MOTOR ACCIDENTS AUTHORITY

# REVIEW OF INSURER PROFIT

## Contents



## Appendices

## *A. Filed Profit*

### MAA statutory responsibility

Section 28(1) of the Motor Accidents Compensation Act requires a licensed insurer to disclose to the MAA "the profit margin on which a premium is based" and "the actuarial basis for calculating that profit margin". Section 28(2) requires that the MAA report annually to the Legislative Council Standing Committee on Law and Justice on its assessment of the profit margin on which the premium is based and the actuarial basis for its calculation, as provided to it by licensed insurers. The MAA currently satisfies its statutory obligations under section 28 by including its assessment of insurer profit in its annual reports. Information provided by individual insurers to the MAA about profit margins either in their filings or in other communication with the MAA is protected information pursuant to section 217. It is for this reason that the MAA reports on profit margins in aggregate.

**Premium Determination Guidelines**

In submitting their premium filings to the MAA, insurers must comply with the Premiums Determination Guidelines issued by the MAA. The current guidelines are attached in Appendix 1. The guidelines set out the information that insurers must provide in their filings. The MAA may reject a premium if it will not fully fund the liabilities or if it is excessive. In relation to profit, the Act provides that a premium will fully fund the liabilities if the premium is sufficient to "provide a profit margin in excess of all claims costs and expenses that represents an adequate return on capital invested and compensation for the risk taken" (section 27(8)(c)).

**Quantifying an adequate profit margin in the filed premium**

The MAA has made every effort to ensure that the profit component of the filed premium is assessed against objective criteria. With the introduction of the MAC Act, the MAA commissioned Taylor Fry Consulting Actuaries to develop a methodology to provide an indicative range of acceptable profit margins. The methodology developed by Taylor Fry is attached in Appendix 2, and is summarised below.

**Taylor Fry methodology – summary**

The Taylor Fry methodology refers to a 'representative' insurer and involves three components:

1. The determination of a suitable quantum of total capital (net assets) for a representative insurer.
2. The determination of a suitable allocation of insurer capital to NSW CTP.
3. The calculation of a profit loading to service the allocated capital at a fair rate of return.

The representative insurer is based on the average of insurers writing CTP business in NSW. Taylor Fry calculations are based on a representative insurer holding capital equal to 58 per cent of CTP technical provisions, which is approximately equal to 66 per cent of outstanding claims provision (OCP) for NSW CTP. The insurer also holds additional (implicit) capital as a prudential margin within the provision for outstanding claims. The Taylor Fry methodology for allocating capital to the CTP line of business is consistent with APRA's new prudential regime.

There are wide variations in levels of capitalisation between individual insurers. The allocation of capital by the representative insurer used in the derivation of the profit margin is

slightly higher than the highest notional capital allocation reported by an individual CTP insurer.

The indicative range resulting from Taylor Fry's calculations is a profit margin of 4.5-6 per cent of gross premium for the representative insurer. As this range of profit margins relates to a representative insurer, they are illustrative only. It is fully expected that profit margins filed by individual insurers may vary from them, reflecting the insurers' own business structures. The MAA accepts that the level derived by the Taylor Fry methodology sets the minimum level of profit to ensure an adequate return on capital and that actual profit levels will be within a range above this as long as the level is justified by the insurer and not considered by the MAA as excessive.

**Insurer views**

In developing the Taylor Fry methodology, Dr Taylor and the MAA consulted with the insurance industry. However, insurers did not agree with some aspects of the methodology or with the profit levels determined by Taylor Fry. Dr Taylor's response to the Insurance Council of Australia (ICA) representation is attached in Appendix 3.

Debate over what is an adequate profit margin and the methodology for determining the appropriate level has continued over the years and, most recently, was aired in two major forums:

- A meeting between the MAA and the ICA in March 2004.
- A seminar in July 2004 sponsored by the Institute of Actuaries of Australia and the Insurance Australia Group on the "Economic theory of profit margins".

The MAA asked Dr Taylor to provide the MAA with his views on the issues discussed and to update his previous advice on profit margins. Dr Taylor's report is attached in Appendix 4. Dr Taylor concluded that, in the main, the matters canvassed did not change his previous conclusions or the Taylor Fry methodology.

The Trowbridge study (Brigstock and Copping, 2004) was one of the papers presented at these two forums. The Trowbridge study's conclusion was that market expectations of Return on Equity (ROE) for CTP business lie in the range 12% - 17% per annum, and, in relation to profit margins as a percentage of gross premiums, that:

- For ROEs to be consistent with market expectations, the profit margin would fall within the range 10% - 14%.
- A profit margin below 9% almost certainly would be interpreted as unlikely to produce an adequate return on capital.

## MAA position on filed profit margins

Over the last five years, profit margins in premium filings ranged from 7.5 to 10 per cent for individual insurers, with an industry average between 7.7 and 8.7 per cent. The MAA considers this range of profit margins to be reasonable although the MAA has ongoing discussions with the CTP insurers who believe that the level of profit derived from the Taylor Fry methodology is not adequate. As referred to above, the 2004 Trowbridge study concluded that profit margins should be between 10% and 14%, and that a profit margin below 9% would be unlikely to produce an adequate return on capital.

Around the time of the ICA meeting and the July 2004 seminar, one insurer lodged a premium filing with the MAA which included a profit margin in excess of the range included in other insurers' filings. The MAA rejected the insurer's filing on the grounds that the profit margin was excessive, and the insurer refiled. There has been a slight increase in the filed profit margin in recent years which reflects increased allocation of capital to this line of business in accordance with revised APRA standards. Apart from this increase, the MAA has maintained the level of the filed profit margin against insurers' insistence that the margins are too low.

The MAA believes the risk of writing business in the NSW CTP scheme is less than for other long tail business because of the legislative changes to promote scheme stability and the existence of a regulator to closely monitor scheme performance.

**Table 1: Filed profit margins**

| Filing period | Range | Weighted average |
|---|---|---|
| | % of gross premium | |
| 1999-00 | 7.5 – 9.5 | 7.7 |
| 2000-01 | 7.5 – 9.5 | 7.9 |
| 2001-02 | 7.5 – 9.5 | 8.2 |
| 2002-03 | 7.5 – 9.5 | 8.2 |
| 2003-04 | 7.5 – 9.7 | 8.5 |
| 2004-05 | 7.5 – 10.0 | 8.7 |

## *B. Projected actual profit margins*

Section 5(2)(d) of the Act provides that the insurers, as receivers of public money that is compulsorily levied, should account for their actual profit margins. The MAA has commissioned Taylor Fry Consulting Actuaries to estimate the profit margin according to underwriting year, and publishes these estimates in its annual report.

While an insurer's premium filing includes the insurer's prospective estimate of profit margin, the actual profit or loss that an insurer ultimately makes depends on the extent to which the other assumptions in the premium filing come to pass. Historically, NSW CTP experience has been volatile. Insurers' profit under the Motor Accidents Act 1988 from 1991 to 1999 varied from an estimated 33 per cent loss in 1994 to an estimated 26 per cent profit in 1996. The average profit for this period is estimated to be eight per cent of premiums.

The assessment of profit requires a review of the actual development of the underwriting year since the time of the premium filing. The profit or loss that an insurer makes on an underwriting year will depend in the main on the level of claim liabilities. During the development of an underwriting year as claims are received and paid, insurers identify a central estimate of claims cost in regular valuations. To meet APRA requirements insurers must hold a risk margin above the central estimate. If subsequent valuations identify a reduction in the claims cost, insurers will be able to release a proportion of the prudential margin for that underwriting year. That can happen at any time during the development of an underwriting year. However, it may also be necessary for insurers to strengthen their reserves if the valuation identifies increased claims cost.

The MAA assesses the estimated future profit by accounting for the actual payments made to date and current estimates of the liabilities for each underwriting year. These estimates do not

represent actual profit but a current indication of the profit that may be realised once all claims are paid if the current liability valuations prove correct. They are, therefore, heavily qualified by the fact that they will change as the scheme develops further and claims are paid. For example, even for the first underwriting year of the new scheme with approximately 88 per cent of full claims finalised, this represents only 66 per cent of the estimated ultimate incurred claims cost. As the larger claims are finalised over the next few years, this may change the estimated incurred claims cost for the underwriting year.

## Differences between projected actual profit and filed profit: Risk premium compared to actual incurred cost of claims

The differences between the filed profit margin and the current actuarial estimates of profit for each underwriting year are mainly due to the differences between the current estimates of claims cost and the estimates included in insurer filings.

To calculate the risk premium that forms the basis of a filing, insurers estimate

1. the projected frequency of full claims, that is, the number of full claims per registered vehicle, that will be experienced in the underwriting year, and
2. the projected average size of claims incurred in the underwriting year.

The actual claim frequency has been lower than the projected claim frequency for each underwriting year reported on in Table 2. In response to the drop in claim frequency in each underwriting year, insurers included lower projected claim frequency in their next filing. However, the claim frequency continued to drop more than projected.

The reduction in claim frequency is partly due to an increase in the number of registered vehicles and a drop in the rate of casualties/registered vehicle. It should also be noted that all Australian CTP jurisdictions report a decrease in claim frequency suggesting that the decrease may be due to factors outside the CTP schemes such as effective road safety campaigns and the prolonged drought, for example.

The average claim size has been lower than projected in premium filings reflecting the effective implementation of the 1999 reforms. With the introduction of the untested reformed scheme in 1999, insurers originally filed for less than 100 per cent scheme effectiveness in the first years of the scheme. As the scheme settled and demonstrated its effectiveness, insurers responded by incorporating scheme effectiveness of 100 per cent in their filings, with the effect that premiums reduced further. The MAA's actuarial advice is that average claim size has increased since 1999 and appears to have settled at a level higher than the first two years of the scheme.

## Table 2: Scheme development by underwriting year ($ millions)

| Year ended 30 Sep | Premiums written | Acquisition costs(1) | Estimate of ultimate claims costs in insurers' premium filings | | Estimated ultimate claims cost excluding claims handling expenses | | | Estimated ultimate claims cost including claims handling expenses | Estimated profit | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Discounted(2) | Discounted +15% prudential margin(3) | Undiscounted | Discounted | Discounted +15% prudential margin | Discounted +15% prudential margin | | |
| 2000 | 1325 | 200 | 1053 | 1211 | 1041 | 717 | 753 | 796 | 328 | 24.8% |
| 2001 | 1321 | 198 | 977 | 1123 | 1047 | 757 | 815 | 862 | 261 | 19.8% |
| 2002 | 1342 | 185 | 997 | 1146 | 1043 | 743 | 822 | 869 | 288 | 21.5% |
| 2003 | 1395 | 197 | 1018 | 1171 | 1061 | 786 | 884 | 935 | 264 | 18.9% |

## Table 3: Claim payments ($ millions)

| Year ended 30 Sep | Claim payments to 30/9/05 | | % of full claims finalised | Estimated proportion of claims costs paid | |
|---|---|---|---|---|---|
| | Actual | Discounted | | Undiscounted | Discounted |
| 2000 | 592 | 476 | 88% | 57% | 66% |
| 2001 | 435 | 373 | 80% | 41% | 49% |
| 2002 | 236 | 212 | 65% | 23% | 29% |
| 2003 | 139 | 131 | 47% | 13% | 17% |

**Notes:**

1. Including estimated net cost of reinsurance
2. The discounted value of the claims estimate translates the estimated ultimate total claim payments back to underwriting year dollars for valid comparison. The actual amount that insurers pay will be greater than the discounted amount.
3. APRA requires that insurers' estimates of their claim liabilities include a prudential margin that will provide at least a 75% probability that the insurers' provisions are sufficient to cover their liabilities. This represents a prudential margin of approximately 15%.

## Releases

In addition to the actuarial estimation of profit provided by Taylor Fry and presented in Table 2, the MAA also requested additional information from insurers in relation to insurers' release of profit from NSW CTP. The MAA requested that each insurer's response be based on accounting standards used for Australian statutory accounts and should relate to the insurer's accounting periods, as individual insurers operate on different accounting year ends. The industry aggregate derived by the MAA from insurer returns is therefore approximate for any given period. The amounts, determined on a pre tax basis, are set out in Table 4.

By the end of June 2005, releases were higher for the earliest years of the scheme and lower for more recent years. Insurers comment that ultimate releases in relation to the more recent years since 2003 will not be as great as for earlier years because they consider that the claim frequency has stabilised.

**Table 4: Profit margins and released profit**

| | **Filed profit margin % of gross premium** | **Projected profit/loss % of gross premium** | | **Pre tax profit release % of gross earned premium reported by insurers to MAA** | |
|---|---|---|---|---|---|
| 99/00 | 7.7 | $328m | 24.8% | $253m | 19% |
| 00/01 | 7.9 | $261m | 19.8% | $257m | 19% |
| 01/02 | 8.2 | $288m | 21.5% | $195m | 15% |
| 02/03 | 8.2 | $264m | 18.9% | $161m | 12% |
| 03/04 | 8.5 | $252m | 17.1% | $53m | 4% |
| 04/05 | 8.7 | | | $9m | 1% |
| **Notes** | **Filing periods: year ending 30 June** | **Underwriting years Ending 30 September** | | **Accident years / accounting years Differ by insurer: therefore approximate** | |

*Appendix 1*

## MAA Premiums Determination Guidelines

MOTOR ACCIDENTS AUTHORITY

# MAA PREMIUMS DETERMINATION GUIDELINES

**Section 24 of the Motor Accidents Compensation Act 1999**

For CTP insurance premiums proposed by insurers to be charged for third party policies issued in relation to registrations commencing, or renewable pursuant to a renewal date, on or after 1 July 2003

**Approved by the MAA Board of Directors - March 2003**

## 1. PREAMBLE

These Guidelines form part of the mechanism for the prudential regulation of premiums under Part 2.3 of Chapter 2 of the Motor Accidents Compensation Act 1999. They supersede previous "Premiums Determination Guidelines" issued by the MAA.

## 2. COMMENCEMENT AND REVOCATION OF PREVIOUS GUIDELINES

These Guidelines are effective for filings submitted for third party policies that the filing insurer proposes will be issued in relation to vehicle registrations commencing, or renewable pursuant to a renewal date, on or after 1 July 2003, and will remain in force until they are amended or replaced.

All previous MAA Guidelines for the Determination of Premiums by insurers are revoked subject to the exception that the superseded guidelines continue to apply to third party policies that are issued in relation to all vehicle registrations commencing, or renewable pursuant to a renewal date, before 1 July 2003.

## 3. DETERMINATION OF INSURANCE PREMIUMS

### 3.1 Premium Classifications

The premium classification is determined by the class of vehicle and the district in which the vehicle is usually garaged as described in the Schedule of Premium Relativities published by the Motor Accidents Authority (MAA). Insurers shall classify vehicles according to the most appropriate vehicle class.

The geographical district shall be determined according to the definition of the relevant district or the insurer may use the locality and postcode manual published from time to time by the MAA. No other rating on geographical, postcode or similar grounds shall be permitted.

### 3.2 Definitions

The "Act" is the Motor Accidents Compensation Act 1999, all associated regulations and statutory instruments.

An "insurer's base premium for a class 1 vehicle located in the metropolitan area whose policyholder is not entitled to any input tax credit ("ITC")" is a premium (inclusive of GST) nominated in the rate filing to which bonus or malus may be applied. The nominated base premium is used to define the allowable range of premiums in terms of the limits for bonus/malus, the relative premiums for vehicle classifications and the loading which allows for policyholder entitlement to an ITC, as set out in these Guidelines. It is approximately equal to

$$100 \times AP \times n / \sum_i (R_i \times BM_i),$$

where

$AP$ = the insurer's average premium including GST calculated as if no policyholders are entitled to any ITC, as shown in the Premium Filing Summary Sheet (Schedule C)

$R_i$ = the premium relativity applicable to the i-th policy, as anticipated to be underwritten over the period of the premium filing

$BM_i$ = the factor applicable as bonus/malus adjustment to the i-th policy, as anticipated to be underwritten over the period of the premium filing

n = number of policies anticipated to be underwritten over the period of the premium filing.

The "reference base rate" is promulgated by the MAA at each 30 April and 31 October, to be effective from the following 1 July and 1 January respectively. Unless otherwise advised by the MAA, the reference base rate is calculated as the weighted average of the insurers' last filed base premiums for class 1 vehicles located in the metropolitan area whose policyholders are not entitled to any ITC. The weights used in the weighted average are market shares (by premium) of the respective insurers on 31 March (for the 30 April calculation) or on 30 September (for the 31 October calculation). Unless otherwise advised by the MAA, the reference base rate promulgated on 30 April is adjusted to take into account changes in premium relativities effective from the following 1 July.

The "reference high rate" at any time is equal to 135% of the reference base rate last promulgated by the MAA.

### 3.3 Risk Premium

The actuarial report accompanying the filing should identify the insurer average risk premium, as estimated for policies to be issued under the Act, taking into account the New Tax System (TNTS). The insurer average risk premium should be calculated as if no policyholders have any entitlement to an ITC. (The loading to premiums for policyholders who are entitled to an ITC should be determined separately.)

The report should include:

- An explanation of how the experience of both claims incurred before 5 October 1999 (which are governed by the Motor Accidents Act 1988) and claims incurred on or after 5 October 1999 (which are governed by the Act) has been taken into account.
- An explanation of how TNTS has been taken into account.
- Sufficient detail that a knowledgeable reader can reproduce its numerical reasoning.

### 3.4 Premium Relativities

The insurer's base premium for each vehicle classification shall be the insurer's base premium for a class 1 vehicle located in the metropolitan area whose policyholder is not entitled to any ITC, multiplied by the relativity rating/100 for the particular vehicle class published by the MAA (Schedule of Premium Relativities) at the time the vehicle registration is due.

In the majority of cases, CTP insurance is purchased for the period of one year. However, quarterly and half-yearly CTP insurance policies are available for short term registrations. The short term premium is calculated by adding $20 to the annual premium excluding GST then multiplying by 1.05 and dividing by 4 for quarterly or by 2 for half yearly. This amount may be rounded to the nearest dollar.

GST is then applied subject to Australian Competition and Consumer Commission (ACCC) rounding guidelines. Common due date short term premiums are to be calculated pro-rata to the relevant annual premium excluding GST. GST is then applied subject to ACCC rounding guidelines.

### 3.5 Bonus/Malus

In determining factors whereby licensed insurers will offer a bonus or impose a malus, insurers can, subject to restrictions in Guideline 3.1, adopt any objective risk-rating factor except race. Premiums charged by an insurer in each vehicle classification shall be:

- no greater than the following multiple of the insurer's base premium for the vehicle classification

  $$100\% \times [RH + (IB - RB) \times D/10]/IB$$

  where

  IB = insurer's filed base premium for a metropolitan class 1 vehicle whose policyholder is not entitled to any ITC
  RH = reference high rate at the time of filing
  RB = reference base rate at the time of filing
  D is a number prescribed by the MAA (3 for the time being).

- no less than 85% of the insurer's base premium for the vehicle classification. Exceptions are:
  1. no less than 75% of the insurer's base premium for vehicle Classes 1, 3(c) and 10(a), (b) and (c), if the vehicle owner is aged 55 or over.

### 3.6 Loading to premiums to allow for entitlement of policyholder to an ITC

The insurer shall determine two sets of premium rates:

- "Nil ITC" premium rates applicable to policyholders with no entitlement to any ITC for GST included in the premium. Nil ITC premium rates shall be determined in accordance with sections 3.1 to 3.5 of these Guidelines, and
- "Some ITC" premium rates applicable to policyholders entitled to claim an ITC for at least some of the GST included in the premium. Some ITC premium rates shall be the insurer's corresponding nil ITC premium rates increased by a loading. The loading shall be determined having regard to the effect of policyholders' entitlement to claim an ITC on the insurer's entitlement to claim decreasing adjustments for claims costs attributable to those policyholders. The loading shall be the same percentage for each vehicle classification and shall not vary according to the bonus or malus, ie the risk-rating factors used to determine the bonus or malus must be the same for the insurer's nil ITC premium rates and some ITC premium rates. However, minor variations in the percentage loading attributable only to the calculation of premiums for non-annual policies, or to application of ACCC rounding guidelines, are acceptable.

