.30 | 49% |
| Death with Rider – Dollar Amount | 0.53 | 0.25 | 48% |
| Ratio | 84% | 83% | |

**Table 4: Naming convention for tables**

| Characters in Table Name | Codes | Meaning |
|---|---|---|
| 1–2 | DO or DR | Death Only or Death with Rider |
| 3 | M or F | Male or Female |
| 4 | N, S or A | Non-smoker, Smoker or Aggregate |
| 5–9 | 04-08 | Years of exposure |

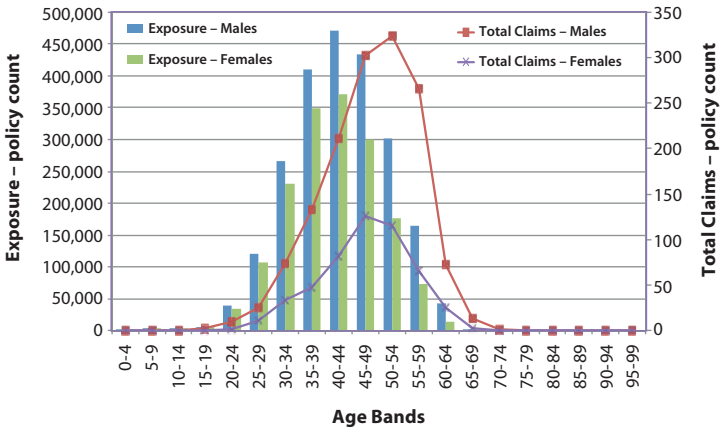


**Figure 3: Death with Rider by policy count – exposure and claims for males and females.**

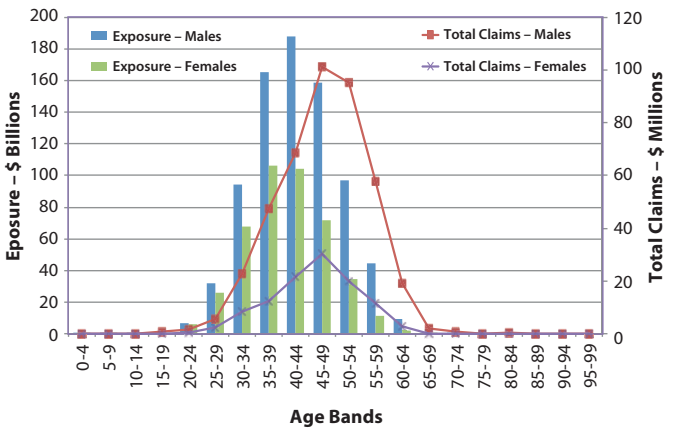


**Figure 4: Death with Rider by amounts – exposure and claims for males and females.**

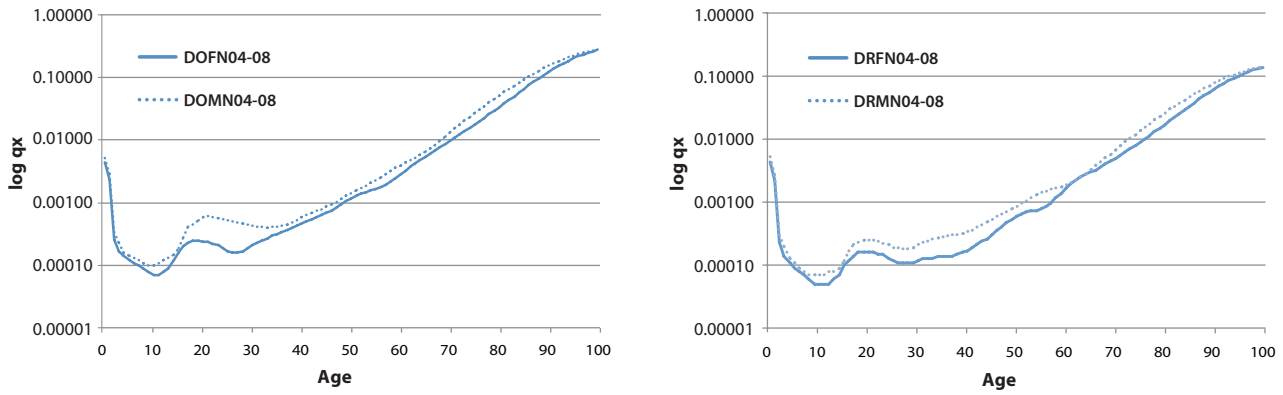


**Figure 5: left, log of mortality rates for Death Only business for male and female non-smokers; right, log of mortality rates for Death with Rider business for male and female non-smokers**

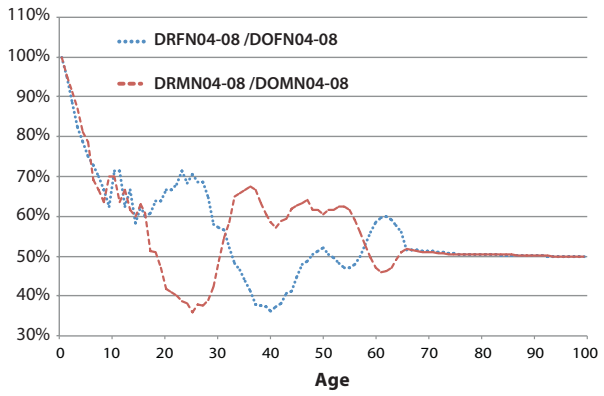


**Figure 6: Ratio of mortality rates for Death with Rider to Death Only for male and female non-smokers**

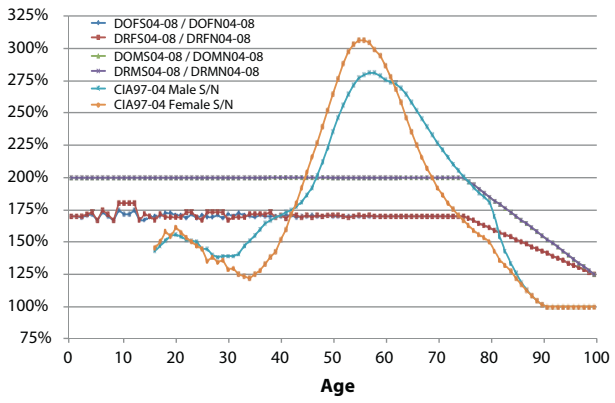


**Figure 7: Ratio of mortality rates for smokers to non-smokers**

## 2.2 Discussion of the tables

The graduated mortality tables for non-smokers are shown in Figure 5. The "accident hump" is clearly present for all tables, although of different form for males and females and for Death Only versus Death with Rider. In particular, the accident hump effect appears to be longer lasting for the male Death Only table: it does not wear off until age 35, whereas for the other tables it disappears after age 25.

