Pricing the ACC Employer and Self-Employed Accounts - 2002

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Introduction

This paper summarises the philosophy and process for setting various levy rates for the ACC employer and self-employed accounts for the 2003/04 financial year. The majority of the work for this process was carried out between May and October 2002 by a combination of our in-house actuarial staff and our external actuarial consultants.

The following "products" have to be priced:

1. Standard Employer work cover for exposure in 2003/04

2. Partnership Programme employer work cover for exposure in 2003/04, including Full Self Cover ("FSC"), Partnership Discount Plans ("PDP") and associated covers (stop loss and high cost claim cover ("HCCC"))

3. Workplace Safety Management ("WSMP") discounts for all employers

4. Standard self-employed work cover for exposure in 2003/04 ("CoverPlus")

5. Self-employed CoverPlus Extra ("CPX") for exposure in 2003/04

6. Residual Claims Levy (for pre-July 1999 work accidents and pre-April 1992 non-work accidents that are still outstanding and not fully funded) for all employers and self-employed.

7. Other accounts (not included in this paper) - Earners (non-work injuries for workers), Motor Vehicle, Medical Misadventure and the Non-Earners (injuries for non-workers - children, students, unemployed and retired).

Pricing Philosophy

ACC is New Zealand's nationalised monopoly provider of accident insurance for the workplace. ACC is a non-profit, non-tax-paying Crown entity providing compulsory accident cover for every employed and self-employed person in New Zealand. ACC also provides accident insurance in virtually every other circumstance ("everywhere for everyone").

As a result of these conditions our pricing philosophy is largely of the “cost-plus” variety. We have 100% market share and no competitive considerations to make in respect of any market segments. As such we aim to set prices to cover just the cost of claims and expenses in any market segment.

Make no mistake, accident insurance is not easy to price. The claims experience in any given market segment is highly volatile over time and with so many drivers of claims experience it is not easy to decide on an appropriate price level for any market segment.

ACC has developed certain pricing principles and associated rules that are aimed at addressing the conflicting forces of

- avoiding cross-subsidisation between market segments
- achieving statistical credibility of claims experience within market segments
- improving levy stability for each market segment
- achieving financial adequacy for each account

These principles are set out in full in the Levy Consultation Documents for both employers and self-employeds. The more pertinent of these will be highlighted throughout this paper.

ACC has also developed a pricing methodology that is intended to be robust, defensible and produce sensible results. An outline of this method forms part of this paper.

Relationship between pricing and the annual Valuation of liabilities

There is a direct relationship between the annual Valuation of ACC's outstanding claims liability and the level of prices set for all accounts, and in particular the employer and self-employed accounts.

The Valuation process develops assumptions about the claim payment run-off patterns in development time after an accident, for each type of claim. These are called the "Payments Per Claim Incurred" or PPCI's.

By applying inflationary factors to the Valuation PPCI's (to allow for the fact that the year of exposure we are pricing is, on average, 18 months ahead of the Valuation date) we get suitable claim run-off patterns for each of the types of claim *at the aggregate account level.* Different inflationary factors are applied to each type of PPCI because different inflationary factors impact on the different claim payment types.

ACC considers 3 main classes of claim payment type:

1. Medical-only claims – these are claims where the only payments made are for basic medical treatment (e.g. GP visits, physiotherapy, osteopathic and chiropractic treatment and assessments for other benefits, ambulance only). The payments are generally "small" amounts to any given individual but in aggregate are significant.

2. Entitlement claims – these are claims that involve payments for anything other than just medical-only payments. Typically this includes surgery, weekly compensation (fatal or non-fatal) and/or other rehabilitation claim payments.

3. Social Rehabilitation claims – these are a subset of entitlement claims where the benefit is for things like home help, attendant care or modifications to the claimant's home (e.g. wheelchair ramps.

Historic PPCI's are effectively calculated as follows:

1. Arrange the total annual payments made for a particular claim type into an "accident-year/development-year" claim triangle (an "upper" triangle). These are adjusted for past (wage) inflation to be in "current" dollars.

2. Divide each of the total annual payments for each accident-year by the corresponding number of incurred claims of that payment type for that accident-year. This gives the historic Payments Per Claim Incurred (PPCI's)

From studying the average levels and any trends in these historic PPCI's (both across and down the claim triangle) assumptions about the PPCI's in the lower half of the triangle can be developed.

The Pricing Process – a marriage of "Top-Down" and "Bottom-Up"

Top Down

The pricing process begins at the aggregate account level (one for each of the employer and self-employed accounts). That is, an overall average levy rate is developed. Hence "Top-Down".