  Each insurer shall determine the percentage loading which it considers appropriate. However, for policies to be issued in relation to vehicle registrations commencing or renewable between 1 July 2003 and 30 June 2004 inclusive, the loading must be not less than 6.5% and not more than 7.5% of the corresponding nil ITC premium rates.

## 4. PROVISION OF INFORMATION

### 4.1 Premium Filing Report

When filing proposed premiums the insurer should base the filing on its own experience and/or industry experience. The report should explain to what extent industry and company experience have been used in setting both claim frequency and average claim size assumptions, including why the approach has been adopted and the reasons for any changes in the approach since the previous filing. The insurer shall provide the following information:

4.1.1 a full report indicating the manner in which the premium was determined by the insurer, and the factors and assumptions taken into account in the determination of the premium, including:-

- actual and expected claim frequency including likely net effect of shared claims and Nominal Defendant claims;
- actual and expected average claim size including likely net effect of shared and Nominal Defendant claims and whether or not legal defence costs are included and calculated as if no policyholders are entitled to any ITC;
- assumed future investment earnings and how that assumption relates to the insurer's investment policy;
- assumed future rates of wage and price inflation;
- assumed future rates of superimposed inflation;
- assumed claim run-off pattern;
- historical and assumed bulk billing costs;
- expected risk premium calculated as if no policyholders are entitled to any ITC;
- statutory levies by the Roads and Traffic Authority and the Motor Accidents Authority;
- average actual and expected rates and amounts of commission payments (maximum of 4% average commission for all policies before taking GST into account and excluding business expenses incurred by intermediaries; also note the Market Practice Guideline issued in November 1999 which states that no insurer is to pay an agent commission or other remuneration that exceeds 7% of the premium payable on any policy issued by the insurer);
- all acquisition and policy handling expenses associated with the operation of the business, a description of the basis used to allocate overhead expenses and a reconciliation of actual and assumed expenses since the previous filing, explaining any material differences. For policies to be issued in relation to vehicle registrations commencing or renewable between 1 July 2003 and 30 June 2004 inclusive, an estimate of the amount of additional expenses attributable to changes in the taxation

treatment of compulsory third party policies with effect from 1 July 2003 should be provided.

**Acquisition costs and marginal costing**
Premiums shall be determined on the basis of the full cost of the policies to the insurer, and the determination shall take account of all costs to be funded by the premium including the proportion of the company's overhead expenses which are properly attributable to the policies. Marginal costing must not be used.

**Ancillary benefits**
The full cost of any ancillary benefits offered by the insurer in addition to the statutory cover must be included in the premium costing. In addition no ancillary benefit will be permitted which is dependent upon effecting another type of insurance policy with the insurer. An example of this is where a bonus is granted off other insurances but the cost is charged against the CTP premium.

**First Party Insurance**
Where the cost of any first party insurance is charged to the insurer's CTP fund, that amount must be included in the premium filing as an acquisition cost. The premium for first party driver at fault insurance, if material, shall not be included with the CTP premiums in any returns or statistics submitted to the MAA. Any claim under such a policy shall not be included in CTP claims information.

**Deferral of costs**
When determining premiums, insurers shall include the full cost of all expenses incurred in relation to the operation of the business. Acquisition costs may only be amortised if they are clearly non-recurring, provide an ongoing benefit to the company, and are not spread over more than two years.

- claims handling expenses including explanation of what is included in this item (with particular reference to legal defence costs);
- the net cost of reinsurance;
- an explanation of how TNTS has been taken into account;
- any other matter the insurer should reasonably take into account in the determination of premiums;
- proposed profit margin and the actuarial basis for its calculation - the percentage of gross premiums intended to be retained as profit, before tax, in order to provide a reasonable rate of return on the capital supporting the business. An explanation of the following should be included:
  - the insurer's actual or notional capital allocation and how it was determined, including the treatment of risk margins included in provisions for outstanding claims liabilities and unexpired risk liabilities;
  - the insurer's target rate of return on capital and how it was determined;
  - the insurer's actual investment policy and the rates of investment return assumed, and
  - the method used to calculate the proposed profit margin from the capital allocation, target rate of return on capital and rates of investment return assumed.

Appropriate justification for the above items should be provided. For example, a statement that the target rate of return was determined by the insurer's board or senior management may not be sufficient unless accompanied by an explanation of why the target rate of return is reasonable;

- details of how the percentage loading applied to the nil ITC premium rates to obtain the some ITC premium rates was determined.

4.1.2 a detailed analysis of the insurer's actual and expected business, and the required average premium to fully fund the insurer's liabilities arising under the expected share of business, calculated as if no policyholders have any entitlement to an ITC;

- actual and expected number and mix of insured vehicles, including commentary on strategies that will result in any changed mix of business;

- proposed use of bonus and malus, the basis on which they will be offered to vehicle owners, and the impact on the insurer's required and expected average premium, both calculated as if no policyholders have any entitlement to an ITC;

4.1.3 a schedule showing how the assumptions in the current premium filing differ from the assumptions used in the previous filing by the insurer including, for the period covered by the previous filing, a statement indicating the required average premium and the actual average premium received by the insurer during that period;

4.1.4 a table showing the changed assumptions and indicating the impact of those changes on the proposed premium, including reconciliation between the old and the new base premium for a class 1 vehicle located in the metropolitan area whose policyholder is not entitled to any ITC;

4.1.5 **Schedule A** - the base premium including GST for each premium classification for policyholders who are not entitled to any ITC;

4.1.6 **Schedules B(i) and B(ii)** – description of proposed bonus and malus structure and the actual amount proposed to be charged for each premium classification and geographical district with:

- Schedule B(i) for nil ITC premium rates, and
- Schedule B(ii) for some ITC premium rates.

4.1.7 **Schedule C** – Premium filing summary.

### 4.2 Insurer Assumptions Differing from Actuary

Where an insurer wishes to adopt an assumption different from that recommended by its actuary, the insurer shall provide a statement of the appropriateness of the assumption used by the insurer and a full analysis by the insurer's actuary of the impact of the assumption adopted by the insurer on the insurer's required and expected premium (both calculated as if no policyholders have any entitlement to an ITC), compared with the assumption recommended by the actuary.

### 4.3 Actuarial Certificate

The insurer shall provide a certificate from a Fellow of the Institute of Actuaries of Australia, in the form agreed between the MAA and the Institute of Actuaries of Australia, indicating the extent to which the proposed premiums in aggregate meet the fully funded test in section 27(8) of the Motor Accidents Compensation Act 1999. The certificate should be provided by an actuary not in the employ of the insurer, and should be a separate item and not included as a comment in the body of an actuarial report.

### 4.4 Insurer Certificate

Each insurer shall provide a certificate from the Chief Executive Officer, for the time being, of the insurer substantially in accordance with the certificate attached to these Guidelines - Appendix A. This certificate should also be tabled at the next meeting of the insurer's Board of Directors.

**Appendix A**

## CERTIFICATE OF THE CEO

I, _____ the CEO
(Name)

of _____
(Name of Insurer)

CERTIFY THAT

_____ has been duly
(Name of Actuary)

authorised by the Insurer to prepare a rate filing on behalf of _____
(Name of Insurer)

_____ to be effective as of _____
(Date of implementation)

until _____
(Date)

1. I have knowledge of the matters that are the subject of this certificate.
2. I am satisfied that the assumptions used are appropriate.
3. I have taken reasonable steps to satisfy myself that the information in the filing has been composed with due care and with regard to the insurer's financial security.
4. I am satisfied that the company's CTP business plan ensures CTP insurance is available to all proposers in accordance with the terms and conditions of the insurer's licence, MAA Premiums Determination Guidelines and MAA Market Practice Guidelines.

_____ _____
(Signature of CEO) (Date)

# SCHEDULE C: PREMIUM FILING SUMMARY SHEET

| | | |
|---|---|---|
| 1a. | Assumed claim frequency for an industry mix of vehicles (net of sharing and nominal defendant) | 0.**% |
| 1b. | Assumed claim frequency for insurer (net of sharing and nominal defendant) | 0.**% |
| 2a. | Average claim size in dollar values at start of underwriting period for an industry mix of vehicles (gross of reinsurance, net of sharing and nominal defendant)[(i)] | $**,*** |
| 2b. | Average claim size in dollar values at start of underwriting period for insurer (gross of reinsurance, net of sharing and nominal defendant)[(i)] | $**,*** |
| 3. | Average claim size (from 2b) including superimposed inflation[(i)] | $**,*** |
| 4. | Average claim size for filing period fully inflated and discounted[(i)] | $**,*** |
| 5. | Bulk billing cost per policy | $**.** |
| 6. | Insurer average risk premium (formula used to combine above assumptions to arrive at average risk premium) [(i)(ii)] | |
| 7. | Insurer risk premium calculation (substitute values in formula) [(i)] | $***.** |
| 8. | MAA levy (% gross premium excluding GST) | *.**% |
| 9. | RTA commission (set fee) | $*.** |
| 10. | Average commission (% gross premium excluding GST) | *.**% |
| 11. | Acquisition & policy handling expenses (% gross premium excluding GST) | *.**% |
| 12. | Claims handling expenses (% gross premium excluding GST) | *.**% |
| 13. | Net reinsurance loading (% gross premium excluding GST) | *.**% |
| 14. | Other assumptions (specify nature and value of assumption) | *.**% |
| 15. | Profit margin (% gross premium excluding GST) | *.**% |
| 16. | Average premium (formula used to arrive at average premium excluding GST on premiums)[(i) (ii)] | |
| 17. | Average premium excluding GST on premiums calculation (substitute values in formula)[(i)] | $***.** |
| 18. | Average premium including GST on premiums[(i)] | $***.** |
| 19. | Ratio Class 1 Metro to average premium | *.*** |
| 20. | Bonus/Malus Factor | *.*** |
| 21. | Nil ITC Class 1 Metro base premium including GST | $***.** |
| 22. | Minimum nil ITC Class 1 Metro premium including GST (ignoring premiums calculated using a bonus factor of less than 85%) | $***.** |
| 23. | Loading applied to nil ITC premium rates to calculate some ITC premium rates (% nil ITC premium rates) | |
| 24. | Period premiums are to apply | |

| Year Ending ***** | Investment Return % | AWE % | Inflation Superimposed % | Payment Pattern Development Year | % Paid % |
|---|---|---|---|---|---|
| * | | | | | |
| * | | | | | |
| * | | | | | |
| * | | | | | |
| * | | | | | |
| * | | | | | |
| * | | | | | |
| * | | | | | |
| * | | | | | |
| * | | | | | |
| * | | | | | |

Notes: (i) Estimates of average claim sizes and average premiums should be those applicable to the nil ITC premium rates, ie calculated as if no policyholders have any entitlement to an ITC, and so as if the insurer has a full entitlement to decreasing adjustments for all claims costs attributable to specific policies. The loading applied to nil ITC premium rates to calculate the insurer's some ITC premium rates is then shown as item 23.

(ii) Use item number for formula description.

## *Appendix 2*

### Taylor Fry Report on Capital and Profit, 10 September 2001

10/09/01 email from Dr Taylor – letter dated 10/9/01 with appendices

p:\client\maa\20\corresp\let270901.doc

4 October, 2001

Mr David Bowen
General Manager
Motor Accidents Authority of New South Wales
Level 22
580 George Street
Sydney NSW 2000



Dear David,

## Capital and Profit

### 1. Background

I refer to the sequence of discussions on capital and profit as they bear on Compulsory Third Party (CTP) insurance in New South Wales. These discussions have taken place between the Motor Accidents Authority (MAA), the industry and Taylor Fry Consulting Actuaries (TFCA) over the past year or so.

The discussions have dealt with the separate subjects:

- determination of a prospective profit allowance for inclusion in filed premium rates;
- retrospective monitoring of past profit.

The present letter is concerned with only the first of these subjects.

Previous discussion has identified the following components of prospective profit determination:

- determination of a suitable quantum of notional total capital (net assets) of an insurer for the purpose of prospective profit;
- allocation of this total capital by Line of Business (LoB), particularly NSW CTP;
- calculation of a profit loading in premiums that would service this allocated capital at a fair rate of return.



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## 2. Scope of the present letter

In previous correspondence, TFCA have suggested procedures for calculating each of the three components of profit determination listed at the end of Section 1. Reference should be made to the correspondence for details, but the suggestions might be broadly labelled as follows:

- **Total capital**: according to representative insurer.
- **Capital allocation to NSW CTP**: according to Myers-Read procedure.
- **Profit margin**: according to Myers-Cohn procedure.

An earlier letter dated 31 July 2000 provided some purely hypothetical illustrations of Myers-Read capital allocation and Myers-Cohn profit margins.

There has been some debate about each of the suggested procedures, as a result of which TFCA agreed to provide results of certain experimental calculations. They were to be mainly concerned with the following issues.

- **Total capital**: How might a representative insurer be reasonably chosen?
- **Capital allocation to NSW CTP**: Test sensitivity of allocation to certain Myers-Read input parameters, especially correlations between LoBs and asset sectors.
- **Myers-Cohn premium loading**: Test sensitivity of loading to industry betas.

Our letter of 10 September on "Capital and profit" (referred to as "our previous letter") considered these matters.

It was discussed with industry representatives and has been the subject of extensive correspondence between Mr Dan Tess of PricewaterhouseCoopers, representing the Insurance Council of Australia, and myself.

This correspondence has led to some changes to the position taken in our earlier letter. These are pointed out in the relevant sections below. While Mr Tess and I have reached understanding on various issues, and agreement on some, there are points on which we differ.

This letter therefore represents the position taken by TFCA in its advice to the MAA after due consideration of industry representations.

## 3. Representative insurer

Appendix A extracts from APRA industry statistics data concerning each of the current NSW CTP insurers. The data items, taken over the years 1993 to 1999, are

- Net premium revenue
- Outstanding claims provision
- Net assets.

Two main solvency ratios can be derived from these statistics:

- Net assets as a percentage of net premium revenue;
- Net assets as a percentage of outstanding claims provision.

These are derived in Appendix A.2 from which Figures 3.1 and 3.2 are extracted.

Figure 3.1

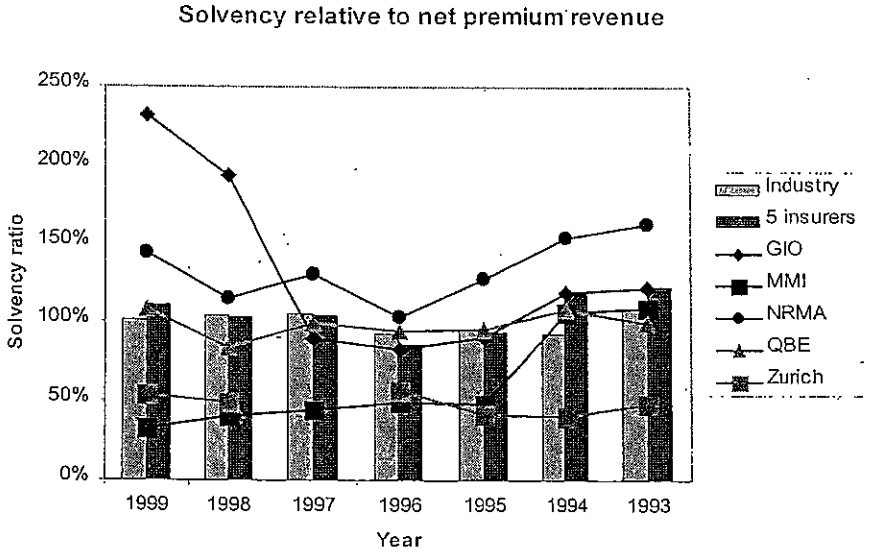
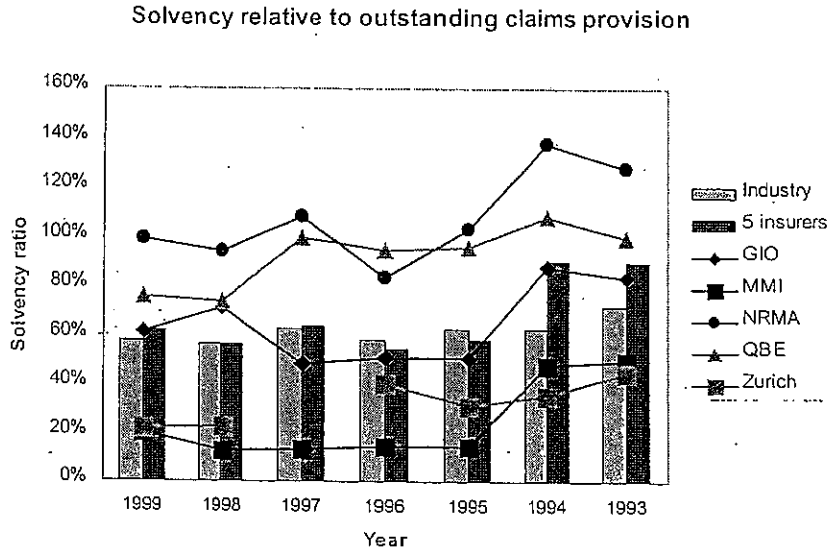


Figure 3.2




Comments on these plots are as follows:

- AAMI's accounts show it carrying very low net assets. It is understood that this is because its business is fully reinsured with RSA. Its results have not been plotted. It has also been excluded from the "5 insurers" averages, which therefore relate to the remainder of the NSW CTP industry.
- The "Industry" results include all private sector insurers, both direct and reinsurers (exclusion of reinsurers from the data was awkward), inside Australia only.
- The results for individual insurers also relate to "Inside Australia".
- Figure 3.1 provides an example of the sort of discontinuity that can occur in premium based solvency ratios. GIO's premium revenue declined abruptly in 1998, and further in 1999, causing an abrupt increase in the solvency ratio.
- Because of the potential for anomalous behaviour in premium based solvency ratios, the alternative ratio plotted in Figure 3.2 may be preferable. This type of ratio has been used as the basis of the remainder of this letter.
- For the most part, there is no marked difference between the solvency of NSW CTP insurers and that of the industry generally.

Solvency ratios are widely spread with:

- 2 insurers well below average;
- 1 close to average; and
- 2 well above average.

Possibilities for a representative insurer might be:

- industry average (58% in 1999); or
- average of the "5 insurers" (62% of outstanding claims in 1999).

Once a basis for choice of this parameter has been decided, it can be applied in future years. This would allow the capitalisation of the representative insurer to vary over time in line with industry variation.

For the purpose of subsequent illustrations in this letter, the 1999 "5 insurers" average has been used. This choice is slightly more generous to insurers than its counterpart in our previous letter.

## 4. Capital allocation

### 4.1 Description

The total capital of a representative NSW CTP insurer has been allocated by LoB. This requires the following inputs:

- Liability structure of the insurer by LoB;
- Asset structure by sector;
- Revenue structure by LoB;
- Volatilities of, and correlations between, asset sector and LoB liability performance.

The essentials of the balance sheet are reproduced from Appendix G.1 in Table 4.1.

**Table 4.1**
**Basic balance sheet**

| | $M |
|---|---|
| Assets | 28,958 |
| Liabilities | 20,137 |
| Net assets | 8,822 |

Liabilities are assumed to comprise only technical liabilities.

**Net assets** are taken as 62% of the outstanding claims portion of liabilities in accordance with Section 3, where the proportions of liabilities represented by outstanding claims and unearned premium respectively are according to industry statistics (see Appendix B.2) for direct insurers, inside Australia.

The **liability and revenue structures** of the representative insurer by LoB are set out in Appendix D.1, and are also in accordance with the same industry statistics.