The ratios of the Death with Rider business to the Death Only business are shown in Figure 6. It is noticeable that these ratios behave in opposite ways for males and females. This may be a reflection of the relative levels of disability incidence between the two sexes at different ages, but this is not further investigated here.

Figure 7 presents the ratio of smoker to non-smoker mortality retained by the Taskforce. As expected, smoker mortality rates are universally higher than non-smoker mortality rates.

Virtually the same ratios were used for Death Only and Death with Rider business for males and females respectively, with male smokers having twice the mortality of non-smokers and female smokers having mortality 1.75 times that of non-smokers. From age 75 for both genders, ratios reduce linearly to a minimum of 1.25 at age 100. It is likely spurious to have a smoker mortality rate for ages below 17.

The final two ratios shown in Figure 7 are those used by the Canadian Institute of Actuaries in the 1997–2004 series of mortality tables (Individual Life Experience Subcommittee, 2010), shown for comparison. This humped pattern is well known (Continuous Mortality Investigation Mortality Committee 2006, Society of Actuaries Mortality Task Force 2001) in particular showing increasing relative

smoker mortality as diseases that have a longer lead time eventuate in the population, with this ratio tailing off over time as selection effects in the two "pools" lead to the experience converging over time.

When developing graduated tables, it is essential to verify the fit to the actual experience. From the data provided this can be examined for total smoker and total non-smoker experience on the one hand and by age band for aggregate (smoker and non-smoker combined) experience on the other hand. These ratios are presented in Table 5 and Figure 8 and Figure 9 respectively.

The fit for male Death Only business by policy count is the best (i.e. closest to 100%). The remaining policy count ratios range from 91% to 101% except for Smoker experience for Death with Rider business at 112% for Males and 86% for Females. The Smoker experience is more volatile as it represents a very small proportion of the overall exposure, ranging from 10% to 21% across the portfolios.

The policy count experience is also very close to 100% for the age bands with the largest exposure as can be seen in Figure 8 for Death Only and Figure 9 for Death with Rider. The ratios become unstable at both younger and older ages, due to the relative lack of exposure. The amounts experience, as expected, tends to be less than 100%.

Regarding the pattern of smoker to non-smoker mortality by age, the data provided does not allow confirmation of the pattern chosen, though it may be that a simpler pattern was chosen to reduce the risk of spurious accuracy.

In the next sections, the graduated rates (i.e. the tables) will be compared with contemporaneous Australian population mortality and the previous insured lives table. For this purpose the rates for all tables have been approximately adjusted to the "age last policy anniversary" definition in order to make them comparable. All adjusted tables have a suffix "a". All subsequent comparisons are done on an aggregate mortality basis, as neither the Australian population mortality tables nor the previous insured lives tables exist on a smoker-differentiated basis.

## 3 COMPARISON WITH AUSTRALIAN POPULATION MORTALITY

Although the exposure is not provided by calendar year by the Graduation Taskforce report, if it is fairly even across all years, it can be assumed that the experience is centred on 2006, and this is broadly supported by a review of the exposure by policy duration. Hence, population tables based on mortality experience over 2005 through 2007 are a valid basis for comparison.

**Table 5: Ratios of actual to expected experience for total smokers and non-smokers using 100% of the relevant graduated tables**

| Actual/Expected | Male | | Female | |
|---|---|---|---|---|
| **Death Only** | **Count** | **Amount** | **Count** | **Amount** |
| Non-Smoker | 99% | 90% | 95% | 87% |
| Smoker | 101% | 102% | 101% | 91% |
| | **Male** | | **Female** | |
| **Death with Rider** | **Count** | **Amount** | **Count** | **Amount** |
| Non-Smoker | 91% | 91% | 98% | 96% |
| Smoker | 112% | 110% | 86% | 103% |

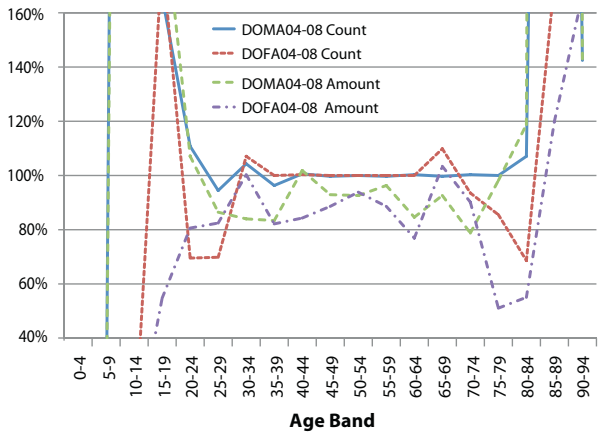


**Figure 8: Ratios of actual to expected experience for Death Only business by age band using the graduated tables**

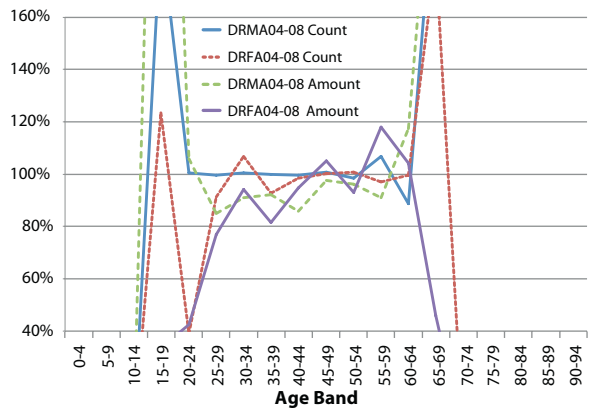


**Figure 9: Ratios of actual to expected experience for Death with Rider business by age band using the graduated tables**

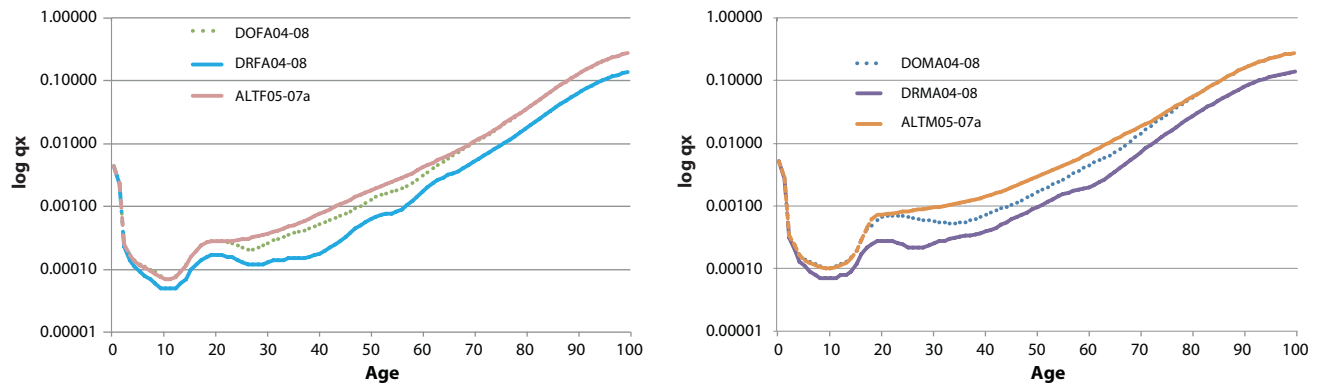


**Figure 10: left, log of mortality rates for females; right, log of mortality rates for males: Death Only and population**