This average rate includes allowance for

- claim costs
- expenses (administration, injury prevention initiatives, claims management, and bulk-billed costs)
- prudential margin (reserves adjustment).
- bad debt loading

and the Workplace Safety Management ("WSMP") loading.

Claim Costs (the "risk" levy)

Starting with the PPCI run-off patterns (as discussed above) for each claim type we first develop suitable numbers of claims incurred to combine with the PPCIs:

The number of claims incurred is "exposure × claim frequency".

The exposure measure we use for pricing the employed and self-employed accounts is liable earnings. Consequently our levy rates are expressed as percentages of liable earnings (per $100 liable earnings). Liable earnings is the annual income for each individual subject to a cap (currently around $87,000).

ACC uses earnings as the measure of exposure rather than numbers of workers because it is far more easily verified (via tax returns) and allows for the effects of full or part time work. Total liable earnings for the year being priced are projected

by applying wage inflation and population growth factors to current levels of earnings.

By carrying out chain ladder analyses of claim numbers (by claim type) we obtain estimates for total claim numbers incurred (for each claim type) for each past accident year. These are divided by the corresponding earnings for those years to give incurred claim frequencies (claims per unit earnings).

By examining trends in these historic claim frequencies and by giving consideration to other factors influencing the direction of the claim frequency time series in the future, an assumption about the claim frequency (for each type of claim) is made for the pricing year. The “other factors” influencing claim frequency include things like injury prevention initiatives, changes in benefits and the general state of the economy.

By combining these assumed frequencies with the projected earnings we obtain the assumed number of incurred claims for each claim type.

These claim numbers can be found in the Consultation Document.

Having established an assumed number of incurred claims for each claim type, we then combine these with their corresponding PPCI's to give the expected total claim payment cashflows in each future year, for accidents occurring in the pricing year. These cashflows run off over around 35 years. That is, we assume it takes around 35 years to make the last payments in respect of accidents occurring in the pricing year.

For seriously injured claimants, the cashflows can extend over a much longer period. However, these cashflows are generally "truncated" at 35 years by including a "bullet" cashflow in the claim payment stream at the 35 year mark.

These cashflows are discounted back to the present to allow for the investment earnings on the levies (premium) received (and invested) near the start of the pricing year.

This gives the discounted cost of the expected future claim payments from the entire account.

Dividing this quantity by the earnings base gives the pure (“fully funded”) risk levy rate for the account.

Note that, for the employer account, we exclude those large employers who are in our Partnership Programme (a risk-sharing programme – discussed below).

Expenses

ACC spends money on injury prevention and claims management, collecting levies and incurs all the usual expenses an insurance operation would (administration, staff salaries, building leases, maintaining and updating computer information systems etc).

These costs are allocated to the various accounts using an Activity Based Costing (ABC) model. The ACC Finance department built this model and uses it to generate the expense assumptions for the pricing.

The total expenses for the entire ACC Scheme in the pricing year are allocated across the accounts to be consistent with ACC's operational budgets.

Dividing the total expenses by the earnings base gives the expense rate component of the total levy rate for the account.

Prudential Margin – The "Reserves Adjustment"

ACC has a reserves policy which states that any liabilities arising out of accident cover are deemed to be "fully funded" when the assets held are 115% of the value of the corresponding liabilities. The reserves policy also states that any over or under funding relative to this 115% target will be achieved over a 3 year period (5 years in extreme circumstances).

The prudential margin is simply a buffer against adverse claims and/or investment experience. As stated above, the claims experience from year to year is highly volatile, even at the account level, and so a prudential margin is a necessary component of the levy rate to be more confident of achieving full funding.

To build the prudential margin a "reserves adjustment" is included in the aggregate average levy rate for the account. It is actuarially convenient to think of there being a "reserves adjustment rate" whose purpose is to provide for the 15% margin.

The reserves adjustment rate is split into two components:

- a component in respect of all accident years prior to the one being priced (July 1999 – March 2003)

- a component for the new year (April 2003 – March 2004)

PAST YEARS COMPONENT

For all accidents occurring before the start of the pricing year we need to examine the funding position of the account the day before the start of the new pricing year. That is, for the 2003/04 pricing year, we need to look at the funding position of the account as at 31 March 2003.

The pricing is done during the 2002 calendar year so we do not have the actual fund balance and outstanding claims liability value as at 31 March 2003. However, we do have the fund balance and outstanding claims liability position as at 30 June 2002 and by using the appropriate claim run-off patterns and projected levy income, expenses and investment earnings we can project the position of the account as at 31 March 2003 (9 months ahead).

The reserves adjustment rate (expressed as a % of liable earnings) for the past accidents component is the additional amount we need to add to the new annual levy rate so that, when we project the fund position in respect of pre-2003/04

liabilities out to 31 March 2006, we have pre-2003/04 assets equal to 115% of pre-2003/04 liabilities.