The **asset allocation** by sector, set out in Appendix E.1, is based on the same industry segment.

The required **volatilities** and **correlations** are set out in Appendices:

- D (liabilities)
- E (assets)
- F (asset-liability correlations).

## 4.2 Results

### 4.2.1 Baseline allocation

Appendix G.2 carries out a baseline capital allocation in accordance with the representative insurer structure described in Section 4.1. Table 4.2 reproduces the main results.

**Table 4.2**
**Baseline allocation**

| Description | Premium income | Technical reserves | Capital allocation | |
|---|---|---|---|---|
| | | | Amount | Apportion-ment |
| | $M | $M | $M | |
| Commercial Fire | 819 | 693 | 436 | 5% |
| Workers Compensation | 607 | 2,169 | 787 | 9% |
| Personal Accident | 556 | 503 | 88 | 1% |
| Householders | 1,936 | 1,556 | 446 | 5% |
| Travel | 138 | 51 | 8 | 0% |
| Public Liability | 645 | 2,869 | 912 | 10% |
| Professional Indemnity | 353 | 1,313 | 394 | 4% |
| Domestic Motor | 2,863 | 1,865 | 453 | 5% |
| Commercial Motor | 886 | 644 | 165 | 2% |
| CTP | 1,876 | 7,598 | 4,804 | 54% |
| Lenders Mortgage Insurance | 77 | 335 | 225 | 3% |
| Consumer Credit | 116 | 254 | 50 | 1% |
| Marine | 390 | 285 | 52 | 1% |
| TOTAL | 11,262 | 20,137 | 8,822 | 100% |

### 4.2.2 Variational allocations

Table 4.2 shows that CTP is the dominant LoB in terms of capital intensiveness, with 17% of premium accounting for 54% of capital. To some extent this dominance is a concentration risk. As Appendix G.3.3 shows, if each LoB is divided into two sub-lines of equal volume, but only partially correlated, the proportion of capital allocated to CTP falls to 51%. The sub-lines may perhaps be thought of as different states.

Table 4.3 reports this and other variations to the LoB structure in which:

- CTP is divided into two sub-lines but other LoBs are left intact (Appendix G.3.1);
- CTP is divided into three sub-lines but other LoBs are left intact (Appendix G.3.2).

**Table 4.3**
**CTP capitalisation for different LoB structures**

| LoB structure | Proportion of capital allocated to CTP |
|---|---|
| | % |
| Baseline | 54 |
| All LoBs split in 2 | 51 |
| Just CTP split in 2 | 56 |
| Just CTP split in 3 | 52 |

These results suggest that if all LoBs were split into three or more sub-lines, the CTP capitalisation would be somewhat less than 51%, say **50%**.

This is equal to **58% of CTP technical reserves**. As noted in Section 8.2 of Mr Adrian Gould's report of 28 September 2001 on "Estimates of profitability of past NSW compulsory third party premiums written by insurers", this capitalisation is considerably higher than that reported by insurers as reflecting past practice.

## 5. Profit margin

### 5.1 Myers-Cohn basis

Section 2 of the letter dated 31 July 2000 included the calculation of Myers-Cohn profit margins for various capitalisation ratios. These need to be supplemented to allow for the case of a 58% capitalisation ratio, such as adopted at the end of Section 4.

Moreover, the earlier letter assumed a liabilities beta of 0% or 10% and these values have been retained in the present letter. This parameter is the regression

coefficient of annual claim costs on share market returns. It is related to the correlation between these two quantities.

The CTP liabilities beta implied by Appendices D to F is in fact 29%, but this value is high relative to received wisdom. The calculated value is a product of the highly uncertain assumptions in the appendices, especially asset-liability correlations. It has not been used in this letter.

As described above, the representative insurer is assumed to hold capital equal to 58% of technical provisions. It holds additional capital as a prudential margin within the provision for outstanding claims. This should be treated as capital (though subject to tax deductibility) in any Myers-Cohn profit margin.

Table 5.1 shows how the capitalisation ratio is affected by the prudential margin.

**Table 5.1**
**CTP capitalisation ratio**

| Prudential margin[(a)] | Capital (as % of technical provisions) | | |
|---|---|---|---|
| | Explicit[(b)] | Implicit[(c)] | Total[(d)] |
| % | % | % | % |
| 0 | 58 | 0 | 58 |
| 15 | 58 | 13 | 76 |
| 30 | 58 | 26 | 94 |

Notes:
(a) As a percentage of central estimate of outstanding claims.
(b) See the preamble to the table.
(c) As a percentage of the central estimate of technical provisions.
Based on a ratio:

$$\frac{\text{outstanding CTP claims provision}}{\text{total CTP technical provisions}}$$

equal to 87.4% (Appendix D.1).
(d) As a percentage of the central estimate of technical provisions.
Calculated as:

$$[(1-r) + r(1+i)](1+e) - 1$$

where
i = the implicit margin
e = the explicit margin
r = the ratio in Note (c).

Myers-Cohn profit margins have been calculated for the three situations displayed in Table 5.1, assuming:

- Alternative CTP liabilities betas of 0% and 10% (see above);
- same payment pattern as in letter dated 31 July 2000 (reproduced in Appendix H.1);
- acquisition costs equal to 15% of gross premium;
- claims handling expenses equal to 6% of claim payments;

- same economic parameters as assumed in that letter except that a company tax rate of 30% (previously 34%) is assumed (Appendix H.2).

The two expense loadings were not included in earlier work. The results are set out in Table 5.2.

**Table 5.2**
**Myers-Cohn profit margins**

| Prudential margin[a] | Total capitalisation[b] | Profit margin[c] for liabilities beta of | |
|---|---|---|---|
| | | 0% | 10% |
| % | % | % | % |
| 0 | 58 | 5.0 | 4.5 |
| 15 | 76 | 5.3 | 4.8 |
| 30 | 94 | 5.6 | 5.0 |

Notes: (a) As a percentage of central estimate of outstanding claims.
(b) As a percentage of a central estimate of technical provisions. From Table 5.1.
(c) As a percentage of gross premium.

Table 5.2 suggests a profit margin in the range 4½-6% of gross premium.

In these examples the need for a premium loading to service capital is reduced to the extent that the part of that capital placed within the provision for outstanding claims reduces tax (compared with the situation in which the same amount is placed in net assets). It may be useful to illustrate the effect of this on the required profit margin. Table 5.3 does so for the case of a zero liabilities beta.

**Table 5.3**
**Profit margins without tax relief on prudential margin**

| Total capitalisation[a] | Profit margin[b] | |
|---|---|---|
| | With tax relief[c] | Without tax relief[d] |
| % | % | % |
| 58 | 5.0 | 5.0 |
| 76 | 5.3 | 6.4 |
| 94 | 5.6 | 7.8 |

Notes: (a) As a percentage of central estimate of provisions.
(b) As a percentage of gross premium.
(c) From Table 5.2. Allows for tax deductibility of increases in technical provisions.
(d) "Total capitalisation" is the same as net assets, ie none is applied to prudential margin.

## 5.2 Bases other than Myers-Cohn

The **internal rate of return (IRR)** method of calculating a premium loading is an alternative to Myers-Cohn. It has been demonstrated theoretically that, under realistic conditions, the two methods give similar results. This correspondence continues to hold for the examples dealt with in Section 5.1, **provided** that an insurer's prudential margin is regarded as capital for the purpose of the IRR calculation of profit loading.

Table 5.4 illustrates.

**Table 5.4**
**Myers-Cohn and IRR profit margins**

| Liabilities beta | Prudential margin[(a)] | Profit margin[(b)] | |
|---|---|---|---|
| | | Myers-Cohn | IRR |
| % | % | % | % |
| 0 | 0 | 5.0 | 5.6 |
| | 30 | 5.6 | 5.5 |
| 10 | 0 | 4.5 | 4.9 |
| | 30 | 5.0 | 5.4 |

Notes: (a) As a percentage of central estimate of outstanding claims.
(b) As a percentage of gross premium.

If the prudential margin is **not** regarded as capital in the IRR calculation, the insurer's leverage will be increased. Hence the required return on capital (for a given asset structure) will increase, and so will the profit margin required in premium.

As the basic calculation of the profit loading assumes that the prudential margin is effectively hidden capital, it seems reasonable to regard it this way throughout. On this basis, the IRR approach to profit margin supports the Myers-Cohn in Section 5.1.

## 5.3 Commentary

### 5.3.1 Liabilities beta

The effect of the liabilities beta is to set the rate for discounting claim payments in the Myers-Cohn method as follows:

discount rate = risk free rate of return (ROR)
+
[liabilities beta
x
share market risk premium]

where the share market risk premium is taken here to be 5%.

Thus, a zero liabilities beta implies discounting of claims costs at the risk free ROR.

If, in addition, the insurer were to invest the central estimate of liabilities in risk free assets and capital (both explicit and implicit) in shares, the expected return on capital (after corporate tax) would be equal to expected return on an indexed fund of shares, here assumed 5% above the risk free ROR.

Alternatively, if the insurer invested **all** assets risk free, the return on capital would be equal to the risk free rate.

In neither of the above situations does the Myers-Cohn premium contain any component providing a specific reward for the risk inherent in underwriting. This is because the liabilities beta of zero implies that risk to be fully diversifiable (from the viewpoint of the insurer's shareholders), and the capital markets theory on which the premium is based includes no price for diversifiable risk.

A negative beta, on the other hand, would imply a premium component rewarding the undiversifiable portion of underwriting risk.

### 5.3.2 Variation of profit margin between insurers

The profit margins calculated in Sections 5.1 and 5.2 relate to the representative insurer. They are therefore illustrative only. It is fully expected that profit margins, even calculated by the same procedures, will vary from one insurer to another in reflection of their different business structures.

### 5.3.3 Dividend imputation

The Myers-Cohn profit margin recognises that investors in insurance companies for the fact that investment earnings on capital are taxed in the hands of the insurer, and then again in the hands of the shareholder. Some compensation for this (the profit margin) is required in order that there not be an advantage in direct investment in financial instruments, as compared with indirect investment through an insurer.

This ceases to be valid to the extent that dividend imputation avoids the above form of double taxation. To this extent the profit margins arrived at in Sections 5.1 and 5.2 will have been over-stated. The degree of over-statement appears difficult of quantification and this has not been attempted.

### 5.3.4 Tax effect of technical provisions

Table 5.3 indicates that:

- the effect on required profit margins of tax deductibility of increases in technical provisions can be substantial;
- this effect increases with the size of the prudential margin included in the outstanding claims provision;
- failure to account for it can lead to considerable over-estimation of the profit margin required to support capital.

## 6. Conclusions

6.1 There are wide variations between participants of the NSW CTP insurance industry with respect to capitalisation. The average capitalisation may be reasonable for a representative insurer (Section 3).

6.2 The NSW CTP capitalisation implied for the representative insurer is considerably higher than insurers have typically reported in the past (Section 4). The higher capitalisation ratio leads to a higher profit margin.

6.3 Application of the Myers-Cohn approach leads to profit margins generally in the range of 4½-6% of gross premium for the representative insurer (Section 5.1).

6.4 Application of an alternative approach, the IRR method, leads to results that generally support those obtained by the Myers-Cohn approach, provided that prudential margins are accounted for properly (Section 5.2).

6.5 The profit margins calculated in this letter relate to the representative insurer, and are therefore illustrations only. It is expected that those filed by individual insurers may vary from them, reflecting the insurers' own business structures (Section 5.3.2).

6.6 This letter's calculation of profit margins takes no account of dividend imputation. To this extent the margins will have been over-stated (Section 5.3.3).

Yours sincerely,

Greg Taylor

# Appendix A

# Insurer capitalisation

## A . 1 Industry data

### A . 1 . 1 Revenue

| Financial year completed in year to 31-Dec | Net premium revenue (a) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | AAMI | GIO | MMI | NRMA | QBE | Zurich | Total of 5 insurers (c) | Industry (b) |
| | $000 | $000 | $000 | $000 | $000 | $000 | $000 | $000 |
| 1999 | 617,756 | 369,202 | 920,436 | 1,742,258 | 725,190 | 470,452 | 4,227,538 | 13,528,421 |
| 1998 | 513,850 | 593,341 | 602,437 | 1,842,680 | 677,644 | 470,937 | 4,187,039 | 12,924,172 |
| 1997 | 0 | 768,571 | 518,121 | 1,674,639 | 538,784 | 0 | 3,500,115 | 6,693,332 |
| 1996 | 352,777 | 770,340 | 471,407 | 1,531,568 | 476,844 | 442,639 | 3,692,798 | 10,881,468 |
| 1995 | 254,965 | 680,217 | 427,112 | 1,242,327 | 405,665 | 423,732 | 3,179,053 | 9,677,496 |
| 1994 | 222,423 | 615,497 | 361,626 | 1,069,708 | 321,485 | 421,342 | 2,789,658 | 9,064,900 |
| 1993 | 213,563 | 606,928 | 292,547 | 996,993 | 220,348 | 403,060 | 2,519,876 | 7,821,065 |

Notes: (a) From APRA abstracts of Underwriting and Profit and Loss Accounts.

(b) The 1997 "year" in fact relates to companies completing their financial years in just the first 11 months of it.

(c) Excluding AAMI.

### A . 1 . 2 Outstanding claims

| Financial year completed in year to 31-Dec | Outstanding claims provision (a) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | AAMI | GIO | MMI | NRMA | QBE | Zurich | Total of 5 insurers (c) | Industry (b) |
| | $000 | $000 | $000 | $000 | $000 | $000 | $000 | $000 |
| 1999 | 633,279 | 1,389,606 | 1,497,448 | 2,524,282 | 1,035,474 | 1,136,006 | 7,582,816 | 23,645,852 |
| 1998 | 528,483 | 1,608,298 | 1,935,358 | 2,255,221 | 773,072 | 1,012,711 | 7,584,660 | 23,872,005 |
| 1997 | 0 | 1,417,041 | 1,712,543 | 2,016,672 | 538,784 | 0 | 5,685,040 | 11,226,590 |
| 1996 | 285,634 | 1,246,272 | 1,528,140 | 1,886,350 | 476,844 | 625,643 | 5,763,249 | 17,364,347 |
| 1995 | 285,634 | 1,205,688 | 1,390,050 | 1,534,384 | 405,665 | 561,922 | 5,097,709 | 14,804,272 |
| 1994 | 195,248 | 832,305 | 792,558 | 1,187,253 | 321,485 | 483,053 | 3,616,654 | 13,485,583 |
| 1993 | 136,509 | 884,292 | 635,980 | 1,262,645 | 220,348 | 434,621 | 3,437,886 | 11,748,546 |

Notes: (a) From APRA abstracts of Balance Sheets.

(b) The 1997 "year" in fact relates to companies completing their financial years in just the first 11 months of it.

(c) Excluding AAMI.

A . 1 . 3 Net assets

| Financial year completed in year to 31-Dec | Net assets (a) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | AAMI | GIO | MMI | NRMA | QBE | Zurich | Total of 5 insurers (c) | Industry (b) |
| | $000 | $000 | $000 | $000 | $000 | $000 | $000 | $000 |
| 1999 | 2,029 | 854,696 | 304,302 | 2,498,648 | 782,522 | 254,784 | 4,694,952 | 13,690,126 |
| 1998 | 2,267 | 1,146,811 | 246,149 | 2,119,518 | 569,311 | 231,732 | 4,313,521 | 13,494,771 |
| 1997 | 0 | 689,932 | 228,393 | 2,189,035 | 536,754 | 0 | 3,644,114 | 7,059,359 |
| 1996 | 2,183 | 636,778 | 230,236 | 1,583,312 | 451,131 | 253,115 | 3,154,572 | 10,106,193 |
| 1995 | 2,449 | 616,439 | 204,703 | 1,586,470 | 388,742 | 177,476 | 2,973,830 | 9,283,983 |
| 1994 | 2,335 | 731,268 | 382,479 | 1,640,232 | 349,004 | 172,036 | 3,275,019 | 8,442,060 |
| 1993 | 2,391 | 738,611 | 317,920 | 1,618,651 | 219,719 | 193,910 | 3,088,811 | 8,480,800 |

Notes: (a) From APRA abstracts of Balance Sheets or Solvency summaries.

(b) The 1997 "year" in fact relates to companies completing their financial years in just the first 11 months of it.

(c) Excluding AAMI.

## A . 2 Solvency ratios

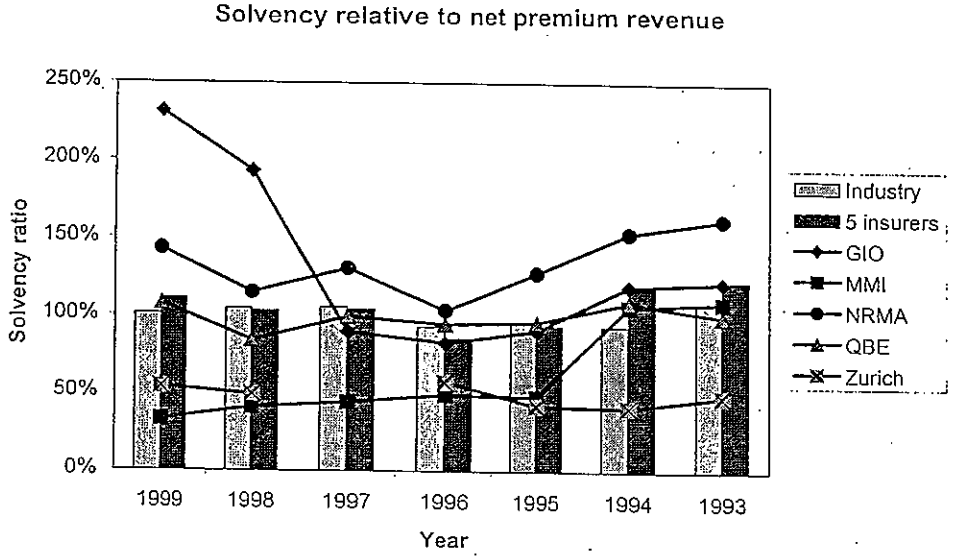
### A . 2 . 1 Relative to premium

| Financial year completed in year to 31-Dec | Net assets as a percentage of premium revenue (a) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | AAMI | GIO | MMI | NRMA | QBE | Zurich | Total of 5 insurers (c) | Industry (b) |
| | $000 | $000 | $000 | $000 | $000 | $000 | $000 | $000 |
| 1999 | 0% | 231% | 33% | 143% | 108% | 54% | 111% | 101% |
| 1998 | 0% | 193% | 41% | 115% | 84% | 49% | 103% | 104% |
| 1997 | | 90% | 44% | 131% | 100% | | 104% | 105% |
| 1996 | 1% | 83% | 49% | 103% | 95% | 57% | 85% | 93% |
| 1995 | 1% | 91% | 48% | 128% | 96% | 42% | 94% | 96% |
| 1994 | 1% | 119% | 106% | 153% | 109% | 41% | 117% | 93% |
| 1993 | 1% | 122% | 109% | 162% | 100% | 48% | 123% | 108% |

Notes: (a) Derived from Appendices A.1.1 and A.1.3.

(b) The 1997 "year" in fact relates to companies completing their financial years in just the first 11 months of it.

(c) Excluding AAMI.



