

CMI Working Papers 52 and 58 A more detailed diagnosis?

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Introduction and Background

The Continuous Mortality Investigation (CMI) has recently published Working Papers 52 and 58. These Papers represent a third phase in the activity of the CMI Critical Illness Committee.

The first phase looked at data and a methodology with which to analyse the claims experience on. This was covered in a number of Working Papers and focused on the issue of delays between diagnosis and settlement. The second phase looked at generating a table of diagnosis rates for accelerated Critical Illness (CI) business and resulted in Working Papers 43 and 50 (with summaries provided by SCOR).

This third phase looks to extend the scope of the analysis beyond the 'plain vanilla' high level results to an additional level of granularity that is likely to be of great interest to practitioners including analysis by sum assured, distribution, office, underwriting year and individual cause of claim. In addition results are shown for stand-alone CI business.

This summary of the key content of Working Papers has been produced by Jamie Leitch, Head of Pricing at SCOR Global Life UK and a member of the CMI Critical Illness Committee. The content of this note are the views and responsibility of SCOR alone.

The full detail of the work is included in the Working Papers and we would encourage you to read them as well as our summary. We acknowledge the considerable effort from the CMI in producing these Working Papers (summarising them is the easy part!) and thank them for their continuing hard work.

Working Paper 52 – cause specific diagnosis rates

Working Paper 43 included some sample diagnosis rates for 6 individual claim conditions for male non-smokers. The conditions were cancer, death, heart attack, stroke, coronary artery bypass graft (CABG) and total and permanent disability (TPD). This covered data using settled claims from the period 1999-2004. No information was provided for other sex/smoker cohorts.

The provision of these rates (as well as spreadsheets showing their derivation) provided interesting insight as well as supporting the derived 'all-cause' diagnosis rates (WP43 rates). The derivation of the rates used a similar methodology to the

'all-cause', however they were subject to a couple of constraints/differences:

- ▶ significantly lower claim volumes
- ▶ imposition of the same select shape for individual causes as the WP43 rates
- ▶ application of a cause specific delay pattern to 'translate' date of claim settlement to date of diagnosis.

Working Paper 52 reproduces the previous analysis using more recent data (2003-2006) and the select shape within Working Paper 50 'all cause' diagnosis rates (the AC04 series) but also extends the analysis to the other sex/smoker groups. The individual causes of claims for which rates are produced are summarised in the table below, along with details of the number of claims in each category:

Claim condition	Male non-smoker	Male smoker	Female non-smoker	Female smoker
Cancer	2,770	816	4,506	962
CABG	249			
Death	1,745	823	667	346
Heart attack	964	795		
Multiple sclerosis			412	
Stroke	390		237	
TPD	199			