It's a bit like a mortgage with a 3-year term. We aim to amortise the surplus/deficit relative to the 115% target over a 3-year time frame.

However, the reserves adjustment for past years is in a perpetual state of "re-sighting" on the 115% target:

For next year's pricing round, the assets and liabilities in respect of the 2003/04 year will fall back into the "Past Year" pot and we will re-sight on having 115% funding in respect of past accidents (July 1999 – March 2004) by March 2007.

This goes on indefinitely.

Note that depending on the projected fund position at the start of the new pricing year, the reserves adjustment rate for past accidents can be negative. This occurs if the account is over-funded in respect of past accidents. This was the case for the employer account for the 2003/04 pricing.

NEW YEARS COMPONENT

For the new year's accidents, we project the outstanding claims liability in respect of claims arising in the 2003/04 year out to March 2006. Our target fund balance for 2003/04 accidents is therefore 115% of this value. Consequently, we set the reserves adjustment rate for the new year to be that marginal increase to the new annual levy rate that will achieve this.

The reserve adjustment for the new year's component is always positive because, for a new accident year, we always start with $0 of assets and $0 of liabilities (i.e. there is no starting surplus).

Note that if the reserves adjustment for past years is sufficiently negative it can make the overall reserves adjustment negative. This was the case for the employer account for the 2003/04 pricing.

WORKED EXAMPLE

Here's some numbers to show how it all "hangs together":

All values shown are in $millions

Claim Run-Off Cashflows

Payment Year	Pre 2002/03 accident years	2002/03 accident year	2003/04 accident year
2002/03	69.447	66.916	0.000
2003/04	33.699	61.636	69.674
2004/05	25.696	26.533	64.711
2005/06	23.523	17.524	27.717
2006/07	23.251	16.047	18.241
2007/08	22.567	14.616	16.704
2008/09	21.407	14.245	15.230
2009/10	20.735	13.118	14.885
2010/11	20.446	12.576	13.719
2011/12	20.028	12.424	13.154
2012/13	19.261	12.216	13.005
2013/14	18.348	11.782	12.787
2014/15	17.404	11.275	12.340
2015/16	16.623	10.637	11.813
2016/17	15.679	10.165	11.141
2017/18	14.688	9.703	10.652
2018/19	13.849	8.948	10.171
2019/20	12.817	8.602	9.369
2020/21	12.022	7.835	9.013
2021/22	11.032	7.436	8.196
2022/23	10.211	6.832	7.779
2023/24	9.692	6.230	7.137
2024/25	9.255	5.874	6.495
2025/26	8.796	5.617	6.121
2026/27	8.369	5.327	5.855
2027/28	8.023	5.057	5.551
2028/29	7.787	4.801	5.268
2029/30	7.881	4.646	5.001
2030/31	11.804	12.414	4.843
2031/32	11.638	3.374	13.325
2032/33	1.276	7.609	3.476
2033/34	1.259	1.995	7.838
2034/35	1.241	0.000	2.056
2035/36	1.222	0.000	0.000
2036/37	8.248	0.000	0.000

Past Years Reserve Adjustment Calculation

Average Levy Rate[4]	0.835%
Res Adj Rate Past Years	-0.079%
Discount Rate	6.8%

Tim Spicer: Goal seek 31/03/2006 unfunded liability to zero by changing "Res Adj Rate Past Years"

Payment Year	Payment Year Liable Earnings[1]	Year Start Fund Balance	Year Start Outstanding Claims[2]	Year Start Unfunded Liability[3]	Levy Income[4]	2002/03 claims	pre-2002/03 claims	Expenses[5]	Net Cashflow[6]	Investment Income[7]
2002/03	40,819	429.195	314.415	67.617	340.674	66.916	69.447	58.843	145.467	36.062
2003/04	41,997	610.724	481.507	56.991	-33.028	61.636	33.699	0.000	-128.364	36.978
2004/05	43,265	519.337	410.800	46.918	-34.026	26.533	25.696	0.000	-86.255	32.189
2005/06	44,572	465.272	382.059	25.903	-35.053	17.524	23.523	0.000	-76.100	28.852
2006/07	45,918	418.024	363.499	0.000						

Notes

1. Projected out with wage inflation and population growth
2. Includes 5% claims handling expense
3. Fund Balance - 1.15 x Outstanding Claims Liability
4. Average 2002/03 rate (excluding WSM, including a 2.5% bad debt rate) applied to earnings; 2003/04 - 2005/06 shows the reserve adjustment
5. Budgeted expenses for 2002/03 year
6. Levy Income - Claims - Expenses
7. Employer levy received on average 5/12 of way through year and claims and expenses paid on average 1/2 way through year