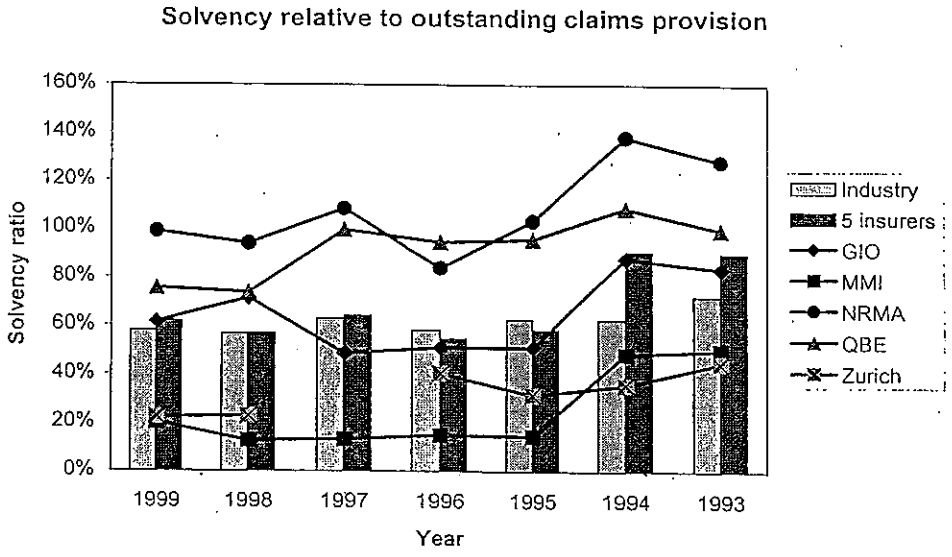
## A . 2 . 2 Relative to outstanding claims

| Financial year completed in year to 31-Dec | Net assets as a percentage of outstanding claims provision (a) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | AAMI | GIO | MMI | NRMA | QBE | Zurich | Total of 5 insurers (c) | Industry (b) |
| | $000 | $000 | $000 | $000 | $000 | $000 | $000 | $000 |
| 1999 | 0% | 62% | 20% | 99% | 76% | 22% | 62% | 58% |
| 1998 | 0% | 71% | 13% | 94% | 74% | 23% | 57% | 57% |
| 1997 | | 49% | 13% | 109% | 100% | | 64% | 63% |
| 1996 | 1% | 51% | 15% | 84% | 95% | 40% | 55% | 58% |
| 1995 | 1% | 51% | 15% | 103% | 96% | 32% | 58% | 63% |
| 1994 | 1% | 88% | 48% | 138% | 109% | 36% | 91% | 63% |
| 1993 | 2% | 84% | 50% | 128% | 100% | 45% | 90% | 72% |

Notes: (a) Derived from Appendices A.1.2 and A.1.3.

(b) The 1997 "year" in fact relates to companies completing their financial years in just the first 11 months of it.

(c) Excluding AAMI.



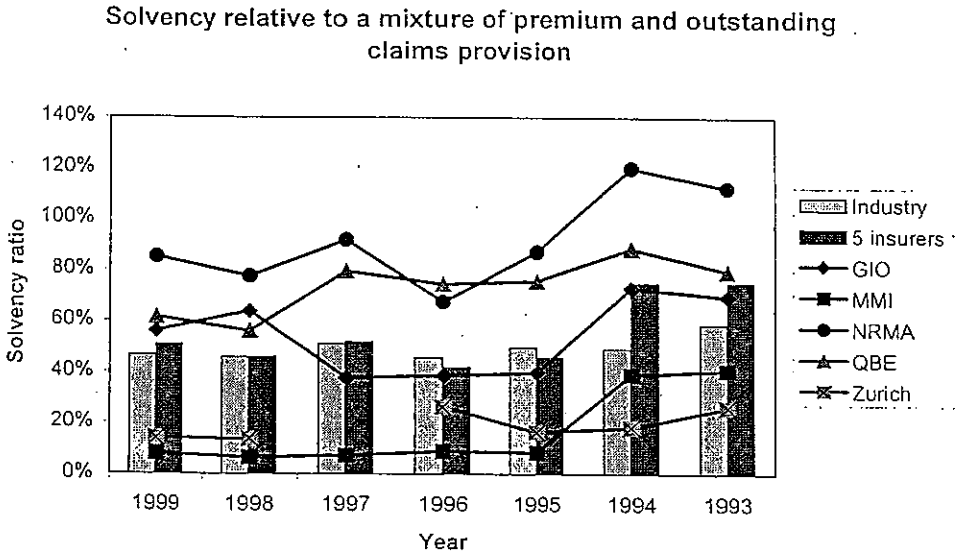
A . 2 . 3 Relative to a mixture of premium and outstanding claims

| Financial year completed in year to 31-Dec | [Net assets less 20% of premium] as a percentage of outstanding claims provision (a) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | AAMI | GIO | MMI | NRMA | QBE | Zurich | Total of 5 insurers (c) | Industry (b) |
| | $000 | $000 | $000 | $000 | $000 | $000 | $000 | $000 |
| 1999 | | 56% | 8% | 85% | 62% | 14% | 51% | 46% |
| 1998 | | 64% | 6% | 78% | 56% | 14% | 46% | 46% |
| 1997 | | 38% | 7% | 92% | 80% | | 52% | 51% |
| 1996 | | 39% | 9% | 68% | 75% | 26% | 42% | 46% |
| 1995 | | 40% | 9% | 87% | 76% | 17% | 46% | 50% |
| 1994 | | 73% | 39% | 120% | 89% | 18% | 75% | 49% |
| 1993 | | 70% | 41% | 112% | 80% | 26% | 75% | 59% |

Notes: (a) Derived from Appendices A.1.1 to A.1.3.

(b) The 1997 "year" in fact relates to companies completing their financial years in just the first 11 months of it.

(c) Excluding AAMI.



# Appendix B

# Insurer assets and liabilities

## B Industry data

### B . 1 Premium

| Line of business | Net earned premium in financial year ended in 1999 (a) | | |
|---|---|---|---|
| | Actual | Long tail version (b)(d) | Short tail version (c)(d) |
| | $M | $M | $M |
| Fire and ISR | 819 | 626 | 969 |
| Houseowners/householders | 1936 | 1479 | 2290 |
| **CTP motor vehicle** | 1876 | 2866 | 1109 |
| Commercial motor vehicle | 886 | 677 | 1048 |
| Domestic motor vehicle | 2863 | 2187 | 3386 |
| Marine & aviation | 390 | 298 | 461 |
| **Professional indemnity** | 353 | 539 | 209 |
| **Public & product liability** | 645 | 985 | 381 |
| **Employers' liability** | 607 | 927 | 359 |
| Mortgage | 77 | 59 | 91 |
| Consumer credit | 116 | 89 | 137 |
| Travel | 138 | 105 | 163 |
| Other accident | 556 | 425 | 658 |
| Other (e) | 272 | 272 | 272 |
| Inward treaty (e) | 816 | 816 | 816 |
| TOTAL | 12,350 | 12,350 | 12,350 |

Notes: (a) For direct insurers, inside Australia.

From Table 6 of "Selected Statistics on the General Insurance Industry Year Ending December 1999", published by APRA.

(b) The relative volumes of the long tail lines have been doubled.

(c) The relative volumes of the short tail lines have been doubled.

(d) The long tail lines are indicated by bold type.

(e) The volumes in these lines remain constant in the three scenarios considered.

## B . 2 Technical liabilities

| Line of business | Industry provision at end of financial year ended in 1999 | | | | | |
|---|---|---|---|---|---|---|
| | Actual (a) | | Long tail version (c) | | Short tail version(c) | |
| | Unearned premium (b) | Outstanding claims | Unearned premium | Outstanding claims | Unearned premium | Outstanding claims |
| | $M | $M | $M | $M | $M | $M |
| Fire and ISR | 353 | 340 | 270 | 260 | 319 | 307 |
| Houseowners/householders | 1,033 | 523 | 789 | 400 | 934 | 473 |
| CTP motor vehicle | 961 | 6,637 | 1,468 | 10,140 | 868 | 5,997 |
| Commercial motor vehicle | 418 | 226 | 320 | 173 | 378 | 204 |
| Domestic motor vehicle | 1,500 | 365 | 1,146 | 279 | 1,355 | 330 |
| Marine & aviation | 98 | 187 | 75 | 143 | 89 | 169 |
| Professional indemnity | 162 | 1,151 | 247 | 1,758 | 146 | 1,040 |
| Public & product liability | 326 | 2,543 | 498 | 3,885 | 295 | 2,298 |
| Employers' liability | 270 | 1,899 | 413 | 2,901 | 244 | 1,716 |
| Mortgage | 320 | 15 | 245 | 11 | 289 | 14 |
| Consumer credit | 203 | 51 | 155 | 39 | 184 | 46 |
| Travel | 18 | 33 | 13 | 25 | 16 | 30 |
| Other accident | 225 | 278 | 172 | 212 | 204 | 251 |
| Other | 176 | 144 | 176 | 144 | 176 | 144 |
| Inward treaty | 444 | 884 | 444 | 884 | 444 | 884 |
| TOTAL | 6,509 | 15,276 | 6,431 | 21,254 | 5,940 | 13,901 |

Notes: (a) For direct insurers, inside Australia.

From Tables 6 and 7 of "Selected Statistics on the General Insurance Industry Year Ending December 1999", published by APRA.

(b) Unearned premium from that source is gross of reinsurance, and has been adjusted by the ratio:

$$\frac{\text{Premium revenue net of reinsurance}}{\text{Premium revenue gross of reinsurance}}$$

(c) Unearned premium and outstanding claims are assumed to change in proportion with premium revenue (Appendix B.1).

## B . 3 Asset allocation

### B . 3 . 1 Raw data

| Asset sector | Amount of assets at end of financial year ended in 1999 (a) | |
|---|---|---|
| | Amount | Proportion |
| | $M | |
| Land and buildings | 757 | 3% |
| Debt securities | 11,610 | 40% |
| Shares | | 0% |
| Listed | 2,395 | 8% |
| Unlisted | 5,304 | 18% |
| Options | 250 | 1% |
| Units in trusts | | 0% |
| Listed | 371 | 1% |
| Unlisted | 2,235 | 8% |
| Other rights & interests in business undertakings | 52 | 0% |
| Deposits | 3,001 | 10% |
| Loans/amounts owing Sec 30 of Insurance Act | 2,580 | 9% |
| Other financial instruments | 24 | 0% |
| Other investments | 236 | 1% |
| TOTAL | 28,815 | 100% |

**Notes:** (a) For direct insurers, inside Australia.

From Table 3b of "Selected Statistics on the General Insurance Industry Year Ending December 1999", published by APRA.

### B . 3 . 2 Assumed for calculations

| Asset sector | Amount of assets at end of financial year ended in 1999 | |
|---|---|---|
| | Amount | Proportion |
| | $M | |
| Government debt: | | |
| Short | 2,882 | 10% |
| Long | 2,882 | 10% |
| Other fixed interest: | | |
| Short | 4,322 | 15% |
| Long | 4,322 | 15% |
| Cash, Notes | 2,882 | 10% |
| Equities | 7,204 | 25% |
| Property and other | 4,322 | 15% |
| TOTAL | 28,815 | 100% |

# Appendix C
# Capital allocation theory

## C.1 Statement of problem

Consider an insurer with total capital C and Product Lines $i$ = 1,2,..., $n$. It is required that the capital be allocated to Product Lines in the sense that an amount of capital $C_i$ is assigned to Product Line $i$, with

$$\sum_{i=1}^{n} C_i = C. \tag{C.1}$$

## C.2 Solution of problem

### C.2.1 Notation

Define

$L_i$ = value of liabilities in Product Line $i$ (valued as if default free)

$L$ = $\sum_{i=1}^{n} L_i$ = value of total liabilities

$c_i$ = $C_i / L_i$ = capital ratio for Product Line $i$

$c$ = C/L = total capital ratio

$A$ = value of assets
= L + C = L(1+c)

$A_i$ = $L_i(1+c_i)$ = value of assets attributed to Product Line $i$.

**See Appendix C.4 for interpretation of the terms "assets" and "liabilities".**

Let a symbol with a tilde over it denote a random variable whose expected value is represented by the same symbol without the tilde, eg $\tilde{L}$ denotes the random variable representing value of total liabilities.

Assume that $\tilde{A}$ and $\tilde{L}$ are bivariate log normally distributed:

$$\left(\log \tilde{A}, \log \tilde{L}\right) \sim N\left(A, L, \nu_A^2, \nu_L^2, \nu_{AL} / \nu_A \nu_L\right) \tag{C.2}$$

with

$$\nu_{AL} = Cov\left(\tilde{A}, \tilde{L}\right). \tag{C.3}$$

Define

$$\nu^2 = V\left[\log \tilde{A}/\tilde{L}\right] = \nu_A^2 - 2\nu_{AL} + \nu_L^2. \qquad \text{(C.4)}$$

Also, for X = A,L, define

$$\begin{aligned}\sigma_X^2 &= \left[\text{coefficient of variation of } \tilde{X}\right]^2 \\ &= V\left[\tilde{X}\right]/X^2 \\ &= \exp\left(\nu_X^2\right) - 1 \qquad \text{(C.5)}\end{aligned}$$

and define

$$\begin{aligned}\sigma_{AL} &= Cov\left[\tilde{A},\tilde{L}\right]/AL \\ &= \exp\left(\nu_{AL}\right) - 1. \qquad \text{(C.6)}\end{aligned}$$

Define

$$\begin{aligned}\sigma_i^2 &= V\left[\tilde{L}_i\right]/L_i^2 \\ \rho_{iL} &= Corr\left(\tilde{L}_i,\tilde{L}\right) \\ \sigma_{iA} &= Cov\left(\tilde{L}_i,\tilde{A}\right)/L_i A\end{aligned}$$

$$\begin{aligned}y &= -\left[\log(1+c)\right]/\nu - \nu/2 \\ \beta_i &= \rho_{iL}\left(\sigma_i/\sigma_L\right) \\ \gamma_i &= \sigma_{iA}/\sigma_{AL}.\end{aligned}$$

### C.2.2 Solution

#### C.2.2.1 Methodology

The values of all liabilities in Appendix C.2.1 have been expressed on a default free basis. The market value of the same liabilities would be less. For example,

$$L^* = L - D \qquad \text{(C.7)}$$

where

L* = market value of liabilities L
D = value of insolvency put, ie of the payoff $\max\left(0, L - A\right)$.

Define the **default ratio**

d = D/L
= value of insolvency put per unit liabilities.

Now let $D_i$ be the part of D assigned to Product Line $i$, and define

$d_i = D_i / L_i$ = default ratio for Product Line $i$.

Equilibrium values of $d_i$ are calculated on the basis that, because of competition, they must be the same for all insurers and independent of mix of business by Product Line.

This approach is used by Myers and Read (1999), who show that it leads to a unique allocation of capital C to the $C_i$.

### C.2.2.2 Result

The capital ratios $c_i$ may be computed:

$$c_i = c + \frac{(1+c)\phi(y)}{\Phi(y)\nu}\left[\frac{(\beta_i - 1)\sigma_L^2}{1+\sigma_L^2} - \frac{(\gamma_i - 1)\sigma_{AL}}{1+\sigma_{AL}}\right], \qquad \text{(C.8)}$$

where $\Phi(\cdot), \phi(\cdot)$ denote the d.f. and p.d.f. respectively of the unit normal distribution.

## C.3 Interpretation of "assets" and "liabilities"

The terms "assets" and "liabilities", as used in the foregoing, can assume any meaning at all consistent with the definition in (C.2).

For the purpose of the present report, $\tilde{L}$ will be taken to be defined as follows:

$\tilde{L}$ = value of total liabilities **one year** after a specific balance date on which the value of liabilities is known.

It is supposed that the value follows a stochastic process over that one year.

Other quantities, eg $\tilde{A}, \tilde{L}_i$ etc are similarly defined.

Note that $\tilde{L}$ relates to **total** liabilities, specifically over all past accident years. The parameters characterising $\tilde{L}_i$, for example, will depend on the mix over accident years. For example,

$$\sigma_i^2 = \sum_{j,k} L_{i(j)} L_{i(k)} \sigma_{i(j,k)} / L^2$$

where $\tilde{L}_{i(j)}$ denotes the liability in respect of accident year $j$ within Product Line $i$, and

$$\sigma_{i(j,k)} = Cov\left[\tilde{L}_{i(j)}, \tilde{L}_{i(k)}\right] / L_{i(j)}, L_{i(k)}.$$

It may be supposed that the portfolio has been subject to **constant growth** for many years, and so is **stable** in its composition of (expected) liabilities by accident year.

## C.4 Evaluation of derived parameters

Some of the parameters used in Appendix C.2 depend on more fundamental quantities. For example,

$$\begin{aligned} \sigma_L^2 &= V\left[\sum_i \tilde{L}_i\right] / L^2 \\ &= \sum_{i,j} \rho_{ij} L_i L_j \sigma_i \sigma_j / L^2 \end{aligned} \qquad \text{(C.9)}$$

where

$$\rho_{ij} = Corr\left[\tilde{L}_i, \tilde{L}_j\right].$$

Also

$$\begin{aligned} \rho_{iL} &= Cov\left[\tilde{L}_i, \tilde{L}\right] / L_i L \sigma_i \sigma_L \\ &= Cov\left[\tilde{L}_i, \sum_j \tilde{L}_j\right] / L_i L \sigma_i \sigma_L \\ &= \sum_j \rho_{ij} L_j \sigma_j / L \sigma_L. \end{aligned} \qquad \text{(C.10)}$$

Let

$$r_{ik} = Corr\left[\tilde{L}_i, \tilde{A}_k\right]$$

where $\tilde{A}_k$ is the rate of return in asset sector $k$.

Then

$$\begin{aligned}\sigma_{iA} &= Cov\left[\tilde{L}_i, \sum_k \tilde{A}_k\right] / L_i A \\ &= \sigma_i \sum_k r_{ik} A_k \tau_k / A \end{aligned} \tag{C.11}$$

where

$$\tau_k = V^{\frac{1}{2}}\left[\tilde{A}_k\right] / A_k .$$

Further,

$$\begin{aligned}\sigma_{AL} &= Cov\left[\sum_i \tilde{L}_i, \tilde{A}\right] / AL \\ &= \sum_i L_i A \sigma_{iA} / AL \\ &= \sum_i L_i \sigma_{iA} / L . \end{aligned} \tag{C.12}$$

# Appendix D

# Liability parameters

## D . 1 Line volatilities

| Line of business (e) | Premium (a) | Unearned premium (b) | Outstanding claims (c) | Technical reserves (d) | Mean term of outstanding claims (f) | Volatility | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Premium related (g) | Reserve related (g) | Total per unit reserves (h) |
| | $M | $M | $M | $M | years | | | |
| Fire and ISR | 819 | 353 | 340 | 693 | 0.5 | 25% | 15% | 40% |
| Houseowners/householders | 1,936 | 1,033 | 523 | 1,556 | 0.3 | 6% | 12% | 13% |
| **CTP motor vehicle (1) (j)** | 938 | 480 | 3,319 | 3,799 | 4.4 | 28% | 20% | 13% |
| **CTP motor vehicle (2) (j)** | 469 | 240 | 1,659 | 1,899 | 4.4 | 28% | 25% | 14% |
| **CTP motor vehicle (3) (j)** | 469 | 240 | 1,659 | 1,899 | 4.4 | 28% | 25% | 14% |
| Commercial motor vehicle | 886 | 418 | 226 | 644 | 0.3 | 3% | 12% | 9% |
| Domestic motor vehicle | 2,863 | 1,500 | 365 | 1,865 | 0.2 | 3% | 10% | 8% |
| Marine & aviation | 390 | 98 | 187 | 285 | 0.6 | 8% | 15% | 18% |
| **Professional indemnity** | 353 | 162 | 1,151 | 1,313 | 4.1 | 12% | 23% | 11% |
| **Public & product liability** | 645 | 326 | 2,543 | 2,869 | 4.9 | 15% | 23% | 10% |
| **Employers' liability** | 607 | 270 | 1,899 | 2,169 | 3.9 | 15% | 25% | 13% |
| Mortgage | 77 | 320 | 15 | 335 | 0.2 | 39% | 12% | 43% |
| Consumer credit | 116 | 203 | 51 | 254 | 0.5 | 7% | 20% | 9% |
| Travel | 138 | 18 | 33 | 51 | 0.9 | 10% | 13% | 30% |
| Other accident | 556 | 225 | 278 | 503 | 0.6 | 6% | 13% | 12% |
| Other (i) | | | | | | | | |
| Inward treaty (i) | | | | | | | | |
| TOTAL | 11,262 | 5,889 | 14,248 | 20,137 | | | | |

Notes: (a) Net earned premium for financial year ended in 1999 (Appendix B.1).