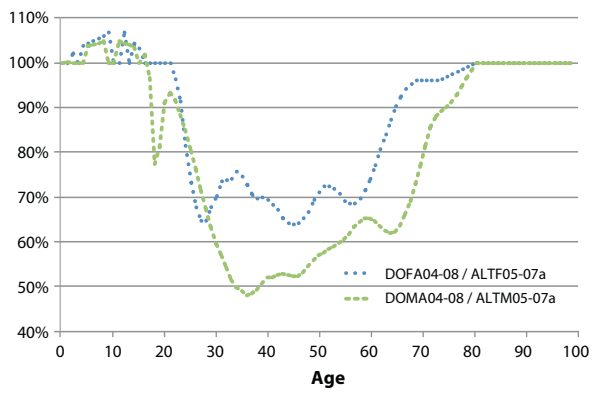


**Figure 11: Ratio of mortality rates for Death Only mortality to that of the population**

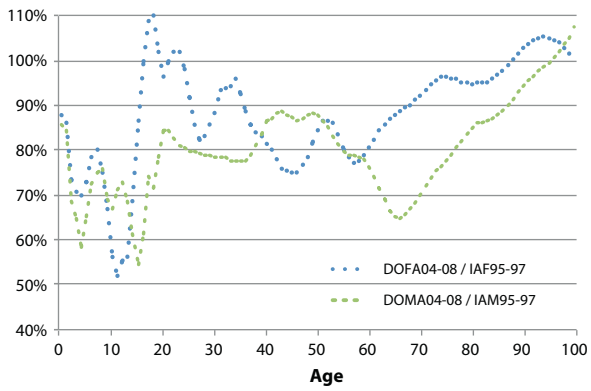


**Figure 12: Ratio of the current to the previous insured lives mortality tables, males and females**

The Australian Government Actuary produced the Australian Life Tables 2005–07, known as ALT05-07, by age and gender using deaths over the calendar years 2005 through 2007, and population as at 30 June 2006 (Australian Government Actuary 2009).

Figure 10 presents the aggregate mortality rates for females (on the left) and males (on the right), plotted on a log scale and shown alongside population mortality.

The use of the Australian Life Tables for aggregate mortality for Death Only for ages 0 to 15 and from age 85 onwards is clear. The remaining key feature is that between the ages of 20 and 60 the insured-lives mortality experience for Death Only business is clearly lower than that of the general population, as would be expected.

Figure 11 presents the ratio of Death Only mortality to that of the general population.

The ratio for Death Only is approximately 100% from ages 0 to 15 (not exact due to the nature of the re-estimation of the age definition). From there female experience descends to about 70% of population rates and male to around 50% to 60%. From age 60, rates rise to blend back into population mortality.

## 4 COMPARISON WITH PREVIOUS INSURED-LIVES MORTALITY

The previous table produced by the Australian Institute of Actuaries for insured-lives mortality experience was IA95-97 (IAAust Mortality Committee 2001). A single analysis of experience against that table was published in 2004 examining the years 1998–99 (The Life Risk Insurance Committee 2004). There is effectively a 10-year gap from the previous table to the current one.

Figure 12 shows the ratio of the current to the previous insured lives mortality table. Ratios prior to

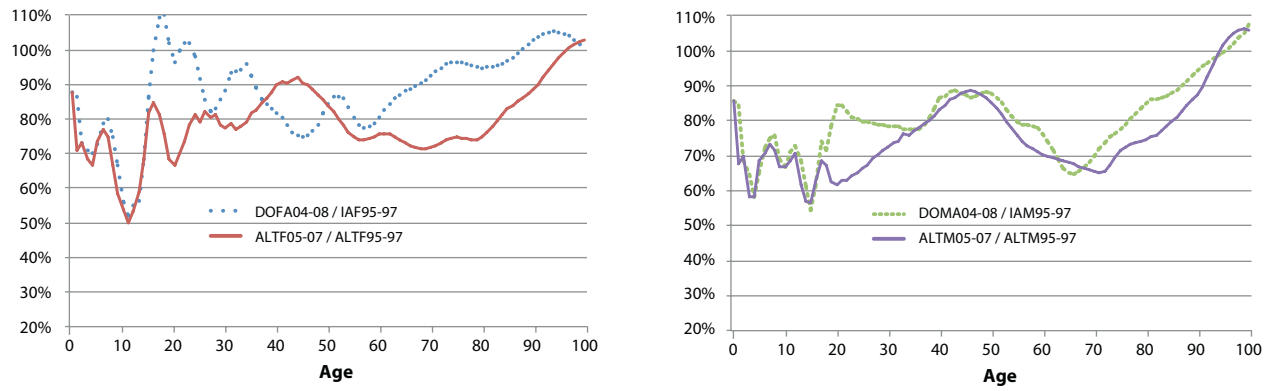


**Figure 13: left for females; right, for males – ratio of current to past mortality rates, for insured lives and general population**

**Table 6: Life expectancies in years at ages 20 and 50 for various tables, females and males**

| Female | ALTF95-97a | ALTF05-07a | IAF95-97a | DOFA04-08 | DOFN04-08 | DOFS04-08 |
|---|---|---|---|---|---|---|
| e20 | 62.0 | 64.1 | 64.3 | 64.8 | 65.2 | 61.1 |
| e50 | 33.0 | 35.0 | 35.0 | 35.5 | 35.7 | 32.0 |
| **Male** | **ALTM 95-97a** | **ALTM 05-07a** | **IAM 95-97a** | **DOMA 04-08** | **DOMN 04-08** | **DOMS 04-08** |
| e20 | 56.5 | 59.7 | 59.8 | 61.7 | 62.3 | 56.6 |
| e50 | 28.6 | 31.3 | 31.0 | 32.8 | 33.2 | 28.1 |

age 20 are shown but are not relevant for insured lives experience. For females current Death Only experience is around 90% of the previous table between ages 25 and 35 and around 80% from ages 35 to 60 before rising to around 100%. For males the pattern is different, moving from around 80% in the 20s and early 30s up to 90% until 50, before descending to around 70% in the mid-60s. This may be reflective of the varying rates of change in mortality rates for different ages. There may be secondary effects, such as changes in underwriting practice or the underlying portfolios that have impacted different age groups and the two genders differently.