Source of claim numbers: Table 2.2 Working Paper 52

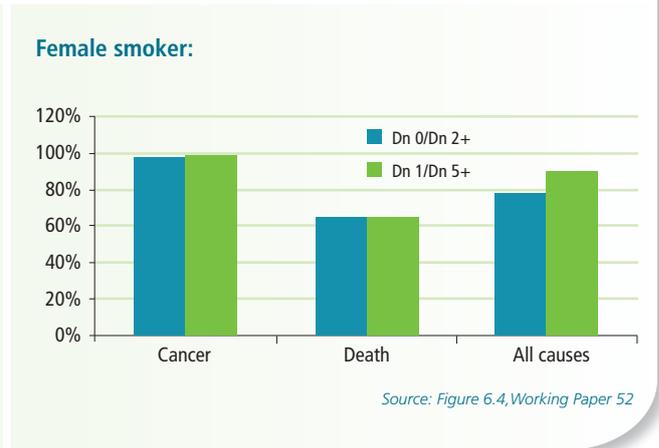
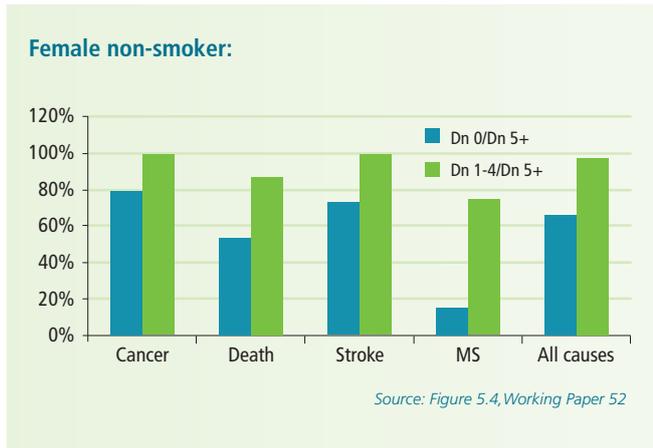
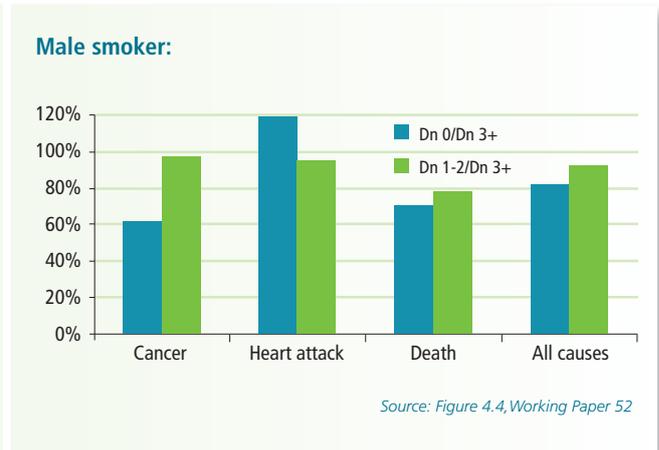
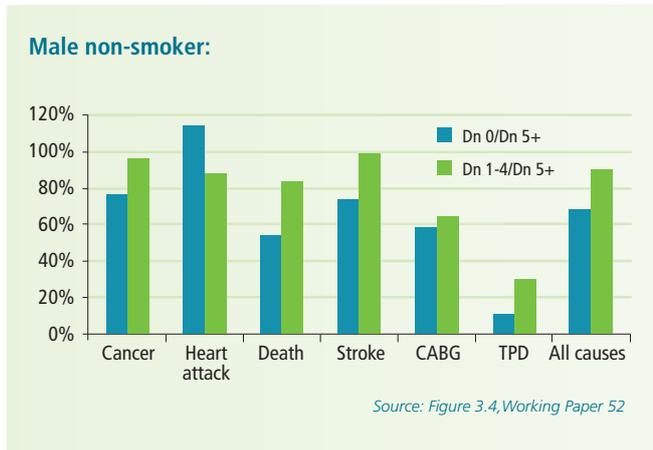
Interesting features within Working Paper 52

Select shape

Clearly the large number of rate tables being produced and the limited volume to derive each meant that some simplification was required/justified. One constraint within the cause specific rates is that the selection shape was set to be consistent with the AC04 rates. As a reminder this led to the following shapes for all conditions:

Male non-smoker:	Durations 0, 1-4 (combined), 5+
Male smoker:	Durations 0, 1-2 (combined), 3+
Female non-smoker:	Durations 0, 1-4 (combined), 5+
Female smoker:	Durations 0, 1, 2+

The levels of selection discounts derived are summarised in the graphs below:



In previous Papers, we have highlighted that the select pattern does not feel intuitive. If we assume that the select pattern is caused solely by an underwriting impact then it feels odd that there is not a smoother durational pattern. For example it is difficult to understand why claims experience would be at the same level for policy years 2 to 5 before increasing for later durations.

There are a number of factors other than underwriting influencing the select pattern from a given data set, for example:

- ▶ impacts by underwriting year: by using claims settled in 2003-2006 it is very unlikely that the claims at duration 0 and those in duration 5+ come from the same new business tranche
- ▶ impacts of changing mix of offices as either market

share or volume of data submitted to the CMI also changes with time.

Working Paper 58 provides additional insight into these effects and will be picked up later in this Paper.

The use of the same selection pattern does produce some 'odd' results when the analysis is considered at this more granular level. This is most obviously demonstrated when looking at female non-smoker multiple sclerosis rates where there is significant evidence of a gradual select effect rather than the pattern that has been imposed (0,1-4 and 5+). It should be noted however that this is based on only 412 claims in total.