(b) Provision for unearned premium at the end of the financial year ended in 1999 (Appendix B.2).

(c) Provision for outstanding claims at the end of the financial year ended in 1999 (Appendix B.2)

(d) Unearned premium + outstanding claims.

(e) Lines of business regarded as long tail are printed in bold.

(f) Calculated as:

$$\frac{\text{Provision for outstanding claims}}{\text{80\% of unearned premium}}$$

where the factor of 80% makes rough allowance for initial expenses.

(g) Selected

(h) Total volatility has been calculated as the square root of:

[Premium x premium related volatility]$^2$
+
[Unearned Premium Reserve x premium related volatility]$^2$
+
[Outstanding claims reserve x Reserve related volatility]$^2$/[Mean Term of outstanding claims reserve]
+
2 x Correlation between UPR risk and Underwriting Risk x UPR x Premium x [premium related volatility]$^2$
+
2 x Correlation between reserve risk and Underwriting Risk x Outstanding claims reserve x [Premium + Unearned premium]
premium related volatility x Reserve related volatility / sqrt[Mean Term of outstanding claims reserve]

The result has been expressed as a percentage of total technical reserves.

(i) Ignored in the capital allocation.

(j) Total CTP has been divided into 3 segments in volume proportions 2:1:1 These segments are assumed only partially correlated (see Appendix E).

D . 2 Line correlations

Correlation matrix of Line of Business result volatilities

| | Commercial Fire | Workers Compensation | Personal Accident | Householders | Travel | Public Liability | Professional Indemnity | Domestic Motor | Commercial Motor | CTP(1) | CTP(2) | CTP(3) | Lenders Mortgage Insurance | Consumer Credit | Marine |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Commercial Fire | 100% | | | 24% | | | | | | | | | | | |
| Workers Compensation | | 100% | | 0% | | 15% | | | | 15% | 15% | 15% | | | |
| Personal Accident | | | 100% | | | | | | | | | | | | |
| Householders | 24% | 0% | | 100% | | 3% | 1% | | | 0% | 0% | 0% | | | |
| Travel | | | | | 100% | | | | | | | | | | |
| Public Liability | | 15% | | 3% | | 100% | 20% | | | 15% | 15% | 15% | | | |
| Professional Indemnity | | | | 1% | | 20% | 100% | | | | | | | | |
| Domestic Motor | | | | | | | | 100% | 50% | 25% | 25% | 25% | | | |
| Commercial Motor | | | | | | | | 50% | 100% | 25% | 25% | 25% | | | |
| CTP(1) | | 15% | | 0% | | 15% | | 25% | 25% | 100% | 25% | 25% | | | |
| CTP(2) | | 15% | | 0% | | 15% | | 25% | 25% | 25% | 100% | 25% | | | |
| CTP(3) | | 15% | | 0% | | 15% | | 25% | 25% | 25% | 25% | 100% | | | |
| Lenders Mortgage Insurance | | | | | | | | | | | | | 100% | 20% | |
| Consumer Credit | | | | | | | | | | | | | 20% | 100% | |
| Marine | | | | | | | | | | | | | | | 100% |

Note: Based partly on a study by another consultant, and partly on judgement.

Blank cells indicate zero correlations.

# Appendix E

# Asset parameters

## E . 1 Sector volatilities

| Asset sector | Proportion (a) | Volatility (b) |
|---|---|---|
| Govt Short | 10% | 2% |
| Govt Long | 10% | 6% |
| Debs Short | 15% | 2% |
| Debs Long | 15% | 6% |
| Cash, Notes | 10% | 1% |
| Equities | 25% | 18% |
| Other | 15% | 15% |
| Total | 100% | 6.1% (c) |

Notes: (a) From Appendix B.3.2.

(b) Selected.

(c) Based on:
- the sector allocation set out in the preceding column; and
- the sector correlations set out in Appendix E.2.

## E . 2 Sector correlations

| | Government | | Debs | | Cash, Notes | Equities | Other |
|---|---|---|---|---|---|---|---|
| | Short | Long | Short | Long | | | |
| Govt Short | 1 | 0.5 | 0.9 | 0.5 | 0.5 | 0.1 | 0 |
| Govt Long | 0.5 | 1 | 0.5 | 0.9 | 0.2 | 0.6 | 0 |
| Debs Short | 0.9 | 0.5 | 1 | 0.5 | 0.5 | 0.1 | 0 |
| Debs Long | 0.5 | 0.9 | 0.5 | 1 | 0.2 | 0.6 | 0 |
| Cash, Notes | 0.5 | 0.2 | 0.5 | 0.2 | 1 | 0 | 0 |
| Equities | 0.1 | 0.6 | 0.1 | 0.6 | 0 | 1 | 0 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

Note: Based in part on the correlations set out on p.100 of Resilience Working Group (1996). "The application of stochastic asset liability modelling to resilience reserving in life insurance". **Transactions of the Institute of Actuaries of Australia** , 79-110.

# Appendix F

## Asset-liability correlations

Correlations between LoB claim costs and asset sector returns

| | Government:Shor | Long | DebsShort | DebsLong | Cash,Notes | Equities | Other |
|---|---|---|---|---|---|---|---|
| Commercial Fire | | | | | | | |
| Workers Compensation | | | | | | | |
| Personal Accident | | | | | | | |
| Householders | | | | | | | |
| Travel | | | | | | | |
| Public Liability | 5% | 5% | 5% | 5% | 5% | 5% | |
| Professional Indemnity | | | 10% | | | -20% | |
| Domestic Motor | | | | | | 10% | |
| Commercial Motor | | | | -20% | | 10% | |
| CTP(1) | | | | | | 10% | |
| CTP(2) | | | | | | 10% | |
| CTP(3) | | | | | | 10% | |
| Lenders Mortgage Insurance | | | | | | -20% | |
| Consumer Credit | | | | | | -10% | |
| Marine | | | | | | | |
| Whole portfolio | 1.3% | 1.3% | 2.6% | 0.3% | 1.3% | 7.0% | |

Note: Based on judgement.

Blank cells indicate zero correlations.

"Whole portfolio" correlations are calculated by taking the weight average covariance of each asset sector with the LoBs, where the weights are the LoB premium volumes (Appendix G.2).

# Appendix G

# Capital allocations

## G . 1 Capital amount

| | |
|---|---|
| Assets ($M) (a) | 28,958 |
| Liabilities ($M) (b) | 20,137 |
| Capital ($M) (c) | 8,822 |
| Capital ratio (d) | 44% |

**Notes:** (a) Calculated as:
Liabilities + Assets.

(b) Technical reserves, from Appendix D.1.

(c) Calculated as:
Outstanding claims (Appendix D.1)
X
1999 "5 insurers" average ratio of net assets to outstanding claims (Appendix A.2.2).

(d) Capital expressed as a percentage of total liabilities.

## G . 2 Baseline allocation

| Description | Premium income (a) | Technical reserves (b) | Volatility per unit reserves (c) | Capital allocation | | | |
|---|---|---|---|---|---|---|---|
| | | | | Amount (d) | % of premium | % of reserves | Apportion -ment |
| | $M | $M | | $M | | | |
| Commercial Fire | 819 | 693 | 40% | 436 | 53% | 63% | 5% |
| Workers Compensation | 607 | 2,169 | 13% | 787 | 130% | 36% | 9% |
| Personal Accident | 556 | 503 | 12% | 88 | 16% | 18% | 1% |
| Householders | 1,936 | 1,556 | 13% | 446 | 23% | 29% | 5% |
| Travel | 138 | 51 | 30% | 8 | 6% | 16% | 0% |
| Public Liability | 645 | 2,869 | 10% | 912 | 141% | 32% | 10% |
| Professional Indemnity | 353 | 1,313 | 11% | 394 | 112% | 30% | 4% |
| Domestic Motor | 2,863 | 1,865 | 8% | 453 | 16% | 24% | 5% |
| Commercial Motor | 886 | 644 | 9% | 165 | 19% | 26% | 2% |
| CTP(1) | 1,876 | 7,598 | 13% | 4,804 | 256% | 63% | 54% |
| Lenders Mortgage Insurance | 77 | 335 | 43% | 225 | 292% | 67% | 3% |
| Consumer Credit | 116 | 254 | 9% | 50 | 43% | 20% | 1% |
| Marine | 390 | 285 | 18% | 52 | 13% | 18% | 1% |
| **TOTAL** | **11,262** | **20,137** | **6.4%** | **8,822** | **78%** | **44%** | **100%** |

Notes: (a) Net earned premium for financial year ended in 1999 (Appendix B.1).

(b) From Appendix B.2.

(c) From Appendix D.1.

(d) Calculated from (C.8) using the parameters in Appendices D, E, F and G.1.

## G . 3 Variations from baseline

### G . 3 . 1 Two CTP sub-lines

| Description | Premium income | Technical reserves | Volatility per unit reserves | Capital allocation | | | |
|---|---|---|---|---|---|---|---|
| | | | | Amount | % of premium | % of reserves | Apportion -ment |
| | $M | $M | | $M | | | |
| Commercial Fire | 819 | 693 | 40% | 486 | 59% | 70% | 6% |
| Workers Compensation | 607 | 2,169 | 13% | 900 | 148% | 41% | 10% |
| Personal Accident | 556 | 503 | 12% | 103 | 19% | 21% | 1% |
| Householders | 1,936 | 1,556 | 13% | 509 | 26% | 33% | 6% |
| Travel | 138 | 51 | 30% | 10 | 7% | 19% | 0% |
| Public Liability | 645 | 2,869 | 10% | 1,047 | 162% | 36% | 12% |
| Professional Indemnity | 353 | 1,313 | 11% | 448 | 127% | 34% | 5% |
| Domestic Motor | 2,863 | 1,865 | 8% | 529 | 18% | 28% | 6% |
| Commercial Motor | 886 | 644 | 9% | 192 | 22% | 30% | 2% |
| CTP(1) | 938 | 3,799 | 13% | 1,988 | 212% | 52% | 23% |
| CTP(2) | 938 | 3,799 | 14% | 2,238 | 239% | 59% | 25% |
| Lenders Mortgage Insurance | 77 | 335 | 43% | 251 | 325% | 75% | 3% |
| Consumer Credit | 116 | 254 | 9% | 59 | 50% | 23% | 1% |
| Marine | 390 | 285 | 18% | 61 | 16% | 21% | 1% |
| TOTAL | 11,262 | 20,137 | 5.9% | 8,822 | 78% | 44% | 100% |

G . 3 . 2 Three CTP sub-lines

| Description | Premium income | Technical reserves | Volatility per unit reserves | Capital allocation. | | | |
|---|---|---|---|---|---|---|---|
| | | | | Amount | % of premium | % of reserves | Apportion -ment |
| | $M | $M | | $M | | | |
| Commercial Fire | 819 | 693 | 40% | 510 | 62% | 74% | 6% |
| Workers Compensation | 607 | 2,169 | 13% | 949 | 156% | 44% | 11% |
| Personal Accident | 556 | 503 | 12% | 110 | 20% | 22% | 1% |
| Householders | 1,936 | 1,556 | 13% | 538 | 28% | 35% | 6% |
| Travel | 138 | 51 | 30% | 10 | 8% | 21% | 0% |
| Public Liability | 645 | 2,869 | 10% | 1,105 | 171% | 39% | 13% |
| Professional Indemnity | 353 | 1,313 | 11% | 474 | 134% | 36% | 5% |
| Domestic Motor | 2,863 | 1,865 | 8% | 561 | 20% | 30% | 6% |
| Commercial Motor | 886 | 644 | 9% | 204 | 23% | 32% | 2% |
| CTP(1) | 938 | 3,799 | 13% | 2,090 | 223% | 55% | 24% |
| CTP(2) | 469 | 1,899 | 14% | 940 | 200% | 49% | 11% |
| CTP(3) | 469 | 1,899 | 14% | 940 | 200% | 49% | 11% |
| Lenders Mortgage Insurance | 77 | 335 | 43% | 263 | 341% | 78% | 3% |
| Consumer Credit | 116 | 254 | 9% | 62 | 54% | 24% | 1% |
| Marine | 390 | 285 | 18% | 65 | 17% | 23% | 1% |
| TOTAL | 11,262 | 20,137 | 5.6% | 8,822 | 78% | 44% | 100% |

## G . 3 . 3 Two sub-lines for each Line of Business

| Description | Premium income | Technical reserves | Volatility per unit reserves | Capital allocation | | | |
|---|---|---|---|---|---|---|---|
| | | | | Amount | % of premium | % of reserves | Apportion -ment |
| | $M | $M | | $M | | | |
| Commercial Fire | 410 | 346 | 40% | 196 | 48% | 57% | 2% |
| Commercial Fire(2) | 410 | 346 | 40% | 196 | 48% | 57% | 2% |
| Workers Compensation | 304 | 1,085 | 13% | 420 | 138% | 39% | 5% |
| Workers Compensation(2) | 304 | 1,085 | 13% | 420 | 138% | 39% | 5% |
| Personal Accident | 278 | 252 | 12% | 53 | 19% | 21% | 1% |
| Personal Accident(2) | 278 | 252 | 12% | 53 | 19% | 21% | 1% |
| Householders | 968 | 778 | 13% | 239 | 25% | 31% | 3% |
| Householders(2) | 968 | 778 | 13% | 238 | 25% | 31% | 3% |
| Travel | 69 | 25 | 30% | 5 | 7% | 20% | 0% |
| Travel(2) | 69 | 25 | 30% | 5 | 7% | 20% | 0% |
| Public Liability | 323 | 1,435 | 10% | 489 | 152% | 34% | 6% |
| Public Liability(2) | 323 | 1,435 | 10% | 489 | 152% | 34% | 6% |
| Professional Indemnity | 177 | 656 | 11% | 223 | 126% | 34% | 3% |
| Professional Indemnity(2) | 177 | 656 | 11% | 223 | 127% | 34% | 3% |
| Domestic Motor | 1,432 | 932 | 8% | 267 | 19% | 29% | 3% |
| Domestic Motor(2) | 1,432 | 932 | 8% | 267 | 19% | 29% | 3% |
| Commercial Motor | 443 | 322 | 9% | 100 | 23% | 31% | 1% |
| Commercial Motor(2) | 443 | 322 | 9% | 100 | 23% | 31% | 1% |
| CTP(1) | 938 | 3,799 | 13% | 2,110 | 225% | 56% | 24% |
| CTP(2) | 938 | 3,799 | 14% | 2,372 | 253% | 62% | 27% |
| Lenders Mortgage Insurance | 39 | 168 | 43% | 116 | 301% | 69% | 1% |
| Lenders Mortgage Insurance(2) | 39 | 168 | 43% | 116 | 301% | 69% | 1% |
| Consumer Credit | 58 | 127 | 9% | 31 | 54% | 24% | 0% |
| Consumer Credit(2) | 58 | 127 | 9% | 31 | 54% | 24% | 0% |
| Marine | 195 | 143 | 18% | 31 | 16% | 21% | 0% |
| Marine(2) | 195 | 143 | 18% | 31 | 16% | 21% | 0% |
| **TOTAL** | **11,262** | **20,137** | **5.6%** | **8,822** | **78%** | **44%** | **100%** |

# Appendix H
# Profit margin parameters

## H.1 Payment pattern

| Development year[(a)] | Percentage of accident year's claim cost paid[(b)] |
|---|---|
| | % |
| 0 | 1 |
| 1 | 7 |
| 2 | 18 |
| 3 | 27 |
| 4 | 16 |
| 5 | 9 |
| 6 | 7 |
| 7 | 5 |
| 8 | 3.5 |
| 9 | 2.5 |
| 10 | 1.5 |
| 11 | 1.0 |
| 12 | 0.7 |
| 13 | 0.3 |
| 14 | 0.2 |
| 15 | 0.1 |
| 16 | 0.1 |
| 17 | 0.1 |

Notes: (a) Measured from accident year.
(b) Including superimposed inflation, but otherwise in constant dollar values.

## H.2 Economic parameters

| | |
|---|---|
| Wage inflation | 4% p.a. |
| Risk free rate of return | 6½% p.a. |
| Share market risk premium | 5% p.a. |
| Tax rate | 30% |

## *Appendix 3*

## Taylor Fry response to ICA representations on Capital and Profit

24/10/01 email from Dr Taylor –

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Mr David Bowen
General Manager
Motor Accidents Authority of New South Wales
Level 22, 580 George Street
Sydney NSW 2000

Dear David,

# Capital and Profit
# ICA representations

## 1. Background

I refer to previous correspondence on this subject. My letter dated 10 September set out a suggested position for the Motor Accidents Authority of NSW ("MAA") to take in relation to the prospective assessment of profit margins in NSW CTP insurance premiums, and specifically as such assessments bear on filed profit margins.

The Insurance Council of Australia ("ICA"), representing NSW CTP insurers, responded to my letter on 19 September. The response was contained in a letter ("the ICA letter") over the signature of Audrey Lee, Executive Manager, Statutory Classes. The present letter discusses the points raised therein.

Our final position on this subject was set out in my subsequent letter to you dated 4 October. This varied some of the substance of my September letter to accommodate insurers' concerns. A residue of topics remained on which agreement had not been reached by insurers and ourselves. The present letter is largely concerned with these.

## 2. Definition of profit margin

Tables 5.3 and 5.4 of my letter of 10 September quoted profit margins ranging from 3.7% to 6.3%, allowing for the tax deductibility of prudential margins included in provisions. The ICA letter states that the range is actually –2.4% to +6.0%.

The difference arises because ICA have adopted a different definition of profit margin. Appendix A gives a rigorous statement of the two definitions.

Both approaches seek to arrive at the same Myers-Cohn gross premium, but assume different risk premiums:

- the Taylor Fry approach assumes that the risk premium and expenses have been priced on the basis of risk adjusted discount rates (possibly different from risk free rates); whereas
- the ICA approach assumes risk premium and expenses to have been priced on the basis of risk free rates.

The two approaches are discussed in Appendix A.4, which reaches the following conclusions:

- the Taylor Fry approach is preferable if the insurer has priced for risk premium and expenses either:
  - on the basis of a risk-adjusted discount rate other than risk free; or
  - on the basis of a risk free discount rate, without the question of risk-adjusted rate addressed;
- the ICA approach is preferable where the insurer has:
  - priced for risk premium and expenses on the basis of a risk free discount rate; and simultaneously
  - argued a compelling case for a risk-adjusted rate other than risk free.

We suggest that a risk adjusted rate other than risk free should be used only on the basis of cogent argument. As is discussed in Section 3.4, we suspect that justifiable departures from risk free rates would be more likely to lead to **decreased** rather than increased premiums. For this reason, we view the adoption of risk free rates as perhaps a minor concession to insurers.

We also see no need for the circumstances that would render the ICA approach valid to arise. If there is a compelling reason to believe that a risk-adjusted rate is other than risk free, there is no apparent reason for an insurer to file a risk premium discounted at risk free rates.

## 3. Miscellaneous ICA comments

The ICA letter makes a number of short comments on the Myers-Cohn approach. The following paragraphs respond to them one by one. In each sub-section, the thrust of the ICA comment is represented in bold.

**3.1** **The low end of the Taylor Fry profit loading range is negative.** This is only true on the basis of the ICA approach to quantifying profit margin. It relates to the case of a positive liabilities beta. This leads to a risk adjusted discount rate for claims that is greater than risk free.

It follows in these circumstances that the gross premium (based on the risk adjusted rate) is less than the value of risk premium and expenses valued at risk free rates. There is nothing illogical about this. It reflects not so much a negative

profit margin, but rather the fact that risk premium and expenses should not have been valued at risk free rates.