In the absence of changes related to insurance practice or portfolio mix, this ratio should represent the improvement in mortality over the 10-year period. This likely fully explains what can be seen in the age range 0 to 15 to 20, which is taken from the general population in both cases. However the ratios for other ages will be a mix of insurance practice and portfolio changes with underlying improvement in mortality rates and may indicate a slower rate of improvement between the two insured-lives tables than that observed in the general population. The comparison is shown in Figure 13.

The ratio is generally lower for the population than for the insured lives, supporting the presence of a slower rate of improvement in the insured lives groups.

Informal discussions with actuaries practising in mortality risk in Australia would suggest that the slower rate of reduction in mortality rates in the insured lives portfolio is potentially due to changes in practice over the period. The business mix is likely also somewhat different. Practitioners consider that relaxation of underwriting requirements and selective lapsation over the period may have contributed, making the insured lives less "select", that is, a group that is overall in less good health than it may have been in the past, particularly when compared with the population as a whole.

## 5 OTHER COMPARISONS AND COMMENT

In order to summarise the changes over time in both population and insured lives mortality into a single figure, Table 6 presents period life expectancies for ages 20 and 50 (noting that these are truncated at age 100).

From 1995–97 to 2005–07 females in the Australian

**Table 7: Differences in life expectancies in years at ages 20 and 50 between the general population and insured lives, females and males**

| Female | IAF95-97a – ALTF95-97a | DOFA04-08 – ALTF05-07a | Male | IAM95-97a – ALTM95-97a | DOMA04-08 – ALTM05-07a |
|---|---|---|---|---|---|
| e20 | 2.3 | 0.7 | e20 | 3.2 | 2.1 |
| e50 | 2.1 | 0.5 | e50 | 2.4 | 1.4 |

population gained 2.1 years of life expectancy at age 20, and males gained 3.2 years. However most of the gain comes from reductions in mortality rates after age 50, as shown by the fact the females aged 50 gained 2 years of life expectancy over the period and males aged 50 gained 2.7 years.

The third column shows insured lives' life expectancy from 1995–97, and it is striking that this was effectively equivalent to population mortality 10 years later.

When these figures are then compared with the current insured lives aggregate mortality (Death Only), it can be seen in Table 7 that the gap between insured lives and the general population has narrowed, particularly in the case of females.

Lastly, the high proportion of non-smokers in the aggregate insured-lives population (80% to 90%) is evident in the small gap between life expectancies for non-smokers and their equivalent aggregate measure. The impact of excess smoker mortality is clear in the reduced life expectancies shown. Smokers from the Death Only portfolio are experiencing population mortality from 10 years earlier.

## 6 CONCLUSION

This set of tables is the only currently publically available record of Australian insured lives mortality experience. Large insurers and reinsurers likely have access to databases as large or larger than that used here, but these are not in the public domain.

The author would be particularly interested in comments and suggestions from users of these new tables, both for further comparisons or analysis and regarding possible explanations for some of the observed features.

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Prepared for the workshop Innovations in Australian mortality research: analysis, models and methods
11 November 2013 at the Australian National University

# Age pension indexation

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**KEYWORDS**

age pension, indexation, benchmarking, pensions, retirement, superannuation

AJAP 2015; 3: 107–115

## INTRODUCTION

As part of the 2014 Federal Budget, the Coalition government announced, or referred to, 20 superannuation and retirement changes. These proposed changes are mainly to superannuation contributions, income tax, Age Pension eligibility age, thresholds and indexation, Commonwealth Seniors Health Card and a number of other related policies. Most of these changes appear under the heading Expense Measures (Federal Budget 2014). In other words, the government is proposing reductions in the benefits it pays, leading to budgets savings. The generalised conclusion that can be drawn from this is that current (and future) recipients of these benefits will be worse off.

Estimates of expense savings were provided in the Budget. These are, however, only on a cash-flow basis five years forward, which may mask the longer term impact of certain proposals, for which the true cost may not be immediately apparent.

On 18 June 2014 draft legislation was introduced in the House of Representatives to give effect to these announcements – *Social Services and Other Legislation Amendment (2014 Budget Measures No 2) Bill 2014*. In respect of the Age Pension, this legislation proposes to make the following amendments:

- increase the qualifying age for Age Pension, and the non-veteran pension age, to 70, increasing by six months every two years and starting on 1 July 2025
- pause indexation of the income and assets test–free areas for all pensioners and the deeming thresholds for all income support payments for three years from 1 July 2017
- ensure all pensions are indexed to the consumer price index (CPI) only, by removing: (a) benchmarking to male total average weekly earnings; (b) indexation to the pensioner and beneficiary living cost index from 20 September 2017
- reset the income test deeming thresholds to $30,000 for single-income support recipients, $50,000 combined for pensioner couples, and $25,000 for a member of a couple other than a pensioner couple from 20 September 2017

From this it is clear that the government's intention is to revert to CPI indexation only. It is unclear at this stage whether any form of wage-based benchmarking would be reintroduced.

This note focuses on one of the proposed changes in particular – the change in indexation (and "benchmarking") of the Age Pension – and aims to highlight the long-term impact that this policy change may have on retirees.

## BACKGROUND

Currently, pensions (including the Age Pension, Service Pension, Disability Support Pension and Carer Payment) are indexed twice each year by the greater of the movement in the consumer price index (CPI) or the pensioner and beneficiary living cost index (PBLCI). Each March and September they are then "benchmarked" against a percentage of male total average weekly earnings (MTAWE).

Legislation (Social Security Act 1991) benchmarks the combined couple rate to 41.76% of MTAWE. The single rate of pension is set at 66.33% of the combined couple rate (which is equal to 27.7% of MTAWE). "Benchmarked" means that after it has been indexed, the combined couple rate is checked to see whether it is equal to or higher than 41.76% of MTAWE. If the rate is lower than this percentage, the rates are increased to the appropriate benchmark level.

The CPI is a measure of changes in the prices paid by households for a fixed basket of goods and services. Indexing pension rates to CPI maintains the real value of pensions over time.

The PBLCI measures the effect of changes in prices of the out-of-pocket living expenses experienced by age pensioner and other households whose main source of income is a government payment. The PBLCI is designed to check whether their disposable incomes have kept pace with price changes.

The MTAWE benchmark is not intended to maintain the value of the pension relative to costs; it is seen as ensuring pensioners maintain a certain standard of living, relative to the rest of the population.