FNS multiple sclerosis A/E (E is based on FNS MS specific, ultimate rates) :

	Duration 0	Duration 1	Duration 2	Duration 3	Duration 4	Duration 5+
A/E result	16%	57%	61%	87%	93%	102%

Source: Derived approximately from Tables D11 and D12, Working Paper 52

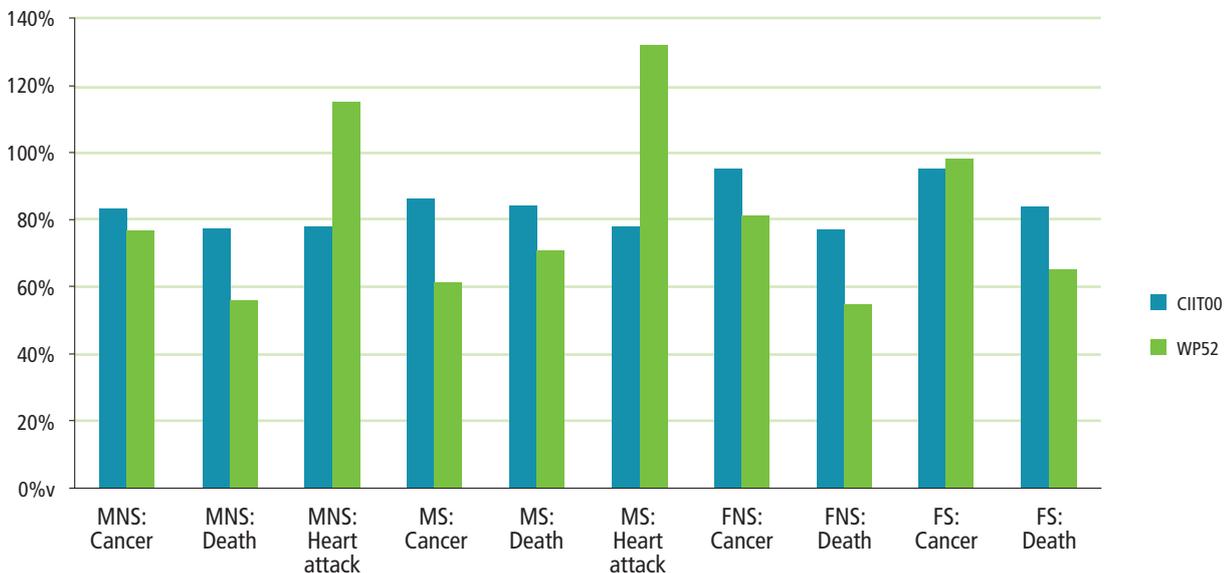
The significant selection discount on multiple sclerosis should be no surprise given that the standard definition requires symptoms that have persisted for a period of at least 6 months - a year 1 claim would therefore require onset of symptoms within 6 months of underwriting.

We do not point out the issue around the select shape as a criticism of the work as the limited number of claims for some conditions makes any analysis of the select effect difficult and

the time/effort involved in a more thorough piece of work would be hard to justify. Instead we believe that it is important to highlight that an actuary should exercise care and judgement in the use of these tables.

It is interesting to compare the selection discounts for a few key claims causes within the CMI rates to those in CIIT00 which is the only other publicly available table that has been derived including selection within the UK. This is shown below:

Dur 0 / Ultimate: CIIT00 v WP52



Heart attack anti-selection?

In Working Paper 43 it was highlighted that the male-smoker 'all cause' rates (WP43 rates) at duration 0 were higher than

those at duration 1. Both Working Paper 43 and our summary paper discussed the possibility of anti-selection. We noted that the possibility of anti-selection appeared to be linked to cardiovascular risks.

Our summary of Working Paper 50 showed that the use of more recent data diminished this feature and that the AC04 tables contained a more standard selection pattern with rates that didn't decrease with duration.

The release of Working Paper 58 provides further insight and interestingly it shows a higher claim rate at duration 0 than duration 1 for 'cause specific' heart attack rates for both male smokers and male non-smokers. This once again hints at the possibility of cardiovascular anti-selection.

This is an area that SCOR continues to monitor as, although we can postulate arguments to support anti-selection, our overall view is that it is difficult to understand this feature. We believe that it is likely to be a combination of some limited anti-selection, volatility around claim numbers and other factors. Underwriting has improved since the period underlying the CMI data set, particularly with regard to combination risks (ie minor disclosures by an individual of a number of risk factors eg BMI and alcohol use) that would impact cardiovascular risks and it will be interesting in future CMI investigations to see whether this feature continues.

Working Paper 58 – supplementary analysis

Working Paper 58 consists of three main sections which significantly add to the understanding of the 2003-2006 CI experience.