3.2 **The high end of the Taylor Fry profit loading range is at the low end of current loadings generally considered prudent and required.** This begs the question as to why higher loadings are considered necessary. The Taylor Fry loadings are derived from a fully defined and rigorous body of methodology. No coherent alternative has been advanced in justification of a higher set of loadings.

3.3 **All shareholder returns generated by Taylor Fry's modelling (8.7% to 10.8%) are well below the level of current market and industry norms.** My letter of 4 October covered this point though, as far as I know, ICA have not seen that letter. Table 5.4 pointed out that, under the right conditions, there is little difference between Myers-Cohn and IRR profit margins. The latter is specifically based on providing an appropriate return on insurer equity.

As pointed out in the text just prior to the table, the "right conditions" involve regarding an insurer's prudential margin as capital for the purpose of the IRR calculation. Appendix B gives a numerical example, in which the IRR margin is based on a 10.7% p.a. return on insurer equity. This return is calculated as commensurate with the insurer's asset and liability risks.

Thus, it does **not** appear that the shareholder returns inherent in the premium are "well below market... norms".

It may be that they are below **industry** norms but, just as in Section 3.2, this begs the question as to why industry norms are what they are. One might reasonably reverse the argument and infer from the high industry norms for shareholder return requirements that insurance shares are subject to systematic risk substantially higher than the share market average (technically, insurance beta > 1). This would be unusual, and the reasons why it would occur are not clear.

3.4 **Key parameters ($\beta_L$ and $E/L$) are not measurable.** It is true that there has been great difficulty in past attempts to measure $\beta_L$. A further attempt is currently being made under a research contract of the Casualty Actuarial Society (US), and this may help.

It should be noted, however, that insurers appear not to have found this a matter of concern in the past. Past rate filings do not appear to have addressed this question.

Generally, we expect this parameter to be not greatly different from zero. We believe that the assumption $\beta_L = 0$ is a reasonable default, but that departures from the default should be justified.

We also believe that, to the extent $\beta_L$ might be non-zero, it is more likely to be positive than negative. A positive $\beta_L$ would lead to lower premiums than a zero $\beta_L$, and so the proposed default appears to us a concession.

As to the **E/L** ratio (equity to liabilities), my letter of 4 October (end of Section 4.2.2) noted that the capitalisation adopted in the prospective profit allowance is considerably higher than reported by insurers as reflecting their past practice.

3.5 **The Myers & Cohn model does not consider all sources of corporate risk, including operational risk.** We think this statement is incorrect.

We think that insurers cover operational and all other risks with capital. The allocation of capital to CTP adopted for prospective profit purposes derives from the allocation of **all** capital of the representative insurer to the various lines of business.
To the extent that the total capital includes a component relating to off balance sheet risks, so will the CTP allocation. The cost of this component of capital will be priced into the profit margins by the Myers-Cohn method.

3.6 **The Myers & Cohn model assumes that all insurer assets will be invested in a theoretically "optimal" way.** The Myers-Cohn method does not, in fact, make any assumptions about asset allocation. If the insurer is conservatively invested, the Myers-Cohn profit margin will be low because expected investment returns, and therefore double taxation, will be low.

The IRR profit margin will also be low because of the low asset beta, and hence low equity beta. The two profit margins will be roughly consistent, as illustrated in Section 3.3.

Please let me know if you would like any expansion of the above comments.

Yours sincerely,

Greg Taylor

# Appendix A
# Definition of profit margin

## A.1 Myers-Cohn premium

Let the following symbols denote sequences of expected cash outflows from an insurer, of the types indicated, in respect of a specific contract:

| | |
|---|---|
| $C$ | claim payments |
| $E$ | expenses |
| $T$ | tax. |

The Myers-Cohn premium for this contact is:

$$P_{MC} = C_L + E_L + T_F \tag{A.1}$$

where in general on the right side of this equation $X_Z$ denotes the present value of the sequence $X$ discounted at risk-adjusted rates applicable to payments of type $Z$, with $Z$ taking the following values:

| | |
|---|---|
| $L$ | claim payments |
| $F$ | risk free payments. |

## A.2 Taylor Fry profit margin

By (A.1), the premium which would cover claims and expenses (ie is equal to their economic value) is

$$P_L = C_L + E_L \tag{A.2}$$

Accordingly, Taylor Fry take the profit margin contained in the Myers-Cohn premium to be

$$M_{MC} = P_{MC} - P_L = T_F. \tag{A.3}$$

Expressed as a proportion of the premium, this margin is

$$\theta_{MC} = T_F / P_{MC}. \tag{A.4}$$

## A.3 ICA profit margin

ICA define the premium sufficient to cover claims and expenses as

$$P_F = C_F + E_F. \tag{A.5}$$

This definition conforms with the manner in which most insurers construct their premium rates. Note that

$$P_F = P_L \text{ if } L = F. \tag{A.6}$$

Then ICA define the profit margin as

$$M_{ICA} = P_{MC} - P_F = T_F + (C_L + E_L) - (C_F + E_F). \tag{A.7}$$

The profit margin as a proportion of premium is

$$\theta_{ICA} = M_{ICA} / P_{MC}. \tag{A.8}$$

## A.4 Discussion

The logic of the Taylor Fry margin (A.4) is that:

(a) the margin would be correct if insurers took correct account of risk-adjusted discount rates;
(b) insurers may not do this in their pricing of risk premiums and expenses, especially as it is fairly conventional to price these components at risk free rates;
(c) insurers should accept any profits and losses inherent in any mispricing under (b);
(d) the margin (A.4) would then be correct, but would generate a profit subject to adjustment according to (c).

The corresponding logic of the ICA margin (A.8) is:

(a) as above;
(b) as above;
(c) insurers should use the profit margin to correct for any profits and losses arising from mispricing in (b), and this would be achieved by margin (A.8).

Neither of these two approaches is unequivocally correct. However, it seems to us that:

- the Taylor Fry approach is preferable if the insurer has priced for risk premium and expenses either:
  - on the basis of a risk-adjusted discount rate other than risk free; or
  - on the basis of a risk free discount rate, without the question of risk-adjusted rate addressed;

- the ICA approach is preferable where the insurer has:
  - priced for risk premium and expenses on the basis of a risk free discount rate; and simultaneously
  - argued a compelling case for a risk-adjusted rate other than risk free.

We suggest that a risk adjusted rate other than risk free should be used only on the basis of cogent argument.

We also see no need for the circumstances that would render the ICA approach valid to arise. If there is a compelling reason to believe that a risk-adjusted rate is other than risk free, there is no apparent reason for an insurer to file a risk premium discounted at risk free rates.

# Appendix B
# Numerical comparison of Myers-Cohn and IRR margins

Consider the case in which:

| | |
|---|---|
| $\beta_L$ | = 0 |
| Prudential margin | = 15% of technical liabilities |
| Explicit capital | = 53% of technical provisions |
| $\beta_A$ | = average asset beta = 36%. |

If the prudential margin is regarded as capital, then

Total capital = (1 + 53%)(1 + 15%) – 1 = 76% of liabilities.

Hence, the insurer's equity beta is

$\beta_E$ = 1.76 x 36%/0.76 = 84%.

Then the required return on the insurer's equity is

$r_E$ = risk free return
+
84% of share market risk premium.

In the present example, this is

$r_E = 6\frac{1}{2}\% + 84\% \times 5\%$
$= 10.7\%$.

*Appendix 4*

**Dr Taylor *Economic profit margins in Compulsory Third Party premiums***
**21 December 2004**

# MOTOR ACCIDENTS AUTHORITY OF NEW SOUTH WALES

## Economic profit margins in Compulsory Third Party premiums

Dr Greg Taylor
Fellow of the Institute of Actuaries of Australia
Fellow of the Institute of Actuaries (UK)

21 December 2004

# Table of Contents



# Appendices

# 1. Background and scope

## 1.1 Legislative background

Compulsory Third Party ("CTP") motor insurance in New South Wales is governed by the Motor Accidents Act 1988 ("the 1988 Act"), as amended, particularly by the Motor Accidents Compensation Act 1999 ("the 1999 Act"). This defines a scheme of insurance ("the Scheme") of the modified common law type.

The Scheme is underwritten by private sector insurers on a "file and write" basis. Premium rates must be filed with the Motor Accidents Authority ("MAA"), and are subject to legislative restriction according to Sections 25 to 30, which permit the MAA to reject them (Section 27(1)) if:

"(a) the premium will not fully fund the present and likely future liability under this Act of the licensed insurer concerned, or

(b) the premium is, having regard to actuarial advice and to other relevant financial information available to the Authority, excessive, or..." .

According to Section 27(8), "a premium will fully fund a liability referred to in this section if the premium is sufficient:

(a) to pay all acquisition and policy administration expenses of the licensed insurer concerned, and

(b) to provide a sum of money that together with anticipated investment income is equal to the best estimate of the cost of claims plus claim settlement expenses (in inflated dollars) at the assumed date of settlement, and

(c) to provide a profit margin in excess of all claims, costs and expenses that represents an adequate return on capital invested and compensation for the risk taken, and

(d) to provide for such other matters as a prudent insurer should, in all the circumstances, make provision for.

By Sections 27(1) and (8)(d), taken in conjunction, filed premium rates may be rejected if they include a profit margin that is either unduly large or unduly small.

## 1.2 Scope and purpose of report

The present report comments on matters to be considered in, and possible methodology to be used for, establishing a normative profit margin against which those filed by insurers might be assessed. It furthers the discussion contained in my earlier letters:

DOS/8721
DOS/8720

- dated 4 October 2001 on "Capital and Profit"; and
- dated 24 October 2001 on "Capital and Profit: ICA representations".

The former of these in particular made estimates of reasonable capitalisation of NSW CTP insurance for the representative insurer, and reached the conclusion that a profit margin in the range 4% to 6% of premium might be reasonable. It will be referred to subsequently as the "original letter on Profit Margins".

In July 2002, Taylor Fry Consulting Actuaries provided the MAA with an Excel spreadsheet that implemented two well-known methods for calculating profit margins. These were:

- The Myers-Cohn ("M-C") method; and
- The Internal Rate of Return ("IRR") method.

The spreadsheet was accompanied by an explanatory document titled "Evaluation of insurance premium profit margins", and we understand that both were distributed by the MAA to insurers. These will be referred to subsequently as "the TFCA spreadsheet" and "the TFCA explanatory document".

Subsequently, insurers have provided comment on the methods and their implementation. This comment has been aired in two major forums:

- A meeting between the MAA and the Insurance Council of Australia ("ICA") on 17 March 2004; and
- A one-day seminar on 20 July 2004, sponsored by the Institute of Actuaries of Australia and Insurance Australia Group on the "Economic theory of profit margins" (referred to subsequently as just "the Profit seminar").

Some material was common to both. Generally, the items of research or opinion proffered to the above forums as bearing upon the subject of profit margins comprised the following:

- A report dated 5 November 2003 to the ICA on "Issues with the MAA model for evaluation of insurance premium profit margins", by Daniel Tess of PricewaterhouseCoopers Actuarial (subsequently referred to as "the PwC report");
- A slide presentation dated 16 January 2004 to insurers on "Profit margins for NSW CTP" by Colin Brigstock and Mark Copping of Trowbridge Deloitte;
- A paper on "Operations of the capital market under entity specific pricing", published by Tim Jenkins in the British Actuarial Journal, 9, 427-455.
- An unpublished paper dated 18 June 2004 on "Re-visiting the principles of insurance pricing using modern economic valuation methods", by Dr Mark Johnston.

Each of these was accompanied by a separate slide presentation to the Profit seminar. In the case of the Brigstock-Copping contribution, the presentation to the seminar was prepared by Tim Andrews, also of Trowbridge Deloitte.

The purpose of the present report is to provide commentary on these contributions and the extent to which they might modify any previously held views on insurance profit margins or means of quantifying them.

# 2. Executive summary

**2.1** Fair profit margins are defined in Section 3.1.1. They were discussed in my original letter on Profit Margins.

**2.2** There are well established methods for fair insurance pricing, based on financial economics (Section 3.1.4).

**2.3** These methods yield premiums that seek to provide an appropriate return on the capital base required by the insurer in order to conduct its business. The "appropriate" return rewards volatility in the underwriting outcome only to the extent that it is undiversifiable for an investor in shares of insurance or other companies (Section 3.1.5).

These methods were also discussed in the original letter on Profit Margins, and were implemented in the TFCA spreadsheet.

**2.4** The main inputs to pricing, other than the expected claims and associated expenses, are:

- Risk adjusted rates of return; and
- Size of capital base (Section 3.3).

**2.5** This report addresses several of the insurance industry's concerns about the implementation of fair insurance pricing. Briefly, these may be stated as follows:

- That a technical formula called Fairley's formula, that features in the theory underpinning the pricing may be incorrect (Section 4.1);
- That the franchise value of an insurer should be included in the capital base to be serviced by fair profit margins (Section 4.2);
- That the profit margins yielded by financial economic methods may be inconsistent with the expectations of the actual "market", as revealed by an industry survey (Section 4.3).

These matters are discussed in Sections 5, 6 and 7 respectively. The conclusions reached there will be summarised below in just the barest form, and the relevant passages should be read in full for an appreciation of all the technicalities and subtleties involved.

**2.6** Section 5, and its associated technical Appendix B, re-affirm the Fairley formula. The doubts about it appear to relate to a couple of notational misunderstandings.

**2.7** For the purpose of the present report, any excess of market value of an insurer's shares over the balance sheet value of net assets is regarded as consisting of two separate components:

- Any identifiable under-statement of assets or over-statement of liabilities in the balance sheet; and
- The balance, regarded as franchise value.

An insurer's franchise value is perceived as representing the market view of future excess rents receivable by the insurer. These, if realised, will themselves service the franchise value, and a further specific addition to premium profit margins for this purpose is unnecessary (Section 6). Appendix C provides a detailed technical argument of this point.

**2.8** Trowbridge Deloitte have carried out a survey of market views on matters related to profit margins.

**2.8.1** The Trowbridge study is intended:

- to identify the views of the share market as to the capitalisation and RoEs required by insurers; and
- to translate these to the profit margins required in CTP premiums.

**2.8.2** In fact, a relatively small fraction of the views canvassed actually relates to the Australian share market (Sections 7.1.1 and 7.1.2).

**2.8.3** Those that do indicate RoEs substantially lower than those found elsewhere in the study (Section 7.1.2).

**2.8.4** Much of the supporting material for capitalisation and RoEs is drawn from other sources such as insurer's internal targets, foreign share markets, analysts, rating agencies, banks, and DFA modelling. None of these represents the local share market directly, and some are subject to specific factors that are likely to distort conclusions drawn from them in relation to that market (Sections 7.1.3 to 7.1.8).

**2.8.5** The study's conversion of capitalisation and RoE into a profit margin is carried out by means of a model of a hypothetical insurer. The model does not attempt to control the relation between the insurer's asset risk profile and the required RoE. This is in breach of the fundamental tenets of financial economics.

Consequently, many scenarios generated by the model may, in our view, be invalid. From the published detail of the study, one is not able to identify which contain combinations of the relevant variables that are valid representations of market expectations (Section 7.2).

**2.8.6** We therefore regard the profit margin results of the study as inconclusive, except to note that, by 2.8.3, they may be systematically biased upward.

**2.9** A paper by Johnston shows that, because the market in insurance contracts is incomplete, insurers and consumers in a free market would negotiate prices in a feasible range (Section 4.4.2). The fair prices would lie at the low extremity of this range.

Johnston argues that a regulator should set prices in this range, and that even prices above fair prices will be acceptable to consumers as increasing their expected utilities.

This seems a valid application of free market theory, but subject to fairly considerable measurement problems since it depends on the utility function of consumers, or at least that of the representative consumer. Presumably, this would require some form of market research on the part of the regulator or the industry.

In any event, it might be acknowledged that estimated fair prices are subject to measurement uncertainty, and so it may be appropriate for a regulator to allow an acceptable pricing range, of width commensurate with the degree of uncertainty.

**2.10** The subject of dividend imputation has not hitherto been introduced into the discussion of insurance pricing. However, there is no doubt that imputation exists and confers a positive benefit on shareholders. To this extent, it is appropriate that allowance be made for it in the computation of fair profit margins. Any rate of imputation in excess of zero would reduce them (Section 8.1).

**2.11** The theory of fair pricing implies that profit margins in premium would be nil except to the extent that dividend imputation were not fully efficient. On this basis, a representative insurer would service its capital base at a rate of return reflecting the (undiversifiable) risk underwritten, but with no further profit margin (Section 8.4).

**2.12** Insurers can, however, achieve further profits by means of efficiencies (Section 8.4).

**2.13** A corollary of this line of reasoning in a rate filing environment is that whether a set of filed insurance premium rates is too high or too low should be assessed against benchmark assumptions, common to all insurers, rather than against the particular insurer's own historical experience (Section 8.4).

**2.14** Useful areas of future research include determination of:

- A reasonable capital base for an insurer with given mix of LoBs;
- A reasonable allocation of total capital base by LoB;
- Liability betas by LoB.

**2.15** With a couple of exceptions, the matters canvassed in the present report do not change the conclusions reached in the original Profit Margins letter, nor the methodology implemented in the TFCA spreadsheet and described in its accompanying TFCA explanatory document.

The exceptions are:

- That allowance for dividend imputation should be introduced (see 2.10 and 2.11); and
- That the point estimates of profit margin made in the TFCA spreadsheet might be expanded to a range that would accommodate the theory advanced by Johnston (see 2.9).

# 3. Financial economics of insurance pricing

## 3.1 Basic observations

This sub-section sets down certain basic principles according to which profit margins might be calculated.

### 3.1.1 Fair profit margins

First, we shall consider only "fair" profit margins as satisfying Section 27 of the 1999 Act. A fair profit margin will be defined as that which would emerge in a freely competitive market. A definition of fair value that is more comprehensive but carries essentially the same meaning is given by Martin and Tsui (1999, p.357) is:

> "the estimate of the price that an asset or liability should trade at if a deep, liquid and efficient market for the asset or liability existed".

There may be reason to consider other forms of profit margin but, with the exception of the approach discussed in Section 4.4.2, they are not considered here.

### 3.1.2 Financial economics

The profit margin associated with an insurance contract is a component of the total premium for that contract. From an economic viewpoint, the total premium represents the sum such that an insurer is indifferent between:

- paying that (fixed) sum; and
- undertaking to fund the financial obligations arising from the insurance contract.

The obligations arising from the contract will include the claim costs, expenses of administering the contract, and any additional tax burden arising from it. These obligations are both distributed over future times, and are stochastic (uncertain) in both quantum and timing.

Financial economics is the natural vehicle for evaluation of the above indifference price. It is the present value of the expectation (in the statistical sense) of the obligations payable by the insurer, where the present value is calculated according to stochastic discount factors (Cochrane, 2001; Sherris, 2003).

These factors make due allowance for the "risk" associated with the stochastic obligations. For an individual, the "risk" associated with the uncertain payment due in a single period is related to the covariance between the amount of that payment and the individual's marginal utility of period consumption (after allowance for the effect of the payment).

On this basis, the fair premium for an insurance contract may be evaluated as:

$$P = \Sigma_t E[m_t X_t] \qquad (3.1)$$

where $X_t$ is the (uncertain) amount of the payment due from the insurer in period t by virtue of the contract, $m_t$ is the associated stochastic discount factor, and E[.] is the expectation operator.

Any profit margin in the premium (see Section 3.2 for definition) is contained in expression (3.1). No explicit addition of a margin is required.

### 3.1.3 Capital Asset Pricing Model (CAPM)

Stochastic discount factors are discussed in Appendix A. It is noted there that their precise form will depend on the particular model of the economy chosen. One possible model of the economy is that which yields the Capital Asset Pricing Model (CAPM).

There are other possibilities, but they are not explored here. To the extent that the CAPM might be judged deficient, it is necessary to specify alternative details of the economy in order to obtain an operational form of the stochastic discount factors.