Prior to 1976, pensions were generally not automatically indexed to movements in prices. Instead, rates were adjusted on an ad hoc basis, typically reflecting upward movements in the CPI. In the early 1970s, the Labor Party under Gough Whitlam announced a commitment to maintain the rate of pension at 25% of average weekly earnings (AWE). The Whitlam Government's policy was that pensions should rise until they reached 25% of AWE. The Fraser Government, in October 1976, introduced automatic increases twice yearly, according to movements in the CPI (though this was briefly reduced to an annual increase in 1978–79).

Benchmarking single pension rates to 25% of MTAWE was a policy of the Hawke and Keating governments. From 1983, aside from the twice-yearly CPI indexation adjustments, Labor governments made four increases to pension rates (in November 1984, April 1990, September 1990 and January 1993).

Automatic benchmarking of the single rate of

**Table 1: Rate of increase in average wages (AWOTE) and price inflation (CPI), over 40 years ending 30 September 2003 to 30 June 2013**

| | Compound annual averages over 40 years | | |
|---|---|---|---|
| 40 years ending | AWOTE | CPI | Difference |
| 30/9/03, 31/12/03, 31/3/04, 30/6/04 | 8.0% | 6.1% | 1.9% |
| 30/9/04, 31/12/04, 31/3/05, 30/6/05 | 7.9% | 6.0% | 1.9% |
| 30/9/05, 31/12/05, 31/3/06, 30/6/06 | 7.8% | 6.0% | 1.8% |
| 30/9/06, 31/12/06, 31/3/07, 30/6/07 | 7.7% | 6.0% | 1.7% |
| 30/9/07, 31/12/07, 31/3/08, 30/6/08 | 7.7% | 5.9% | 1.8% |
| 30/9/08, 31/12/08, 31/3/09, 30/6/09 | 7.5% | 5.8% | 1.7% |
| 30/9/09, 31/12/09, 31/3/10, 30/6/10 | 7.3% | 5.7% | 1.6% |
| 30/9/10, 31/12/10, 31/3/11, 30/6/11 | 7.2% | 5.6% | 1.6% |
| 30/9/11, 31/12/11, 31/3/12, 30/6/12 | 7.0% | 5.5% | 1.5% |
| 30/9/12, 31/12/12, 31/3/13, 30/6/13 | 6.9% | 5.4% | 1.5% |

Source: Table 8.4 in Grenfell (2013)

age pension to 25% of MTAWE was legislated by the Howard Government and took effect from September 1997. This was despite the 1996 National Commission of Audit stating its opposition to automatic benchmarking. When the relativity of the single rate was increased to 66.33% of the couple rate in 2009, the 25% of MTAWE benchmark was not updated to 27.7% in the legislation.

Following the Harmer Review of Pensions in 2009, the Rudd Government introduced the current indexation method and increased the single pension rate by $30 to improve its relativity to the couple rate. The Review had found that single pensioners living by themselves were finding it much more difficult to meet their living costs compared with couple pensioners. Since 2009 the single pension rate has been fixed at 66.33% of the couple rate.

## CPI VERSUS WAGE INFLATION

In recent decades, wages have tended to increase at a faster rate than prices, meaning that pension rates have increased much more than prices. There have, however, been short periods when CPI has increased at a higher rate than wages, for example between 1985–86 and 1989–90, during the year 2000–01 and very recently in the first half of 2013–14.

There have also been individual years when the CPI has decreased (for example in 1997), but during such periods pension rates have typically remained at the level set by the previous adjustment. Movements in the PBLCI have driven three of the ten pension increases since this method began to be used in 2009 (the most recent was driven by a rise in the CPI).

On average, over the past 40 years, the rate of increase in average wages (AWOTE) has exceeded price inflation (CPI) by approximately 1.5% per annum, shown in Table 1 (Grenfell 2013).

**Table 2: Average annual increase in various indices for single retirees for the period 2007 to 2013**

| Index | Increase |
|---|---|
| ASFA Comfortable | 2.4% |
| CPI | 2.8% |
| PBLCI | 3.1% |
| AWOTE | 4.9% |
| Age Pension | 7.0% |

In recent years, other measures of retirement inflation have emerged, most notably the ASFA Retirement Standard (ASFA 2014). The ASFA Retirement Standard benchmarks the annual budget needed by Australians to fund either a comfortable or modest standard of living in the post-work years. It is updated quarterly to reflect inflation, and provides detailed budgets of what singles and couples would need to spend to support their chosen lifestyle. It therefore combines changes in living standards, as well as changes in prices, as these relate to retirement lifestyles.

A comparison of the average annual increase in various indices for single retirees for the period 2007 to 2013 is shown in Table 2.

Since the introduction of the ASFA Retirement Standard, the Age Pension rate (for singles) as a proportion of the income required for a Modest lifestyle (for singles), has increased from 73% in June 2006 ($13,330 vs $18,192) to 94% in March 2014 ($21,912 vs $23,283), as shown in Figure 1.

Another example of the result of different measures of indexation can be found in the difference between the current Age Pension level and that of the Newstart Allowance. Since the indexation arrangements for these two benefits were separated in 1996, the Newstart

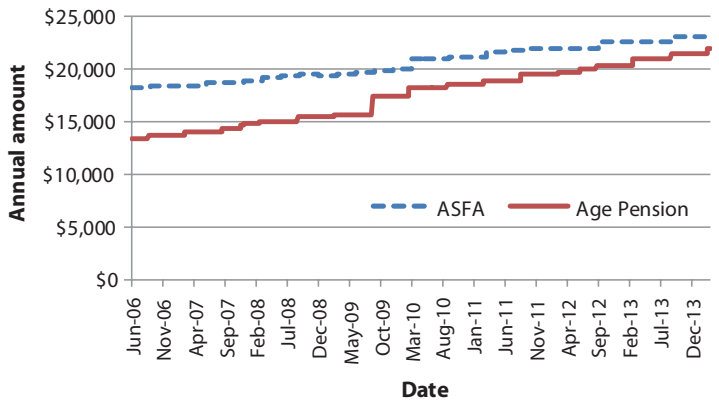


**Figure 1: Comparison of full Age Pension rates for singles with the income required for a Modest lifestyle according to the ASFA Retirement Standard, June 2006 to December 2013.**

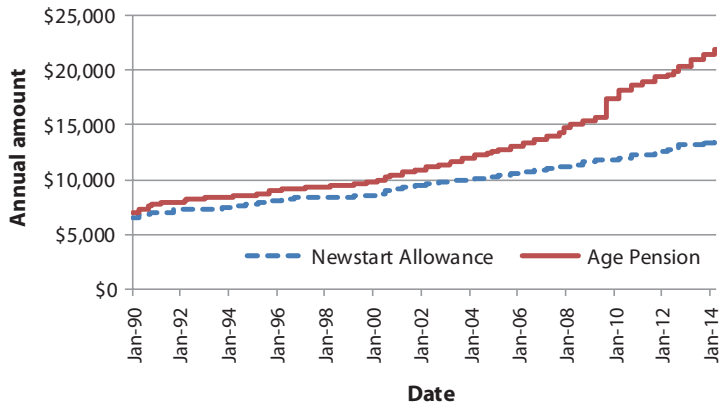


**Figure 2: Comparison of Newstart Allowance with Age Pension rates, January 1990 to January 2014.**

Allowance (indexed to CPI), as percentage of the single rate Age Pension (benchmarked to MTAWE) has reduced from approximately 90% in 1997 to only approximately 60% in 2014 (Figure 2).