New Years Reserve Adjustment Calculation

OCL as at 31 March 2006, incl 5% Claims Handling Expense ("A")	158.753
PV of "A" @ average time of levy receipt in 2003/04	133.941
PV of 15% prudentail margin @ time of levy receipt in 2003/04	20.091
Reserve Adjustment Rate (as % of 2003/04 liable earnings)	0.048%
Combined Reserve Adjustment Rate	-0.031%

<- These anomalous looking cashflows are serious injury "bullet" payments (equivalent to the run-off)

The above is for the employers account only. A similar calculation is carried out for the self-employed account.

Bad Debt Loading

ACC's Finance department determines the percentage of historically invoiced levy that is ultimately never received by ACC. From this we determine an appropriate bad debt loading for the new pricing year.

Final Average Fully Funded Rates

The final average fully funded rates for the employed and self-employed are set out in the following table (all figures are % of liable earnings):

Levy Component	Employer	Self-Employed
Risk-only levy rate (excluding bulk billed costs)	0.67%	1.19%
Bulk-billed costs (ambulance, pharmaceuticals etc)	0.04%	0.08%
Expenses	0.11%	0.23%
Reserve Adjustment	-0.03%	0.10%
Bad Debt Loading	0.03%	0.12%
Workplace Safety Management Loading	0.05%	0.00%
TOTAL Levy Rate*	0.86%	1.72%

*Total may be different to sum of values shown due to rounding.

These are now the target overall rates for any set of levies by risk group.

Bottom Up

An outline of the Bottom-Up process is as follows:

1. Calculate the lifetime cost of claim payments for every work related claim ACC has had since 1 April 1992 (even though we will largely ignore accident years prior to 1 April 1996 on relevancy grounds)

2. Calibrate the results to be consistent with the annual liability Valuations for the employer and self-employed accounts

3. Allocate the claims (by cost and number) to their correct industry classification unit ("CU").

4. Determine the earnings for each combination of account (EM/SE), accident year (1992/93 – 2001/02) and classification unit ("CU").

5. Calculate the lifetime claims to earnings ratio (lifetime claims/earnings) for each combination of account, accident year and CU and combine the CUs into credible sized risk groups for levy rating based on their industry type and their claims/earnings ratio history

6. Set the levy rates for the resulting risk groups for the 2003/04 year so that

    - Each levy rate reflects a central estimate of the projected lifetime claims/earnings ratio for the risk group for 2003/04

    - The liable earnings weighted average levy rate across each account for the 2003/04 year equals the aggregate fully funded rates developed during the "top-down" part of the process (above).

7. Develop a set of "pure" income and non-income benefit rates for the self-employed.

8. Develop a set of Workplace Safety Management ("WSMP") loadings for the employer rates.

9. Apply the appropriate "commercial" over-rides to the rates to allow for invoice minimums and caps on rate increases over the 2002/03 rates

Step 1 – Calculating the lifetime cost of claims

For each claim incurred since 1 April 1992, the total incurred cost of claims, discounted to the start of the accident year (the "lifetime" cost), is estimated.

The lifetime claim cost is in two parts

- the sum of the claim payments made to date
- the estimate of the total of any outstanding claim payments

The first component is a known quantity. ACC keeps records of all claim payments made for accidents occurring after 1 April 1992 (and records of all claim payments made in respect of any claims that were open on or after 1 April 1992).

The second quantity is the estimate of the outstanding claim payments. Taken in aggregate these should equate to the annual outstanding claims liability Valuations for the employer and self-employed accounts, except for the fact that the Valuation discounts future payments to the Valuation date (31 March 2002) whereas for pricing we discount back to the start of the accident year.

ACC currently has two case estimate models for any claims that are outstanding as at 31 March 2002:

- A statistical case estimate model for non-serious injury cases
- A serious injury case estimate model

The statistical case estimate model is a survival model. A survival model is a type of GLM. The survival modelling process produces a "hazard function" (equivalent to the "force of recovery from injury") for different combinations of "rating factors" (e.g. duration on claim (i.e. "select" rates), age, sex, CU, injury site on body etc). By integrating along the hazard function, combined with a suitable claim payment intensity and discount rate, a case estimate (like an annuity) is produced.

In contrast to the non-serious injury cases, serious injury case estimates are not generated by a statistical process. Instead, seriously injured claimants are "profiled" (based on historical experience and the expertise of serious injury case managers). Having established the profile, the number and expected costs of treatments of various kinds, for that profile, are computed.