The first section looks at some of the sensitivities around the assumptions that have been made in deriving the AC04 rate series. The primary sensitivity that is highlighted is the claims development distribution (CDD) ie the progression of a claim from diagnosis to settlement.

This analysis shows that the overall impact of different assumptions is reasonably limited. However, the impact of the CDD is more significant upon the duration 0 claims experience which, under the scenarios tested, varied by upto 7%. Perhaps the CDD for heart attacks plays some part in the duration 0 experience highlighted earlier?

The first section also demonstrates an approximate measure of confidence intervals. The analysis can only be approximate as the AC04 rates have not been derived from a standard statistical model but rather in using a more pragmatic approach. The approximate intervals are measured as:

$$\text{Crude } A/E \pm 1.96 \frac{\sqrt{A}}{E}$$

Unsurprisingly this measure indicates more credibility where data (in particular expected claims) is greatest. It is however, interesting to note that this results in the smallest confidence interval at age 41, duration 1-4, for female non-smokers and shows that the choice of select pattern impacts this assessment of confidence – were this data not grouped the confidence interval would be significantly wider. An actuary using these confidence intervals should, as with other aspects of this work, exercise care in doing so.

The second section of the Paper produces more insight into the experience by breaking the results down by:

- ▶ product type
- ▶ sum assured bands
- ▶ sales channel
- ▶ period of commencement
- ▶ office

We believe that this more granular level of analysis is a very welcome addition and a significant step forward with regards to the work of the CMI. Some of the more interesting features of the results are outlined below.

The third section of the Paper shows some results for stand-alone Critical Illness. Working Papers produced to date have focussed on the accelerated critical illness business as the volumes are significantly higher, however it is a welcome addition to the work to see an indication of the experience emerging from stand-alone business on a basis that is consistent with the AC04 diagnosis rates series.

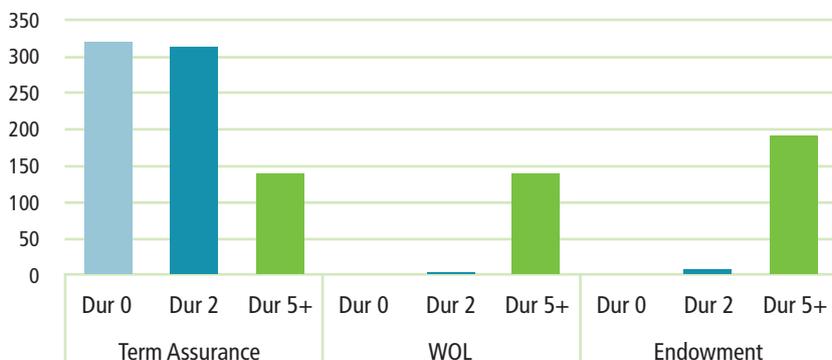
Interesting features within Working Paper 58

Experience by product type

The Paper outlines the changing mix of CI products sold with time. The earliest Critical Illness sales (in the 1990's) were dominated by whole of life (WOL) and endowment products, while pure protection became the more dominant product around the turn of the century. The exposure within the 2003-2006 period for endowments and WOL product is therefore heavily weighted towards the ultimate durations.

Overall the select rates within the AC04 series are driven by term assurance products while the ultimate rates are a much more balanced product split. The graph below provides some indication of relative exposure weights by considering the durational exposure at ages 40-44 for different products.

Exposure (in thousands) by product, ages 40-44



Source: derived from Figs. 3.1-3.3, Working Paper 58

The overall experience by product is outlined in the table below and shows consistency between term assurances and endowment assurance with higher experience on WOL products.

Product type	A/E result
Decreasing Term Assurance	103%
Level Term Assurance	103%
Unclassified Term Assurance	90%
All Term Assurance	99%
Endowment	97%
Whole of Life	112%

Source: Table 3.1, Working Paper 58

It is also interesting to note that experience is consistent between level and decreasing term assurances despite the possible different causes of sale – family protection and mortgage.

Experience by sum assured

The analysis was split into three bands (providing broadly equal splits of the business) and the results are summarised in the table following:

Product type	A/E result
0-40k	96%
40-80k	104%
>80k	102%

Source: Table 3.4, Working Paper 58

These results suggest that, unlike mortality business where there appears to be a strong correlation between sum assured level and claims experience (with better experience at higher sum assured levels), this is not the case with accelerated CI business.