It can be argued that the ASFA Retirement Standard represents the most realistic measure of pensioner cost of living changes over time. However, the subjective nature of the selection and ongoing adjustment of the basket of goods distracts from its credibility as a formal indexation measure.

## THE IMPACT ON RETIREES VARIES

The impact of a change in indexation of the Age Pension from MTAWE to CPI will not take effect for a number of years, as commencement is proposed only for September 2017. Furthermore, on the assumption that annual increases in wages exceed annual CPI increases (historically by a margin of approximately 1.5% per annum), the full impact of such a change will only materialise for retirees over an extended period of time.

In this note the word 'retiree' includes both current retirees (those already retired) and future retirees (those planning to retire, perhaps many years hence).

The actual impact for an individual retiree needs to be considered holistically, that is, by viewing Age Pension benefits as a component of total retirement income. Retirement income from superannuation savings and other assets outside of superannuation will also affect the individual's outcome.

Therefore, the impact of a change in Age Pension indexation for an individual will depend on a combination of two main factors: current age (i.e. term to retirement) and the estimated level of savings at retirement. This means that there are broadly three different groups of retirees that will be impacted differently over the long term (discussed separately here):

- Age Pension–only retirees
- completely self-funded retirees
- retirees receiving part Age Pension.

### Age Pension–only retirees

Even though Australia has a compulsory superannuation system, there will be retirees who do not participate in the system, or retire with minimal assets. Examples are the long-term unemployed, self-employed or those who retired without having worked since the superannuation guarantee system was introduced. These retirees will be fully reliant on the Age Pension as their source of post-retirement income. Although this is currently the majority of retirees (approximately 60%), it is expected that this proportion will reduce to approximately 30% by 2049 (Rothman 2012).

Changing Age Pension rate indexation will impact these retirees in two ways. Firstly, the relative value of the pension *during* retirement. And secondly, the rate of pension at retirement, that is, when individuals become eligible for the Age Pension.

Benchmarking the pension rate to a wage index provides retirees with increases in living standards *during* retirement consistent with those of the working population. By changing to CPI indexation, only retirees' Age Pension income during retirement will no longer keep track with increases in population living standards (assuming CPI increases are less than wage increases over time). CPI indexation will, however, maintain the purchasing power of the Age Pension during retirement.

The current Age Pension rate for singles is benchmarked to 27.7% of MTAWE (41.76% for couples). New retirees will become entitled to this rate at retirement. If the MTAWE benchmark is removed (i.e. Age Pension indexation reverts to CPI only), the relative value of the Age Pension at retirement will gradually reduce over time.

Based on the assumptions for CPI (2.7%) and AWOTE (4.2%) noted earlier (Grenfell 2013) and assuming that MTAWE increases are identical to AWOTE increases, this would mean that, after seven years of CPI indexation, starting 2017 (say 2024) the Age Pension rate for singles would fall from the current 27.7% of MTAWE to about 25%, which is the previous benchmark, prior to the rate adjustment for singles in 2009 following the Harmer Pension Review (Harmer 2009). After 20 years (say 2037) the rate would fall below 21% of MTAWE, as shown in Table 3.

**Table 3: Effect of CPI only indexation on Age Pension rates as a percentage of MTAWE from 2017 to 2037**

| Year | | Year | |
|---|---|---|---|
| 2017 | 27.70% | 2028 | 23.66% |
| 2018 | 27.31% | 2029 | 23.32% |
| 2019 | 26.92% | 2030 | 22.99% |
| 2020 | 26.53% | 2031 | 22.66% |
| 2021 | 26.16% | 2032 | 22.34% |
| 2022 | 25.78% | 2033 | 22.02% |
| 2023 | 25.42% | 2034 | 21.71% |
| 2024 | 25.06% | 2035 | 21.40% |
| 2025 | 24.70% | 2036 | 21.10% |
| 2026 | 24.35% | 2037 | 20.80% |
| 2027 | 24.00% | | |

### Completely self-funded retirees

The initial conclusion should be that retirees who are completely self funded will not be impacted by any changes to Age Pension benefits. The main reason for this would be that their assets or income exceed the thresholds in the means test for the Age Pension. Statistics suggest that this is approximately 20% of retirees (Rothman 2012). However, a distinction has to be drawn between the current position compared with future positions, and current self-funded retirees compared with future self-funded retirees.

Current self-funded retirees may not be affected immediately, but over time, as their assets are depleted by retirement consumption, they may well meet the thresholds of the means test and become entitled to a part Age Pension at some point in the future. Reducing indexation on pension rates will mean that when self-funded retirees become eligible for the Age Pension, the real value of the Age Pension benefit will be less relative to what it would have been, had the MTAWE benchmark remained in place. The level of this relative reduction in benefit will be greater, the longer it takes for a retiree to qualify for a part Age Pension.

Future projected self-funded retirees may also be impacted at some stage in the future. As with current self-funded retirees, there will be a time when they do qualify for a part Age Pension, at which stage the relative value on CPI indexation will be lower compared with current MTAWE benchmarking.

It is not possible to quantify the impact for these retirees, as it will be different for each individual, depending on, amongst other things, their total assets, the period to or since retirement (i.e. age), spending rate post-retirement and relative funding level (current or projected at retirement).

### Retirees receiving part Age Pension

The impact on retirees receiving only a part Age Pension will be a combination of the impacts described above, which will depend on their relative individual level of self-funded retirement savings (i.e. superannuation and other assets) compared with the level of Age Pension received, and their period to, or into retirement.

Currently these retirees make up approximately a quarter of the population over age 65, but the proportion is expected to grow to almost 50% by 2049 (Rothman 2012). This increase in part pension recipients is as a result of the superannuation system maturing over time with more retirees self-funding a portion of their retirement.

## IDEAL INDEXATION STRUCTURE

From the above it should be clear that applying only CPI indexation to pension rates (i.e. removing the current MTAWE benchmarks) will lead to reduced Age Pension benefits. For younger people, further away from retirement, the relative impact will be worse. Those individuals who are most dependent on the Age Pension for retirement income will experience the worst relative impact. The question then becomes: "How far is this, or any future government, willing to let it go?"