There are many more non-serious injuries than serious (as you might expect/hope) and so a more "algorithmic" process is required for estimating outstanding claim payments for non-serious cases. For the 2002 pricing of the employer and self-employed accounts there were more than 16,000 statistical case estimates calculated. In contrast there were only around 150 serious injury claims requiring case estimates.

The case estimate models calculate the discounted value of future claim payments for

- weekly compensation, medical, rehabilitation and independence allowance for serious injuries

- weekly compensation only for non-serious injuries

It is expected that the sum of all the case estimates, by accident year, account and payment type would agree reasonably well with the corresponding Valuation of outstanding claims liabilities.

Any difference (shortfall), *in theory*, should be accounted for by Incurred But Not Reported ("IBNR") claims and the possibility that some claims that are currently closed will re-open. It turns out that this theoretical shortfall is reflected very well by the actual data. In general, the sum of the case estimates does fall short of the outstanding claims liability by an amount that decreases as you look at older accident years. That is, the sum of case estimates is a greater percentage of the Valuation result for older accident-years. This makes sense because older accident years should be less affected by IBNR simply because these claims have had more time to be reported.

Step 2 – calibrating the lifetime costs to the Valuation results

The Valuation results include a summary that gives the lifetime cost of claims, discounted to the start of the accident year, by account, accident year and one of 5 payment types:

- death benefits (D)
- weekly compensation benefits (W)
- medical benefits (M)
- rehabilitation benefits (R)
- independence allowance (I)

The aim of the calibration process is to ensure that we allocate the outstanding cost of claims across all the classification units (CUs) in a fair and reasonable manner

and achieve consistency between the Valuation results ("top-down") and the individual claim details ("bottom-up").

To achieve this aim, we "gross up" each case estimate by a constant factor to ensure that, when we sum across all the grossed up case estimates in an account/accident-year/payment-type "cell", we get a total equal to the Valuation result (discounted to the start of the accident year) less the sum of payments made to date.

There is a separate gross up factor for each "cell".

As we don't have statistical case estimates for any benefit types other than weekly compensation, we create provisional estimates for the other payment types by assuming that, for each claim, the ratio

$$\frac{\text{sum of payments to date + case estimate of future payments}}{\text{sum of payments to date}}$$

for payment type W is the same for the M, R and I payment types. In the above ratio all quantities are discounted to the start of the accident year.

The serious injury model produces case estimates for all payment types except death (there are no serious injuries that are also deaths – deaths are obviously a bit too serious to be serious!!!).

Deaths are treated a little differently – we spread the total outstanding death claims liability for each accident-year between those death claims that are still active, pro-rata to the sum of death claim payments to date.

The constant factor applied to each case estimate in "cell j" (a particular combination of account/accident-year/payment-type) is therefore

$$\frac{\text{(Valuation result in cell j – sum of paid to date for all cases in cell j)}}{\text{sum of all case estimates in cell j}}$$

The effect of this grossing up or "calibration to Valuation" is to allocate the unforeseen claim costs (IBNR and re-opened claims) to the different cases and hence to the various CUs (when claims are eventually allocated to CUs). It also corrects for any inherent "roughness" in the provisional case estimates for "M", "R" and "I" case estimates.

The rationale for the whole calibration process is that the IBNR and re-opened claims (as captured by the difference between the Valuation results and the sum of the case estimates) will end up belonging to some CUs, and it seems reasonable to spread these latent costs pro-rata to existing reported costs.

Step 3 – allocating claims to classification units (CUs)

At the end of step 2 we have all the relevant claim information for employers/self-employed, accident years 1992/93 – 2001/02 and the 5 payment types, such that when we sum the paid to date and calibrated case estimates across any cell we reproduce the Valuation result.

The next stage is to link each case back to an industry classification unit.

Every work accident, in theory, must have come about from working for an employer, or as a self-employed person, under a particular industry classification unit.

However, when an accident is reported to ACC, the process of establishing the correct CU to allocate the claim to is not perfect. If the claim results in any payment type other than "M", then we should expect that the correct CU for the accident would be established. This doesn't always occur but it does most of the time.

If the claim is a "medical payment only" claim ("M" only) then it may well never receive a proper CU. The standard in this situation is to load the claim as CU 99999 (a dummy CU number) to activate payment as it is usually not cost effective to spend the time trying to establish the employer and the CU under which the claimant was working at the time of the accident.

In the claim file in our ACC database there is a CU for every work related claim. However, this has been shown to be an unreliable field.

We carry out a process to validate the CU attaching to a claim and, where possible, re-allocate the claim to a CU or CUs that makes more sense in relation to other data that we have.

To validate a CU we carry out the following process:

Reallocating CUs for pricing

Every claim should have a corresponding employer, CU and accident year.