In any event, Appendix A.3 gives the CAPM version of $m_t$ as a t-period discount factor at the risk adjusted discount rate associated with $X_t$, namely

$$r_X = r_F + \beta_X \{E[r_M] - r_F\} \qquad (3.2)$$

where
$r_F$ = risk free rate of return ("RoR")
$r_M$ = share market RoR

and $\beta_X$ is the CAPM beta associated with payment $X_t$:

$$\beta_X = \text{cov}[X , r_M] / E[X] \, V[r_M]. \qquad (3.3)$$

This result represents the situation in which individuals' competing preferences, expressed in their personal discount factors $m_t$, have settled to an equilibrium. The CAPM therefore does not reflect these individual preferences explicitly.

There are three main conclusions to be drawn concerning the application of (3.2) to (3.1):

- Each "payment due from the insurer" needs to be discounted at its own risk adjusted RoR; and
- These RoRs, and hence the insurance premium, include no allowance for diversifiable risk, that part of volatility which may be reduced to a negligible level by aggregating an increasing number of stochastically independent risks (see Section 3.1.5 for more detailed explanation).
- In the CAPM, the share market return functions as a proxy for the rate of increase of wealth in the economy generally. It is therefore evident from (3.1)-(3.3) that fair premiums:
  - will involve claim costs discounted at risk free RoRs, and no explicit profit margins, if claims experience is not correlated with the performance of the economy;

- will be higher (respectively lower), all other things equal, for classes of business whose claim costs are negatively (respectively positively) correlated with the economy's performance.

### 3.1.4 Insurance pricing methods

There are two main recognised pricing methods based on financial economics, namely those listed in Section 1.2. They are discussed in Cummins and Harrington (1987), and brief descriptions of them follow.

Both methods are applied longitudinally to a single generation of policies underwritten over a relatively short period.

*Myers-Cohn method*
This is the method described in (3.1), and considers transactions from the standpoint of the insurer. Typically, the costs to the insurer whose discounted value will contribute to the premium comprise:

- Claim payments;
- Expenses;
- Tax on underwriting profit;
- Tax on investment income.

*Internal Rate of Return method*
This method considers transactions from the standpoint of the shareholder. These typically comprise:

- Capital contributions and refunds;
- Dividends.

The method determines the premium for the generation of policies such that the IRR of the cash flows to and from shareholders is equal to the risk adjusted RoR associated with the asset-liability structure of the insurer.

Applications of this method encountered in practice sometimes fail to observe this last condition, e.g. assume the insurer fully invested risk free but entitled to a return on capital commensurate with share market returns.

*Expenses and tax*

Expenses can be added into the example. They add some complexity, but change none of the principles.

In the case of perfect dividend imputation, and equal tax rates for corporations and individuals, the shareholder's position is just as if there were no company tax. Tax therefore has no effect on the example; the premium is still just the present value of claim costs and expenses, with no profit margin.

If, however, there are imperfections in the tax system, e.g. no imputation, then the shareholder suffers a tax dead-weight in the sense that his/her returns from the insurer's holding in equities are taxed once in the hands of the insurer and again in the hands of the shareholder.

This penalises the shareholder relative to the position of taking a direct holding in a portfolio of equities, and so the premium must be increased in compensation. The fair premium is then equal to the present value of claim costs and expenses, plus some margin, which one may choose to call a profit margin.

This example illustrates how profit margins in fair premiums arise essentially for no reason other than tax inefficiencies.

***Comparison of the two methods***
It has been shown by Taylor (1994) that, subject to some relatively realistic conditions, the two methods are just different, but equivalent, views of the same process, and yield the same premiums.

### 3.1.5 Fundamental anatomy of pricing

A simple example is helpful to an understanding of why no explicit profit margin need to be added to (3.1).

Consider a hypothetical insurer over a single time period. At the start of the period the insurer:
- Raises equity;
- Underwrites and receives premium;
- Invests premium risk free, invests equity in share index.

At the end of the period the insurer:
- Receives investment return;
- Pays claims;
- Distributes remaining funds to shareholders.

Assume that the liabilities beta ($\beta_X$ for X=claim payments) is zero, i.e. that claim payments are not correlated with the economy's aggregate wealth. It will also be convenient to assume for the time being that there are no expenses or taxes.

If an M-C premium is charged, equal to the risk adjusted discounted claim costs, the expected shareholder profit consists of just the earnings on the equities purchased with the capital raised. This is consistent with financial economics because it reflects the net investment position of the insurer.

***No price for diversifiable volatility***
The M-C premium in this example manifestly contains no profit margin to compensate the insurer for the volatility in claim payments.

This is sometimes viewed as paradoxical. The question is asked as to what motivation the insurer has to underwrite volatility for no greater return than available for underwriting a certain outgo.

The answer is obtained by looking through the insurer to its shareholders, since the insurer is their "agent", i.e. makes decisions on their behalf, not its own. From the viewpoint of a shareholder, the volatility is irrelevant. The shareholder can reduce this volatility by simply by reducing his/her holding in the insurer. If

the shareholder's portfolio is sufficiently diverse, the diversifiable component of its volatility can be made negligibly small.

## 3.2 Expression of profit margin

Generally, profit per unit of gross premium may be expressed as p/(1+p), where p is the profit per unit of net premium (risk premium plus expense loading).

According to the explanation given on Section 3.1.4, the last two of the four listed components of the M-C premium may reasonably be regarded as the profit margin, and hence the first two components as the net premium.

It follows that p must be calculated as the ratio of profit to net premium, with all four components involved **discounted at their respective risk adjusted RoRs.**

Practitioners sometimes express the profit margin in a different, and incorrect, form. Because it has been conventional to calculate risk premiums by discounting costs at risk free RoRs, p is taken as the ratio of profit to net premium, with the latter **discounted at risk free RoRs.**

This difference is analysed in Appendix D. It is seen there that, if the risk adjusted RoRs applicable to claims and expenses are in fact risk free, then both approaches yield the same calculated profit margin. Otherwise, however, they give quite different results.

The incorrect formulation gives the false impression that the profit margin swings wildly with changes in the liabilities beta. Table 3.1 gives a numerical example in which the liabilities beta is allowed to vary over the values -0.2, 0 and +0.2.

**Table 3.1**
**Numerical illustration of correct and incorrect expression of profit margin**

| Liabilities beta | Myers-Cohn profit loading | |
|---|---|---|
| | Correct | Incorrect |
| | % of net premium | % of net premium |
| -0.2 | 5.2 | 10.0 |
| 0 | 4.2 | 4.2 |
| +0.2 | 3.2 | -1.2 |

## 3.3 Major determinants of profit margin

The main inputs to pricing, other than the expected claims and associated expenses, are:

- Risk adjusted RoRs:
  - For claims and expenses in the M-C case;
  - For assets and equity in the IRR case.
- The capital base, since it affects:

- The quantum of tax on investment earnings of the net equity in the M-C case;
- The quantum of investment earnings, and hence the profit payable to shareholders in the IRR case.

These are therefore the major two determinants of fair insurance profit margins. Major questions associated with them are:

- In relation to **risk adjusted RoRs**:
  - Is the CAPM a reasonable model of these?
  - If not, what is?
  - If an alternative model, does it support a price for diversifiable risk (where the CAPM does not)?
- In relation to the **capital base**:
  - What is a reasonable total capitalisation of an insurance operation?
  - How should it be allocated to individual lines, or other segments, of business?
  - Should "capitalisation" mean balance sheet capitalisation, share market capitalisation, or some other?

# 4 Insurance industry concerns

The insurance industry has expressed a number of concerns with the versions of fair pricing described in Section 3. Some of these were aired at the meeting on 17 March 2004 between the MAA and the ICA mentioned in Section 1.2. These and related matters were discussed at the Profit seminar. The concerns are described briefly in Sections 4.1 to 4.4.

## 4.1 Fairley's formula

A fundamental formula for an entity with assets A, liabilities L, and net equity E=A-L, is the following:

$$E\beta_E = A\beta_A - L\beta_L \qquad (4.1)$$

where $\beta_E$, $\beta_A$, and $\beta_L$ are the CAPM betas associated with E, A and L respectively.

An early paper by on fair pricing of insurance contracts by Fairley (1979) expressed this general identity in a form said to be equivalent for an insurance operation. This was as follows:

$$\beta_E = (ks+1)\beta_A + \beta_p s \qquad (4.2)$$

where
k = the insurer's reserves to premium ratio
s = premium to surplus ratio

and $\beta_p$ is the CAPM beta associated with the insurer's profit. The form (4.2) will be referred to subsequently as "Fairley's formula".

This asserted equivalence is noted in Section 6.4 of PwC report, where it is said to be incorrect. Attachment A to that report purports to demonstrate the incorrectness.

## 4.2 Franchise value

It is typical for the market value of shares in an insurer to exceed the insurer's net asset value according to its balance sheet. The difference is referred to as the insurer's **franchise value** in Tess (2003, p.8).

Franchise value, according to this definition, is the value of the ongoing business over and above its net financial assets, and might include such things as:

- The value of distribution systems;
- The value of an advanced computer system in excess of its written-down balance sheet value;
- Value imputed by the share market on account of oligopolistic market positioning ;
- etc.

New shareholders must purchase shares at prices that include the franchise value, and will seek a return on that outlay. Therefore, the insurer must seek a return on equity ("RoE") at a risk adjusted rate applied to a capital base that includes franchise value.

This is essentially the argument presented in Section 7 of Tess (2003). It is discussed in Section 6.

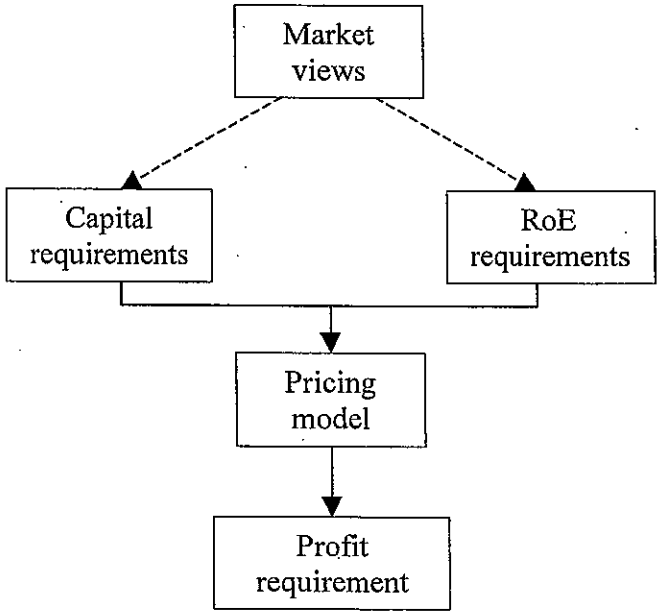
### 4.3 Market expectations

The presentation by Brigstock and Copping (2004) mentioned in Section 1.2 provides an empirical study of "the returns on capital being made by insurers and the response of the investment markets to those returns". It is supported by a similar presentation by Andrews (2004). The two presentations cover similar ground, and will be referred to collectively as "the Trowbridge presentations" or "the Trowbridge study".

An empirical study has the appeal of making direct reference to market behaviour, rather than relying on an assumption that the market conforms with this or that particular model.

The Trowbridge study is structured as laid out in Figure 4.1. This indicates that market views were sought in relation to insurer capitalisation and RoE. These views were then converted to a profit margin by means of a model relating the three items.

**Figure 4.1**
**Structure of Trowbridge study**




In the collation of market views, reference was made to the following sources:

- For Capital requirements:
  - The requirements of the Australian Prudential Regulation Authority;
  - Standard & Poors ("S&P");

- Market analysts;
- Trowbridge's internal modelling;

- For RoE requirements:
  - Insurer performance on stock markets:
    - Actual performance on the Australian market;
    - Forecast performance on the Australian market;
    - Forecast performance on the US market;
    - Forecast performance on European markets;
    - Forecast performance in various IPOs;
  - Insurers' targets;
  - Market analysts' views;
  - S&P's views;
  - Australian bank performance.

More detail of the pricing model is given in Section 7.

The Trowbridge study (Brigstock and Copping, 2004) arrives at the conclusion that market expectations of RoE for CTP business lie in the range 12-17% p.a. and, in relation to profit margins as a percentage of gross premiums, that:

- "For ROEs consistent with market expectations, most results fall within the range 10% to 14%".
- "Below 9% almost certainly would be interpreted as unlikely to produce an adequate return on capital".

### 4.4 Other economic matters

Neither of the papers by Jenkins (2003) and Johnston (2004) is concerned with advocating specific profit margins. Instead each is more concerned with constructing an integrated economic framework in which insurance pricing can be understood in the context of consumer decision making.

#### 4.4.1 Jenkins paper

Jenkins (2003) considers an economy comprising:

- Productive firms;
- Insurance companies;
- Individuals, as:
  - Consumers;
  - Shareholders.

Individuals are risk averse maximisers of expected utility. The risks they face have mean-variance characterisations.

The author constructs a market in which each firm charges prices including supply-side determined profit margins that are directly proportional to risk undertaken. Here, risk is measured by variance, and is **total risk** including both diversifiable and undiversifiable (p.436).

It is noted, however, that the detailed entity-specific profit loading takes the following form.

$$\text{Profit loading} = \text{const.} \times \frac{\text{Variance [Profit]}}{\text{Supporting capital}} \qquad (4.3)$$

where all quantities here are per unit of liability.

The optimal allocation of the economy's wealth, in capitalisation of the firms, is calculated (pp.437-440).

A CAPM approach to the same questions is then examined. By the nature of the CAPM, expected returns on each firm's capital reward only undiversifiable risk. This framework is shown to lead to the same allocation of the economy's wealth as previously (pp.445-446).

Thus, entity-specific pricing on the basis of total risk is shown to lead to the same results as CAPM pricing of the sort discussed in Section 3.1. Ultimately, this occurs because all investors are assumed to have identical utility functions. Tthis causes all investors to chooses the same mix of investments, whence each investor must hold the market portfolio. It then follows that the ratio of undiversifiable to total risk is the same across all entities, leading to the stated result.

### 4.4.2 Johnston paper

Johnston (2004) considers an economy containing insurers and consumers in which prices are subject to a number of conventional economic axioms. These include a no-arbitrage axiom.

It is assumed (as in Section 4.4.1) that consumers are risk averse maximisers of expected utility, and that insurers, as corporates, are effectively risk neutral, and moreover that the market in insurance contracts is incomplete, i.e. insurance contract payoffs are not replicable with traded instruments.

These conditions create a spread between the maximum price consumers are willing to pay and the minimum price insurers are willing to charge. The latter would be the fair price, as defined in Section 3.1.1.

It is concluded that there is a feasible range of market prices, within which a price may be negotiated satisfactorily to both parties, and that the fair price is the lower bound of this range. The range arises from the market incompleteness condition.

Classical economics would argue that, in the long run, a fully competitive insurance market would bid prices down to the lower bound of the feasible range for the representative insurer. Conversely, any extension of this range above the fair price arises from competitive inefficiencies, e.g. oligopoly power.

On the basis of this theory, it might be argued that a regulator would award prices above fair prices only if it believed that it should recognise market inefficiencies and reward them. It might be acknowledged, however, that estimated fair prices are subject to measurement uncertainty, and so it may be appropriate for a regulator to allow an acceptable pricing range, of width commensurate with the degree of uncertainty. Table 3.1 (correct version) provides a numerical example.

In a subsequent version of his paper, Johnston argues, on the other hand, that "the regulator must consider more than just a definition of the fair premium based on market vakues of the insurer's balance sheet components – they should consider whether the premiums are value-creating for consumres", meaning increasing consumers' individual expected utilities even if more expensive than fair premiums.

This seems a valid application of free market theory, but subject to fairly considerable measurement problems since it depends on the utility function of consumers, or at least that of the representative consumer. Presumably, this would require some form of market research on the part of the regulator or the industry.

# 5 Fairley's formula

While the TFCA spreadsheet is explicitly dependent on the CAPM, it is only tangentially dependent on Fairley's formula. In fact, the latter is not required at all for application of either the M-C or the IRR method. However, the spreadsheet does set warning flags when (4.1) is breached, as this is regarded as inconsistent application of the two methods. This is discussed in Section 3.2.3 of the TFCA explanatory document.

The PwC report therefore appears to question the correctness of those flags, though not the M-C and IRR calculations themselves.

Our view is that Fairley's assertion of the equivalence of (4.1) and (4.2) is correct. Appendix B to this report considers the detailed PwC argument to the contrary. It identifies what seem to be a couple of misunderstandings of Fairley's notation, and provides an argument more or less parallel to PwC's, justifying some of Fairley's claims.

# 6 Franchise value

The PwC definition of franchise value, recounted in Section 4.2, is equal to the value of the ongoing business over and above its net financial assets. The "value of the ongoing business" here is the value that could be realised by sale of the business in a market of willing but not anxious buyers. It is referred to below as the "market value of the business".

On this definition, the franchise value would include any hidden assets in the sense of balance sheet under-statement of assets or over-statement of liabilities. Risk margins carried in booked insurance liabilities, for example, being essentially net assets not recognised as such because of conservative valuation of liabilities (e.g. the addition of risk margins), would contribute to this franchise value.

It might assist analysis if these hidden assets are excluded from the definition of franchise value. The definition of the latter would then be as follows:

| Franchise value = Excess of the market value of the business (after correction for hidden assets) over net financial assets. (6.1) |
|---|

The market value of the business would then consist of three components as follows:

| |
|---|
| Net financial assets |
| Hidden assets |
| Franchise value |
| Market value of the business |

As noted in Section 4.2, it is necessary for market value, the total of these components, to be serviced at its risk adjusted rate by profit.

Appendix C gives a mathematical argument that, according to this definition:

| Franchise value = **Expected future excess rents** generated by the business discounted at their risk adjusted rate, (6.2) |
|---|

where an **excess rent** in a period is the excess profit achieved over that required to service the capital base excluding franchise value (but including hidden assets) at its risk adjusted rate.

According to this argument, the franchise value will be nil for a business that is expected to produce an RoE exactly equal to the risk adjusted return on the equity. Correspondingly, a market assigns a business a franchise value because its future RoE is expected to exceed the risk adjusted return.

This may occur for any number of reasons, including the examples set out in Section 4.2. The reasons are irrelevant to identity (6.2).

Equivalently,

| Market value = **Expected future profits** generated by the business discounted at their risk adjusted rate, (6.3) |
|---|

Consistently with the commentary on (6.2), the **expected profit** of a period is equal to the risk adjusted return on the capital base that includes any hidden assets but excludes franchise value.

By either (6.2) or (6.3), future profits will service the market value of the business if they emerge exactly equal to the expectations factored into that value by the market. They will produce windfall gains or losses relative to this standard if they are more or less respectively than market expectations.

The windfall gains or losses represent errors in market judgements of the future. These are typical investment risks, and do not require any compensation of a specific loading in prices.

This situation is slightly more complicated if the market's error is to assume that the regulator will allow a profit margin in premiums to support excess rents, thus also supporting a franchise value, but the regulator does not do so. In this case, the regulator would need to consider:

- Whether a franchise value exists;
- If so, whether it derives from NSW CTP business (it is feasible for an insurer's value to carry a substantial franchise value, but generated by other lines of business and/or other states);
- If so, to what extent the regulator feels obliged to allow the market to extract excess rents from NSW CTP business on the sole ground that that is what the market expects to do.

As noted in the commentary on (6.2) and (6.3), the "capital base" to be serviced by the profit margin contained in premiums should include hidden assets. To the extent that these consist of risk margins contained in insurance liabilities, they are appropriately included in the capital base taken into account in the TFCA spreadsheet (though subject to a tax treatment different from that of the remainder of the capital base).

In the application of that spreadsheet, any other hidden assets should be identified and explicitly added to financial net assets to form the capital base to be serviced by the profit margin contained in premiums.