It is interesting that £80k represents the upper 30% of the exposure as this feels low with regards to a current day distribution. One of the main reasons behind this is likely to be the significant sum assured inflation over time. It would be interesting if the CMI could look at more recent experience at higher sums assured particularly given the possible anti-selection effects covered earlier in this paper – it is possible that an anti-selective applicant would select a higher sum assured in order to maximise their payout.

Experience by sales channel

Within mortality business distribution has often been considered when thinking about pricing and experience as both a proxy for socio-economic mix of the underlying client but also because of possible differences in underwriting

practices at the point of sale. As a result of this it is often considered for mortality that IFA business is 'better quality'.

The CI experience has been split between three broad categories: Bancassurer, IFA and Direct Sales. Within these broad headings there are likely to be different sales models eg direct sales could include door to door salesmen, telephony teams as well as internet sales.

These results show that CI business demonstrates a similar pattern to mortality business with better experience emerging from IFA distribution.

Product type	A/E result
Bancassurer	104%
IFA	97%
Direct Sales	104%

Source: Table 3.5, Working Paper 58

Experience by year of underwriting

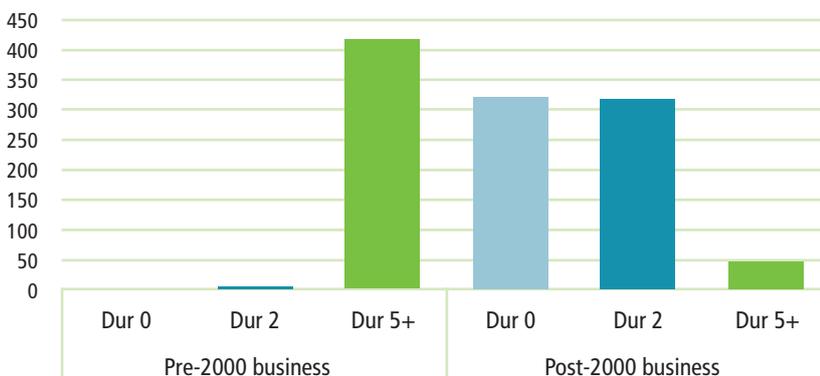
An analysis by year of underwriting was undertaken in order to determine whether the experience would vary significantly depending on new business date given the changes in underwriting over time as a result of market pressures or better understanding of risk.

The data was split into business written pre and post 1st January 2000. Because of the period of investigation (2003-2006) the earlier business naturally forms the bulk of the exposure at later durations, while the more recent business is skewed towards the shorter durations. The result is that the level of the AC04 series rates at later durations is largely driven by the experience of the pre-2000 business. The graph below provides some verification of this by comparing exposure for the age band 40-44 over the investigation period.

It is then not surprising that the analysis of actual claims experience against expected claims (derived from AC04) shows results that are reasonably close to 100%. A similar result was seen for the post-1999 policies as AC04 at earlier durations was largely derived from that business.

We believe that underwriting standards have changed significantly over the last 15 years with the most significant changes occurring around 2003/4 with a small improvement in experience as a result. Our analysis has shown that the proportion of rated cases increased significantly from a level of around 6% in the early 2000's to 11% in 2009. Hopefully in years to come the CMI will continue to produce this type of analysis and it might be easier to draw a conclusion as to the impact of these underwriting changes upon the CMI experience.

Exposure (in thousands) by year of commencement, ages 40-44



Source: derived from Figs. 3.19-3.20, Working Paper 58

Experience by office

Unsurprisingly there was a significant amount of variation between the results for the eight largest data contributing offices - their identity being kept anonymous. Results varied from an A/E result of 93% to 114%. This differential is likely to be driven by a number of factors including underwriting standards and distribution as well as volatility around claims numbers.

Multi-variate analysis

The analysis that has been undertaken at this more granular level provides useful results however the CMI CI Committee do acknowledge that there may be flaws in such analysis as a result of the possible correlation between the various different factors. For example, the results show that WOL experience is 13% worse than term assurance business and also shows that Bancassurance experience is 7% worse than IFA business. If the Bancassurers sold relatively more WOL business than the IFA then this could explain why the Bancassurer results are worse and could suggest that if the Bancassurer was to sell term business then the experience may not be different from the IFA selling term business.