The aim of this process is to ensure that this is indeed the case, and where it isn't, to reallocate the claim in a sensible way.

1. Match on Employer, CU and Accident Year ("EP")

If the claim details match perfectly and earnings are positive then no reallocation is required.

2. Tax-Group, CU and Accident Year ("TP")

This is where the employer has no earnings in the CU and accident year but their tax group does. A tax group is a group of companies under a parent "umbrella". ACC does not monitor tax group constituents any more but we do have the historical constituent employers for historical claims.

This is an almost perfect match - no reallocation required.

3. Employer and Accident Year, no match on CU ("EY")

This is where the employer has earnings in the accident year but not under the CU in the claim file. In this case, the claim is reallocated to the CUs the employer did have earnings under, pro-rata to earnings under those CUs.

4. Tax-Group and Accident Year, no match on CU ("TY")

This is where the employer has no earnings under any CU in the accident year but the tax group does (not the CU in the claim file or else it's "TP").

In this case, the claim is reallocated to the CUs the tax group did have earnings under, pro-rata to earnings under those CUs.

5. Employer, no match on CU or Accident Year ("E")

Find the nearest accident year in which the employer has had earnings.

Priority is -1, +1, -2, +2, . . . etc

Now we have a "new" accident year so check whether employer has earnings under the original CU in that new accident year. If so, claim is reallocated to that new accident year and CU. If no earnings under that CU then split claim pro-rata across the CUs in the new accident year.

Note that the "new" accident year was used just for the purpose of checking (and possibly reallocating) the CU the claim belongs to. The claim is NEVER reallocated to a new accident year as such. If it occurred in 1998 then it stays in the 1998 accident year experience, it's just that we would use the CU earnings from the nearest accident year for any reallocation.

6. Tax Group, no match on CU or Accident Year ("T")

Find the nearest accident year in which the tax group has had earnings.

Priority is -1, +1, -2, +2, . . . etc

Now we have a new accident year so check whether tax group has earnings under the original CU in that new accident year. If so, claim is reallocated to that new accident year and CU. If no earnings under that CU then split claim pro-rata across the CUs in the new accident year.

Similar comments to that in 5. apply here regarding 'new" accident years.

7. Employer/Tax Group has no earnings in any accident year ("N")

Claim stays where it is.

One of the unusual aspects of this reallocation process is that a single claim can be spread across more than one CU. If a claim is reallocated at any of stages 3 – 6 above then it is possible for there to be non-integer values for numbers of claims:

e.g. if the CU number in the claim file is 12345 but the claimant's employer declares earnings of $3m in CU 23456 and $7m in CU 34567 (in the accident year of the claim) then a $100,000 claim would be re-allocated so that CU 23456 gets 0.3 of a claim and $30,000 in claim costs while CU 34567 gets 0.7 of a claim and $70,000 in claim costs.

At the end of this step we have validly allocated the entire lifetime claims cost held by all claims since 1 April 1992 into the appropriate "account/accident-year/CU" cell. We also have a breakdown into the 5 payment types.

Step 4 – allocating earnings to CUs

In this step we match the total employer earnings in the "account/accident-year/CU" cell with the lifetime claims costs in the same cell - as developed in step 3.

At this stage we summarise the individual claims and earnings information into a "Pricing Master Data Set" which contains all the relevant information we need to do the pricing.

Step 5 - calculate the lifetime claims/earnings ratio

At this stage we need to calculate the claims/earnings ratio history (1996/97 – 2001/02) for each CU, for the employer and self-employed separately.

The claims/earnings ratio is obtained by dividing the total lifetime cost of claims in the account/accident-year/CU cell by its corresponding earnings. This gives the cost of claims per unit earnings and is the risk measure we use to drive the pricing.

In fact, since our final levy rates are expressed as a % of earnings, the claims/earnings ratio is effectively like the "risk premium" component of the total levy rate.

We also calculate a measure of uncertainty in the claims/earnings ratio. This will tend to understate the true standard error in the claims/earnings ratio because the case estimates for any particular combination of case estimate factors will be the same, rather than variable about a mean equal to the case estimate. However, it still helps to get a feel for how reliable the claims/earnings ratio is and how significantly different two claims/earnings ratios are from one another.

Grouping CUs for credibility

Many CUs have very sparse claims experience and therefore cannot stand on their own and provide a credible claims/earnings ratio from which we can develop a levy rate. Hence we look to group CUs in similar business activities together to form risk groups with a more credible claims experience base, where necessary.