The possible consequence of a prolonged period of indexation based on price increases rather than wage increases is well illustrated by the recent ongoing turmoil in the United Kingdom. This in large part has arisen because their social security age pensions have been increased only for price inflation for over 20 years, resulting in totally inadequate current pensions, destitute pensioners, much public unrest and political angst.

It can be argued that the ideal structure for Age Pension indexation would be to benchmark the rate to wages until retirement date, thereby maintaining the relativity to the working population's changes in standard of living. After retirement date indexation

can be relative to prices, such as CPI, to maintain purchasing power of income. Such a structure would require a different pension rate for every individual retiring and is clearly completely impractical to implement or administer.

## MTAWE VERSUS AWE

Historically, the MTAWE benchmark (male total average weekly earnings) has been used for Age Pension indexation, as a female or total persons wage index was not published by the Australian Bureau of Statistics until the 1980s. The total value of the Age Pension has been gradually rising over time, even relative to the benchmark of MTAWE. This is occurring in the context of an ageing population.

The Report of the National Commission of Audit (NCOA 2014) considers that average weekly earnings (AWE) is a more appropriate benchmark for the rate of the pension. It is more appropriate than MTAWE given that women are a major part of the labour force and it more closely represents the wage received by the average worker. Benchmarking to AWE still recognises that pensions should have regard to community standards through benchmarking to wages and is a more generous measure than the median wage (the mid-point wage).

Figure 3 (NCOA 2014: Chart 9.1.4) shows how the maximum Age Pension entitlement has increased relative to wages over time. Historically, the total pension package fluctuated between 20 and 25 per cent of MTAWE until the late 1980s. In the 1990s and mid-2000s the total pension package was worth around 25 to 27 per cent of MTAWE, or around 30 per cent of AWE.

## THE CASE FOR CPI INDEXATION

The Age Pension provides basic income support for those who are most at risk of falling below an acceptable standard of living. It is intended to be a safety net, not a guaranteed primary source of post-retirement income.

The introduction of the superannuation guarantee (SG) provides a mechanism that links retirement savings with a person's earnings and level

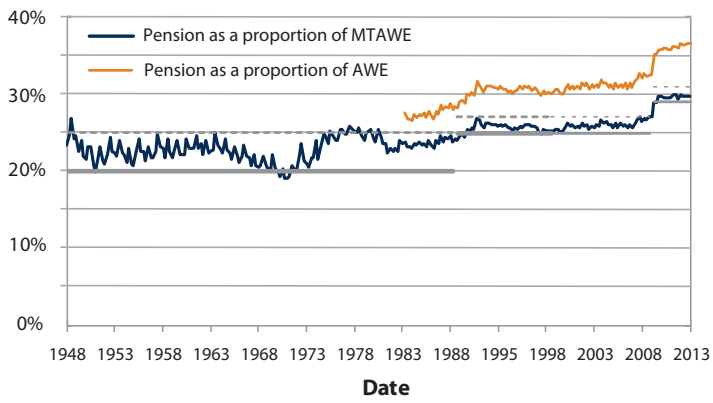


**Figure 3: Maximum fortnightly single rate of the Age pension as a proportion of wages.**
Note: The chart includes supplements to the Age Pension such as the Pension Supplement.
Source: NCOA (2014) Chart 9.1.4

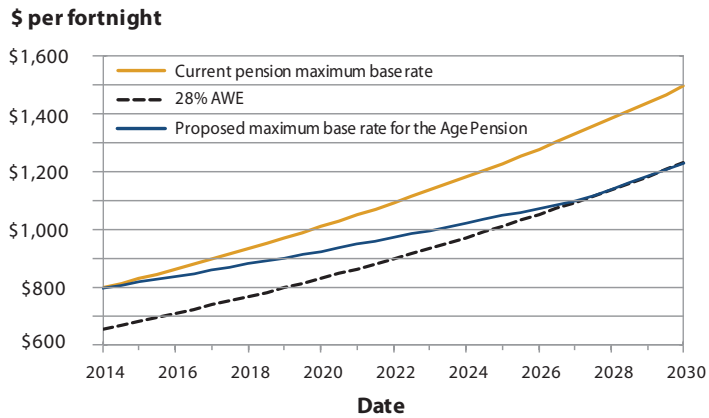


**Figure 4: Transition to new Age Pension benchmark.**
Source: NCOA (2014) Chart 7.2

of engagement with the workforce over their lifetime. The SG reduces the risk of 'myopic' behaviour (that is, individuals not saving enough for their retirement), and thereby helps smooth income over an individual's full lifetime.

By introducing and maintaining the SG the government forgoes revenue through tax concessions. These concessions serve to compensate for the compulsory nature of the SG, as well as assist in the long-term viability of the retirement incomes system as a whole. As the superannuation system matures, there will be a relative reduction in aggregate Age Pension costs, as more retirees will have a larger proportion of their retirement income self-funded. In other words, as the relative value of superannuation increases, the relative value of aggregate government support should decrease.

This case is recommended in the Report of the National Commission of Audit (NOCA 2014), based on an assessment of the sustainability of the Age Pension. As shown in Figure 4, on current trends the transition of the Age Pension from currently (approximately) 28% of MTAWE to 28% of AWE can be expected to be completed by around 2027–28 (that is in just under 15 years' time).

Recommendation 12 from the 2014 report is included below:

> The recommended re-benchmarking of the Age Pension will ensure that Australia's Age Pension programme is more sustainable over the long-term. The proposed transition to the new arrangements will ensure that a person's pension entitlement does not fall in either real or nominal terms.
>
> Recommendation 12: Age Pension – establishing a new benchmark
>
> The Age Pension is an essential part of Australia's social safety net. The Commission recommends that changes be made to make it more sustainable by:
>
> a. changing current Age Pension indexation arrangements to a new benchmark of 28 per cent of Average Weekly Earnings and maintaining other price indexation arrangements; and
> b. transitioning to this arrangement, approximately over a 15 year period, by indexing the Age Pension maximum base rate at a rate equal to the higher of the growth in the Consumer Price Index or the Pensioner and Beneficiary Living Cost Index until it is equal to 28 per cent of Average Weekly Earnings.

The Commission does not, however, recommend CPI indexation indefinitely. It envisages that, under these transitional arrangements, the value of the Age Pension will be maintained in both real and nominal terms until a new benchmark is reached. Upon reaching the new benchmark (28% of AWE), the maximum base rate of the Age Pension will resume growing in line with growth in AWE, rather than MTAWE. Post-transition, indexation should also maintain existing price indexation arrangements. That is, the Age Pension should increase in line with the higher of AWE or CPI/PBLCI.