The CMI have undertaken some initial generalised linear modelling (GLM) work to try and consider how the results differ when allowance is made through this multi-variate analysis for the different possible risk factors. The results from this work are interesting and not always consistent with the one-way analysis highlighted above. However, the Committee is clear to indicate that the results are indicative, may suffer from not having included product type and that conclusions

from the analysis should be regarded as tentative.

Although definitive answers haven't emerged from the analysis that has been conducted Working Paper 58 is a very positive step in the direction of providing a greater insight into the experience of accelerated CI business.

Experience of stand-alone Critical Illness business

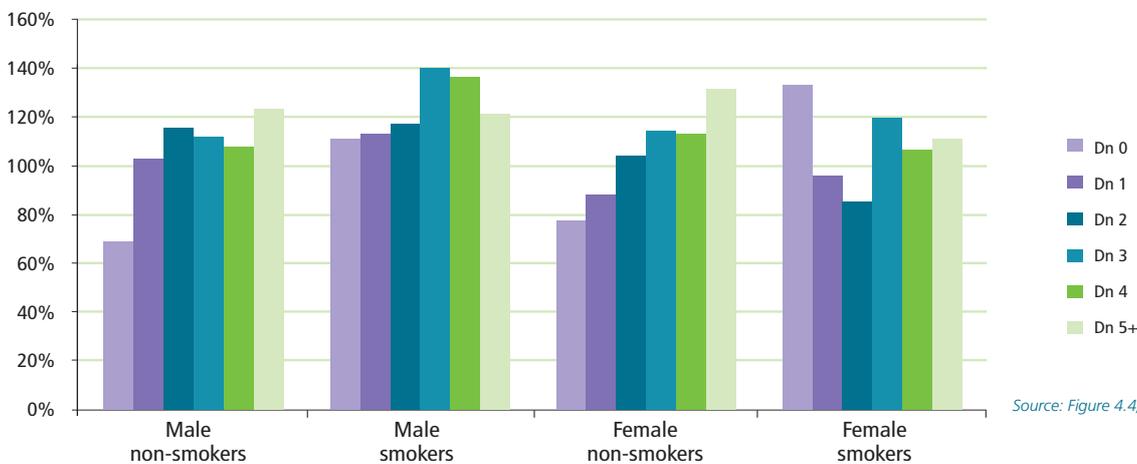
The stand-alone Critical Illness data that has been submitted to the CMI contains around 2,500 claims. It has not been considered appropriate to derive diagnosis rates based on this data. However, Working Paper 58 has generated some diagnosis rates (ultimate duration only) by considering the accelerated CI diagnosis rates less the 'cause specific' death rates.

Note that the 'cause specific' death rates should only include deaths that would not have been a valid earlier CI claim, and as a result this should form a reasonable expected basis from which experience analysis can be conducted. These rates are not intended as a 'standard' table. The A/E results against this are shown in the table below:

Cohort	A/E result
Male non-smoker	112%
Male smoker	123%
Female non-smoker	112%
Female smoker	107%
Total	113%

Results are also produced by duration and are shown below:

A/E results for stand-alone CI business



Source: Figure 4.4, Working Paper 58

A couple of features are worth highlighting:

- ▶ The experience emerging for stand-alone business is significantly higher than might be expected – given that we believe that the expected basis is a reasonable proxy for the ultimate experience we would expect to see results below the 100% level after allowing for a select effect. There is no obvious explanation for this feature. It has been suggested that stand-alone CI policies may be more commonly associated with anti-selection however we believe that the difference is more likely to relate to the source of the business with the volatility of results by sales channel, product and office, shown earlier in this Paper, indicating that this is plausible.
- ▶ Although the claim numbers are fairly small when broken down by duration it is worth noting that a clear selection discount does seem to exist for the non-smokers which are the largest subsets. This supports the theory that the high stand-alone results are not the result of anti-selection where we would expect to see worse claims experience in the earlier years. It also provides another piece of the jigsaw in considering the possible anti-selection in the accelerated CI business.

Conclusions

We welcome the additional analysis that has been undertaken by the CMI CI Committee and feel that it provides valuable insight into the claims experience that is emerging but also into the derivation of the AC04 rates series.

The difference in results between the multi-variate analysis and the single factor analysis provides a lot of food for thought in considering the ways in which actuaries analyse the data and the possibility of misinterpretation – often we focus on the underlying risk and miss the risk inherent in our own analysis.

SCOR would be happy to discuss and share views on any issues raised within the working papers, this summary or any additional questions that follow on.

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