It is at this stage that we developed a detailed hierarchical structure that shows how the entire employer and self-employed accounts are successively broken down into

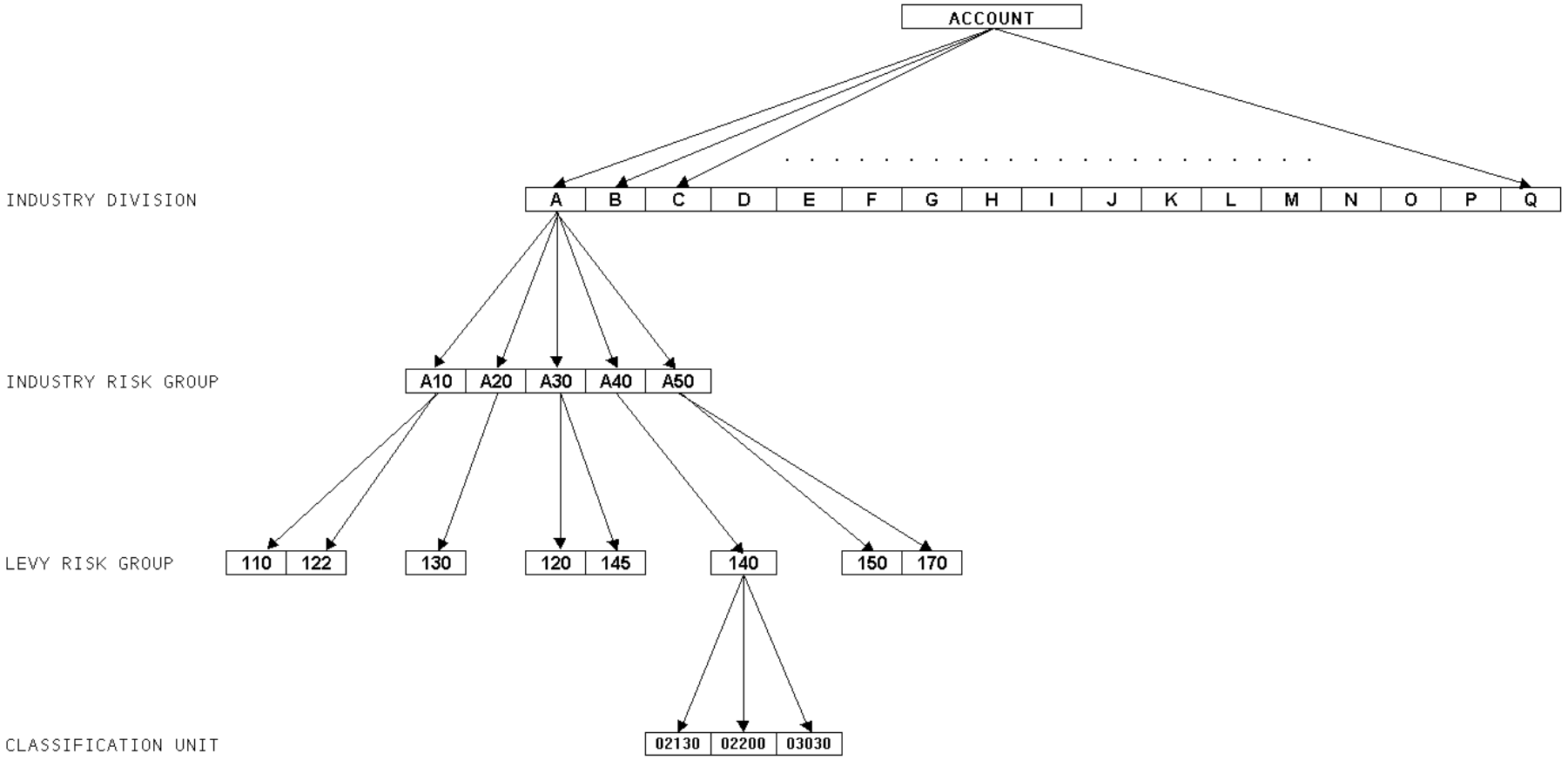
- 17 industry groups
- 55 industry based risk groups (one option for the level at which rating is done)
- 130 levy risk groups (the second option for the level at which rating is done)

- 550 (or so) CUs

There is a strict "one to many" relationship going down the hierarchy. That is, every CU is allocated to 1 of 17 industries and all LRGs and IRGs created thereafter will only consist of CUs from within that industry.

The following diagram provides an example of the entire classification hierarchy:

PRICING HIERARCHY
Based on ANZSIC



The hierarchical structure was established by starting with the 2002/03 levy risk group structure (130 risk groups).

Each of the 130 levy risk groups (LRGs) had the CUs in it examined to see if their claims/earnings ratio histories were statistically indiscernible from one another. In other words, by examining the claims/earnings ratio for each CU in a LRG (with confidence bounds set by reference to the claims/earnings ratio uncertainty measure) we determine if there is clear evidence of any outlier CUs within a LRG.