No clear comment is made about the assumed percentage growth in AWE over CPI which underlies the 15 year transition period.

## THE CASE FOR MAINTAINING WAGE-BASED BENCHMARKING

The Harmer Pension Review (2009: xiv-xv) summarised its findings as follows (bolding added for emphasis):

> Effective indexation arrangements are essential to maintaining the capacity of income support payments to provide a basic acceptable standard of living over time, and therefore to provide pensioners with ongoing financial security. The Review noted that this question, as with the determination of the rate of pension, needs to consider both the absolute standard of living of pensioners and the relativity of this to the rest of the community.
>
> While there are strong arguments for decisions on changes in the rate of pensions to be taken as deliberative decisions by government, the Review considers that automatic indexation provides greater security for pensioners and should be continued.
>
> In considering how this can be best done, the Review analysed different approaches to price adjustment, including the Consumer Price Index and the analytical living cost indexes produced by the Australian Bureau of Statistics, and the wide range of different ways in which a community benchmark can be defined and measured. It also analysed the longer term relationship between indexation and sustainability in the light of changes in the population structure, especially the rising dependency ratio between the population aged over 65 years and the "working age" population.
>
> While supporting the continuation of the current two part indexation to prices and community living standards, the Review considered there should be a different emphasis on the roles of the two components, **with benchmarking to changes in community living standards as the central long-term indexation factor for pensions**.
>
> Finding 8: The Review finds that automatic indexation of pensions and a two-part approach of benchmarking and indexation should continue. **Benchmarking pensions relative to community standards should be the primary indexation factor**, with indexation for changes in prices acting as a safety net over periods where price change would otherwise reduce the real value of the pension. (Section 4.4.2)
>
> >

The Review considered that both the current measures used for indexation, the Consumer Price Index and Male Total Average Weekly Earnings have drawbacks that make them less than ideal measures to ensure the maintenance of an appropriate rate of pension over time.

Detailed analysis of the Consumer Price Index and other measures of price changes led the Review to conclude that an alternative measure of price change which is more fully responsive to specific changes in pensioners' purchasing power would be appropriate.

The Review's analysis also indicates that reforms are needed to the current approach of using Male Total Average Weekly Earnings to benchmark pensions to community living standards because of its lack of transparent relevance to the experience of the wider community. While there was no single measure ideally suited to this task, the Review considered that a measure based on the net income of a full-time worker was the most appropriate, in that it removed the distorting influence of part-time work and focused on the disposable, rather than pre-tax, income of people in the workforce.

Finding 9: The Review finds that pension indexation for price change would be better undertaken through an index that more specifically reflected cost of living changes for pensioners and other income support recipient households. (Section 4.4.3)

Finding 10: The Review finds that no single measure to benchmark the pension to community living standards is without limitations. However, the Review considers that a measure of the net income of an employee on median full-time earnings may be a more appropriate measure than the existing Male Total Average Weekly Earnings benchmark. (Section 4.4.4)

Indexation is however highly technical and the Review's approach would involve some additional data collection and analysis as well as refinement of measurement frameworks. There is also the potential for interaction between the setting of the proposed benchmark and potential policy changes subsequent to the Australia's Future Tax System Review. For these reasons the Review considered that implementation of reform may need to be staged.

Finding 11: The Review finds that, while reform to indexation and benchmarking is important to the financial security of pensioners, implementation may need to be phased in to account for policy developments that may arise out of the Australia's Future Tax System Review and to allow for the development of appropriate mechanisms for benchmarking and indexation. (Section 4.4.4)

The Review also considered how other income support parameters, such as the means test free areas, should be adjusted. These parameters are usually indexed by the Consumer Price Index, and therefore increase less quickly than pension rates. This 'fiscal drag' has the potential to introduce unintended distortions into payment structures. The Review concluded that indexation arrangements that create distortions between different components of the payment systems should be avoided, and if they cannot, should be subject to regular review.

Although benchmarking to community standards should be maintained, these reasons should be independent of what the level of the pension should be. The reasons for that for future retirees and existing retirees are different.

For future retirees who will be completely dependent on the Age Pension in their retirement, there should be a minimum standard of living (measured against the standard of living for the community as whole) that the safety net should provide. The only way that this can be achieved is if the age pension before retirement is indexed to wage increases.

The major reason for this is that wage increases include a share of the productivity benefits that better use of capital and labour generate. Employees can use this productivity component prior to their retirement to improve their standard of living (i.e. buy a better car or television) in line with the improvements in the standard of living of the general community. If the Age Pension is not maintained as some minimum level of AWE, then the minimum standard of living provided by the safety net will be gradually eroded over time.

There is some discussion of how "poverty" should be measured. However, the main poverty line used in the OECD and the EU is a relative poverty measure based on "economic distance", a level of income usually set at 60% of the median household income. As this measure is based on household income, indexing the Age Pension to CPI must ultimately result in the safety net provided by the Age Pension reducing below the minimum poverty level. It is difficult to see how such an Age Pension would provide an appropriate safety net.

Currently, AWE is around $75,000 per annum. This is approximately $58,000 after tax, which would set the OECD poverty line at $34,800 per annum. If we assume that this is an income for a couple (which may not necessarily be correct) then the single poverty line could be 60% of this, or $20,880 per annum. If we assume a single pensioner receives all available supplements, they would receive around $22,000 per annum, which is tax free. This is 105% of the poverty line. Taking the figures used in this paper, in 2037 the age pension would be $20.8 \div 27.7 \times 105\% = 79\%$ of the poverty line.

This discussion is the result of a very short look at the issue. However, indexing the Age Pension to CPI will mean that an increasing number of Age Pensioners will be living in poverty.

For actual retirees, similar arguments would apply. However, although it is desirable for pensioners to continue to benefit from productivity improvements generated by employees, it could be argued that once the Age Pension commences, pensioners should no longer benefit from the productivity improvements they have not generated themselves. There is also an

expectation that the level of expenditure will decrease as a person ages. Indexing to CPI may be a backdoor way of reflecting this. It is impractical to have a two-tier indexation regime: therefore, benchmarking to AWE for all would be more equitable.

## CONCLUSION

Public policy relating to support for the elderly is a multi-faceted and complex issue. It extends well beyond merely the structure by which future Age Pension rates are indexed. A number of other items need to be included in considering the matter holistically. These include, but are not limited to, the minimum rate to provide age support, superannuation concessions, maturity of the system, means testing (including the value of the primary residence), government expenditure and revenue, political motivations, healthcare and longevity.

Without considering all the direct and indirect issues associated with the Age Pension, it would be hard to express an opinion on indexation in isolation. Rather, our duty should be illustrating the costs and the impact (and expected trends) to various stakeholders of the different policy options available.

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### Legislation

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