# 7 Market expectations

## 7.1 Data sources

### 7.1.1 General

The present section discusses the Trowbridge study described in Section 4.3. This has been presented as a "Review of market's views and expectations of insurer's financial performance".

The sources of these views and expectations are set out in Section 4.3 as involving insurers, analysts, rating agencies, foreign share markets, and others. In fact, a relatively small minority of the information assimilated in the Trowbridge study derives from observed Australian share market performance.

The following sub-sections provide commentary on the various sources, with particular reference to their relevance and reliability.

### 7.1.2 Australian share market

Table 7.1 summarises the study's empirical data on insurer RoEs.

**Table 7.1**
**Empirical data on insurer RoEs**

| Type of insurer | Average RoE during | |
|---|---|---|
| | 1997-2002[(a)] | 1997-2003[(b)] |
| | % per annum | % per annum |
| Listed | 10-11 | 11-12 |
| All | 8 | 9 |

Notes: (a) Source: Brigstock and Copping (2004).
(b) Source: Andrews (2004).

Short term risk free rates averaged about 5% per annum over the same period, so the results in the table appear broadly consistent with CAPM returns assuming an equity beta of about 1 for insurers if one assumes, fairly conventionally, a share market risk premium of 4-7% p.a.

While we do not wish to argue strongly for the above RoEs, observed over such a short period, to be representative of the long term market, we do note that:

- They are the only data presented that are directly relevant to the Australian share market.
- They are at least not inconsistent with the RoEs suggested by financial economics, and the CAPM in particular.
- They are somewhat lower than the range of 12-17% per annum suggested in the conclusions of the Trowbridge study (see Section 4.3).

### 7.1.3 Foreign share markets

Brigstock and Copping (2004) quote RoEs on recent US IPOs in the range **9.6%-15.1%** with an average of **12.5%** per annum.

This is somewhat higher than the empirical results appearing in Table 7.1. However, the Australian tax system provides for dividend imputation, whereas the US does not. On this account, one would expect Australian RoEs to be lower than their US counterparts by 0-30%, depending on the ability of the representative investor to take advantage of imputation credits.

This factor would convert the above average of 12.5% to an equivalent Australian RoE somewhere in the range **9-12.5%** per annum. This appears broadly consistent with Table 7.1.

### 7.1.4 Insurers' RoE targets

Insurers' targets are quoted in the range **12.5-15%** per annum, again somewhat higher than in Table 7.1. The following comments may be made:

- Individual insurers' views of what they wish to achieve do not necessarily equate with what is actually achieved subsequently.
- The companies from which targets are obtained may be a select group, including the larger and more successful in the market.
- It is natural for insurance managers to set targets higher than mean performance. While internal stretch targets may be valuable in motivating performance, their applicability to fair pricing is dubious.

### 7.1.5 Market analysts

Analysts' suggestions fall in the range **13½-17%** per annum. This appears to be the RoE considered appropriate for a cross-section of lines of business ("LoBs"), as it is separately suggested that long tail LoBs should command higher rates. A range of **15-20%** per annum is mentioned in this context. These RoEs are considerably higher than those discussed in Sections 7.1.2 to 7.1.4.

The following comments may be made:

- Just as with insurers, analysts' views of what is a reasonable return will not necessarily accord with actual outcomes.
- It is not clear whether the analysts' views relate to the cost of raising equity capital, or simply the excess rents likely to accrue to insurers over an unusually favourable near future.
- The higher ends of the quoted ranges may relate to the latter.
- The reason for the analysts view that long tail LoBs should command higher RoEs is not clear. On the reasoning given in Section 3, this would require that long tail lines be subject to more undiversifiable volatility than short tail lines, i.e. long tail claim costs be more related than short tail to the economy at large. I am not aware of any evidence for this view.

In relation to the last of these points, it appears that the analysts favour **both** higher capitalisation and higher RoE for CTP business relative to other LoBs. The former appears reasonable but, as noted, the reasons for the latter view are unclear.

### 7.1.6 Rating agencies

Table 7.2 is reproduced from the Trowbridge presentations, which cite the Standard & Poor's ("S&P") rating agency.

**Table 7.2**
**S&P benchmark profit ratios**

| Insurer Financial Strength Rating | Benchmark RoE | |
|---|---|---|
| | Workers compensation | General liability |
| | % | % |
| BBB | 6 | 10 |
| A | 10 | 17 |
| AA | 15 | 26 |

These results were taken from the website:

http://www2.standardandpoors.com/NASApp/cs/ContentServer?pagename=sp/Page/FixedIncomeRatingsCriteriaPg&l=EN&b=2&f=&s=&ig=&i=&r=1&fr=1&ft=&fs=7&fig=26&fc=,

which appears to have been since updated, perhaps causing some difficulty in reconciliation between its present version and Table 7.2.

Certainly, the current website does not quote RoEs. It states that "Although many organisations use ROE as a performance benchmark, Standard & Poor's tends not to emphasise this ratio...". The website then quotes **RORs** which, although I cannot find a definition, I take to be **returns on revenue**, or what we usually refer to a profit margin (per unit of premium).

The website appears also to have changed the grouping of LoBs, so that "General liability" (see Table 7.2) is no longer tabulated. In Table 7.3, which is intended to be a current form of Table 7.2, I have replaced this line with "Other liability-occurrence".

**Table 7.3**
**S&P benchmark profit ratios (updated)**

| Insurer Financial Strength Rating | Benchmark profit margin | |
|---|---|---|
| | Workers compensation | Other liability-occurrence |
| | % | % |
| BBB | 7 | 13 |
| A | 11 | 20 |
| AA | 15 | 28 |

The figures in the table differ marginally from those in Table 7.2, though they now have the meaning of ROR rather than RoE. There are a number of comments to be made about them.

*Tax*
As pointed out in Section 7.1.3, US ROEs require reduction by a factor in the range 0-30%, on account of dividend imputation, for comparability with Australian. If rough allowance is made for this by reducing the profit margins by the same factor, Table 7.3 is adjusted to Table 7.4.

**Table 7.4**
**S&P benchmark profit ratios (adjusted for dividend imputation)**

| Insurer Financial Strength Rating | Benchmark profit margin | |
|---|---|---|
| | Workers compensation | Other liability-occurrence |
| | % | % |
| BBB | 5-7 | 9-13 |
| A | 8-11 | 14-20 |
| AA | 11-15 | 20-28 |

***Interpretation of the table***
Quite apart from uncertainty about the correction for the tax effect, there is further uncertainty in the choice of an entry from this table.

First, CTP (or its US equivalent) does not appear to be addressed in its own right by S&P. One must attempt inferences on the basis of other LoBs. The Trowbridge study suggested, and I agree, that CTP profit margins could be expected to lie between those of Workers Compensation and General Liability (now Other Liability – occurrence).

Second, it is not clear which of the tabulated ratings is representative of NSW CTP insurers. They are described by S&P as:
- BBB: Good;
- A: Strong;
- AA: Very strong.

A purely illustrative example would be produced by assuming that:
- A representative NSW CTP insurer would have an A (Insurer Financial Strength) rating; and
- In terms of risk, CTP lies mid-way between the two LoBs displayed in Table 7.4.

In this case the required CTP profit margin would be **11-15%** of gross premium, depending on the efficiency of dividend imputation. However, this example is no more than illustrative, and any such conclusion would be heavily qualified by the uncertainty surrounding the assumptions on which it is based, as well as other uncertainties dealt with below.

***Relation between ratings***
The S&P system proceeds by calculating both capital requirements and profit benchmarks for a baseline rating, and then adjusting these to other ratings by means of multipliers. The multipliers are set out in Table 7.5.

**Table 7.5**
**S&P ratings multipliers**

| Rating | Multiplier for capital adequacy | | Multiplier for earnings adequacy | |
|---|---|---|---|---|
| | As given by S&P | Relative to AA | As given by S&P | Relative to AA |
| | % | % | % | % |
| BBB | 100-124 | 82 | 70-129 | 62 |
| AA | 125-149 | 100 | 130-189 | 100 |
| AAA | 150-174 | 118 | 190-249 | 138 |

It is not clear why the two columns headed "Relative to AA" are dissimilar. If the required earnings of any rating were intended to service its required capital, one would expect them to be at least roughly proportional to that capital. This would not be an issue, of course, if the AA rating were considered the appropriate standard, but this is subject to uncertainty (see above).

### 7.1.7 Australian banks

Table 7.6 summarises some of the Trowbridge data on retail banking. Only past data have been extracted; forecasts of future returns have been omitted.

**Table 7.6**
**Retail banking RoEs**

| Bank | Average RoE 2000-2002 |
|---|---|
| | % |
| ANZ | 20.0 |
| CBA | 16.9 |
| NAB | 17.6 |
| WBC | 20.3 |
| **"Big 4"** | **18.7** |
| SGB | 12.5 |
| BWA | 14.1 |
| BEN | 10.2 |
| ADB | 13.1 |
| **Smaller** | **12.5** |

One noticeable feature is the difference in returns between the "Big 4" and the smaller banks. This raises the question of whether the former group are

currently extracting oligopoly rents. The average returns of the smaller banks are somewhat higher than the range appearing in Table 7.1.

In any event, the relevance of banking returns to the insurance industry is not clear. Although both belong to the financial services sector, they are subject to different risks. The Trowbridge presentations state that insurance profits are more volatile than banking but, according to the CAPM, a more relevant comparison would be that between insurance and banking undiversifiable volatility.

### 7.1.8 Trowbridge internal modelling

The Trowbridge study reports on their internal application of Dynamic Financial Analysis ("DFA") to quantify the amounts of capital required to meet specified objectives.

Thus, it is stated that:

- A mono-line CTP insurer would require capital equal to 1.95 times the minimum capital requirement ("MCR") required of an insurer by statute in order that its probability of breaching the MCR within a year be no more than 5%;
- An insurer underwriting CTP insurance as part of a diversified portfolio would require capital equal to:
  - 1.35 times MCR in order that its probability of breaching the MCR within a year be no more than 5%;
  - 1.6 times MCR in order that its probability of breaching the MCR within a year be no more than 1%.

It is difficult to interpret these results in terms of the demands of the market for insurer security because it is not clear what is accepted by the market as a typical probability of breaching MCR.

## 7.2 Trowbridge model

As pointed out in Figure 4.1 and the surrounding text, a model is required to translate estimated market expectations of capitalisation and RoE into a premium profit margin. As is typical, this is a detailed model incorporating assumptions as to:

- The rate at which the claims of an accident year run off;
- The levels of reserves carried, both central estimates and risk margins;
- The allocation of assets by class
- etc.

While we have not seen the details of this model, we find it conceptually unobjectionable in most respects.

We note, however, that, while the Trowbridge study examines various asset allocation scenarios, the numerical examples given allow the required RoE to remain constant across all of them. This means that, irrespective of how stable or volatile the assets held by the insurer, the market expects the same return on shares in that insurer.

The justification for this assumption is not stated. It is not related to any aspect of market behaviour. It certainly conflicts with theory, and seems to conflict also with intuition as to market behaviour. One would expect the market to demand a greater return from an insurer with assets fully invested in equities than from one fully invested in sovereign debt.

As to theoretical considerations, financial economics is quite specific on this matter. The relevant result is derived in the middle of Appendix B (just before (B.1)), and is as follows:

$$r_K (A-L) = r_A A - r_L L \qquad (6.4)$$

where

$A$ = value of assets
$L$ = value of liabilities
$r_A$ = expected return on assets ("RoA")
$r_L$ = risk adjusted return on liabilities
$r_K$ = required RoE.

Equivalently

$$r_K = [r_A A - r_L L]/(A-L). \qquad (6.5)$$

According to this relation the expected RoE is directly related to the expected RoA. The higher the latter (usually associated with a higher asset risk profile), the higher the required RoE.

The numerical scenarios of the Trowbridge study do allow RoE to vary but all combinations of RoE and asset allocation are considered, whereas the above reasoning suggests that only a subset of combinations is valid.

These scenarios are all variations of a **baseline** in which:

- risk free rate of return 5.5% per annum;
- expected market average return on equities is 10.5% per annum;
- capital is invested 75:25 in riskless securities and equities;
- risk margins (hidden capital) are invested (it appears) in riskless securities.

The other scenarios allow for the proportion of capital invested in equities to vary no higher than 50%.

It is evident that, the lower the asset risk profile, the lower the expected RoA, and so the higher the profit margin required in premiums to support a pre-determined RoE. The calculated profit margin will represent market requirements only if the combination of asset risk profile, RoA and RoE properly reflect market requirements. The Trowbridge study presents no evidence on this point.

A summary of the Trowbridge baseline is that the insurer targets a RoE of 12-17% p.a. (i.e. equity beta in the range 1.3-2.3) while 75% of net assets are riskless.

## 7.3 Summary

**7.3.1** The Trowbridge study is intended:

- to identify the views of the share market as to the capitalisation and RoEs required by insurers; and
- to translate these to the profit margins required in CTP premiums.

**7.3.2** In fact, a relatively small fraction of the views canvassed actually relates to insurers in the Australian share market (Sections 7.1.1 and 7.1.2).

**7.3.3** Those that do indicate RoEs substantially lower than those found elsewhere in the study (Section 7.1.2).

**7.3.4** Much of the supporting material for capitalisation and RoEs is drawn from other sources such as insurers' internal targets, foreign share markets, analysts, rating agencies, banks, and Dynamic Financial Analysis ("DFA") modelling (i.e. detailed stochastic modelling of a general insurance operation). None of these represents the local share market directly, and some are subject to specific factors that are likely to distort conclusions drawn from them in relation to that market (Sections 7.1.3 to 7.1.8).

**7.3.5** The study's conversion of capitalisation and RoE into a profit margin is carried out by means of a model of a hypothetical insurer. The model does not attempt to control the relation between the insurer's asset risk profile and the required RoE. This is in breach of the fundamental tenets of financial economics.

Consequently, many scenarios generated by the model may, in our view, be invalid. The study does not contain material enabling one to identify which contain combinations of the relevant variables that are valid representations of market expectations (Section 7.2).

**7.3.6** We therefore regard the profit margin results of the study as inconclusive, except to note that, by 7.3.3, they may be systematically biased upward.

# 8 Other economic matters

## 8.1 Dividend imputation

Dividend imputation has been mentioned in several of the preceding sections. It is evident that the greater the imputation credits allowed by the tax system, the less the tax burden on the insurance company shareholder.

It is pointed out in Section 3.1.5 that, in the absence of corporation tax, the fair insurance premium would include **no profit loading**. Perfect imputation would produce a situation equivalent to nil corporation tax. Subject to the considerations below, therefore, profit loadings in insurance premiums are justified only to the extent of imputation inefficiency.

The subject of dividend imputation has not hitherto been introduced into the discussion of insurance pricing. No allowance for it has been included in the TFCA spreadsheet. This has been partly due to the difficulties in measurement of the representative investor's entitlement to imputation credits.

However, there is no doubt that imputation exists and confers a positive benefit on shareholders. To this extent, it is appropriate that allowance be made for it in the computation of fair profit margins. To do so would require the determination of a rate of imputation, somewhere in the range 0-30%, and representative of insurance company shareholders. Any rate in excess of zero would cause a reduction in fair profit margins.

## 8.2 Frictional costs

Ng and Varnell (2003) discuss the frictional costs of insurers, defined as "positive, irrecoverable cashflows away from shareholders and bondholders that have a convex (U-shaped) relationship with profit". Smith, Moran and Walczak (2003) argue similarly.

These authors identify various categories of these costs, and nominate the following two as contributing most substantially to price:

- Costs of financial distress;
- Agency costs.

### 8.2.1 Costs of financial distress

Such costs arise in situations of stressed solvency and/or profitability. They can include, for example, loss of customer base, loss of experienced staff, cost of redundancy, etc.

While these arguments are undoubtedly true and may, for example, affect the valuation of a stressed insurance portfolio, they seem to have limited, if any, relevance to fair pricing, and indeed Ng and Varnell do not appear to argue for such application.

It is fundamental to pricing models that they allocate sufficient capital to the subject line of business to reduce the probability of financial distress to a low level. The profit margin is then set in such a way as to service this high level of capitalisation. To service a capital base that minimises the chance of financial distress and then claim for the costs of that distress would amount to double counting.

It may happen that an insurer that is able to collect adequate premiums in respect of one LoB (e.g. CTP) is nevertheless stressed by virtue of one or more other LoBs. In this situation, pricing CTP to recognise the stress amounts effectively to subsidising the other LoBs.

### 8.2.2 Agency costs

Agency costs are those costs incurred by shareholders as a result of their agents (usually company management) acting in the interests other than those of the shareholders, usually some form of management self-aggrandisement.

Again, this may be a real threat to an insurer and, if so, may detract from its value. However, it does not affect fair pricing.

The fair price continues to be sufficient in expectation to service a reasonable capital base on a risk adjusted basis. If it failed to do so because it had been somehow squandered by management, shareholders would pay the price for the appointment of a poor executive. The fair price would remain unchanged.

In any event, the market will have factored its own perceptions of these risks into its pricing of an insurer's shares through its views of required insurer RoE in the presence of such risks. Hence, if one is able to derive market based betas, they will include allowance for agency costs.

## 8.3 Liabilities beta

The application of the fair pricing methods described in Section 3.1.4 requires knowledge of, or assumptions as to, the relevant betas, as defined in Section 3.1.3.

Asset betas may be obtained without great difficulty, equity betas with a little more difficulty, but liability betas have been elusive in the past. The PwC report gives some detail of this. However, a research work in progress by Cummins and Phillips (2004) provides some encouragement that reliable measurement might soon be achieved.

By (4.1), the three betas of any particular insurer are related. Knowledge of any two will determine the third. Cummins and Phillips attempt to estimate equity betas for insurers in different LoBs, and these, combined with asset betas, would lead to estimates of liability betas by LoB.

An earlier paper by Cummins and Lamm-Tennant (1994) listed estimates of equity betas, year by year, for various individual insurers. These were consistently clustered around unity, with the majority distributed over the interval (0.85,1.15).

The latest version of the Cummins-Phillips paper referred to above produces two alternative models of equity betas:

- Full information CAPM; and
- Full information Fama-French 3-factor model;

where the latter is a generalisation of the CAPM, its three factors recognising:

- Undiversifiable volatility (as in the CAPM);

- Size of insurer;
- The distinction between insurers as growth or value stocks.

This work is as yet incomplete, but appears promising.

## 8.4 Comparative advantage

As pointed out in Section 8.1, the theory of fair pricing implies that profit margins in premium would be nil except to the extent that dividend imputation were not fully efficient.

In this situation, an insurer whose operations mirrored precisely the assumptions made in the fair pricing models (expected claims costs, expenses, etc) could be seen as entering into a swap transaction with each policy underwritten. The transaction would swap an uncertain financial outcome (the future claims experience) for a certain amount (the premium).

Under fair pricing, the swap would be carried out on a pure financial basis, with no profit loading awarded to either party to the transaction. This would provided the insurer with an adequate return on the capital base established to support such transactions.

It is evident that the insurer could establish a profit margin by achieving efficiencies relative to the benchmarks set in the pricing models, e.g. if it can sustain an expense rate lower than benchmark. This appears consistent with the behaviour of firms in other competitive industries, which seek to achieve profit by establishing some form of comparative advantage over their competitors.

A corollary of this line of reasoning in a rate filing environment is that whether a set of filed insurance premium rates is too high or too low should be assessed against benchmark assumptions, common to all insurers, rather than against the particular insurer's own historical experience.

Application of this principle in the context of NSW CTP would necessitate a change to the current MAA Premium Determination Guidelines.

## 8.5 Future research

Application of fair pricing theory to a rate filing regime requires some procedure for determining:

- A reasonable capital base for an insurer with given mix of LoBs;
- A reasonable allocation of total capital base by LoB;
- Liability betas by LoB.

The Cummins-Phillips research mentioned in Section 8.3 may deal satisfactorily with the final area. Further research in the first two may be justified.