When a CU is deemed to be an outlier it is moved to an LRG within the same industry that has the closest claims/earnings ratio.

We used the combined experience of all workers (employed and self-employed) in a CU to determine the aggregations of CUs into into risk groups because

- we wanted the same risk groupings for all workers
- any differentiation between employers and self-employed can be achieved within the risk group if there is sufficient evidence of a difference in claims experience between the employed and self-employed.

At the end of this process, all CUs within each LRG should have claims/earnings ratios that are not significantly different from one another. The only possible exceptions are for very low (very high) claims/earnings ratio CUs who have no lower (higher) risk LRG to go to within that industry and are too small to warrant the establishment of a separate LRG.

It should be noted that, in the case of CUs with very low (high) claims/earnings ratios that are not large enough to stand alone, there is in fact insufficient evidence that these apparently extreme values are indicative of very low (high) risk, simply because the experience is not credible!

A similar process is used to put LRGs (as a whole unit) into IRGs.

Step 6 – setting the 2003/04 risk only levy rate (projected claims/earnings ratio)

The ultimate goal in this step is to set projected claims/earnings ratios (i.e. risk premiums) for 130 levy risk groups, such that the liable earnings weighted average claims/earnings ratio equals 0.71% for employers and 1.27% for self-employed (i.e. the claims cost rates calculated in the "top-down" process, including bulk-billed costs).

To help maintain control and discipline over the process of deciding on a projected claims/earnings ratio for each of 130 levy risk groups, I decided to set notional claims/earnings ratio targets for the 17 industry groups, then the 55 industry risk groups ("IRGs") and finally the 130 levy risk groups ("LRGs").

Naturally, the target claims/earnings ratio for an industry is a weighted average of the claims/earnings ratios of the IRGs/LRGs/CUs in the (heterogeneous) industry.

Setting the industry target claims/earnings ratios
At this stage we examine the historic claims/earnings ratio in each of the 17 (heterogeneous) industry groups and develop a set of representative projected claims/earnings ratios for each of employers and self-employed. The constraint placed over the 2 sets of 17 target claims/earnings ratios are that they re-generate the 0.71% and 1.27% values that are the risk only components of the employer and self-employed aggregate rate respectively, when weighted with the liable earnings mixes across industries.

Note that the historic claims/earnings ratios are exclusive of bulk-billed costs and do not include an upwards adjustment for superimposed inflation on the non-income related benefits (claim types M, R and I). Therefore, it should come as no surprise that the projected claims/earnings ratios will tend to be slightly higher than what you might project from the historic claims/earnings ratios alone.

Setting the IRG target claims/earnings ratio
Having set the target claims/earnings ratio in each of the 17 industry groups, it is then a matter of carrying out an identical process to establish a set of projected claims/earnings ratios at the IRG level. These are such that the liable earnings weighted average claims/earnings ratio across the IRGs in a given industry re-generates the projected industry claims/earnings ratio.

This step produces a set of 55 IRG projected claims/earnings ratios that when re-weighted with their projected liable earnings re-generate both the correct target industry claims/earnings ratios and the account projected claims/earnings ratios (0.71% for employers, 1.27% for self-employed).

Setting the LRG target claims/earnings ratio
This same process is repeated again down to the LRG giving 2 sets of 130 LRG projected claims/earnings ratios such that when recombined with the projected liable earnings gives

- the 55 target/projected IRG claims/earnings ratios
- the 17 target industry claims/earnings ratios
- the projected account claims/earnings ratio (0.71% for employers, 1.27% for self-employed)

Having developed projected claims/earnings ratios for each risk group by coming down the hierarchy it was then a matter of working back up the hierarchy using credibility weighting to ensure every final projected claims/earnings ratio selected was also grounded in a fully credible base.

Our criteria for full credibility was satisfaction of either of the following two criteria:

1. Expected number of entitlement claims per annum in the risk group must be at least 250.

2. Expected earnings in the risk group must be at least $400 million per annum

Any group not having full credibility had partial credibility in accordance with the credibility formula:

$$Z = MAX\{sqrt(N/250) , sqrt(E/400m)\}$$

where N is the number of entitlement claims expected in the risk group per annum and E is the expected annual earnings in the risk group.

For example, suppose that an LRG had a projected claims/earnings ratio of 1.20% as a result of working down the hierarchy. Suppose also that it had, on average, 90 entitlement claims per annum and earnings of $100 million.

Suppose the IRG just above it in the hierarchy is fully credible with claims/earnings ratio of 0.90%.

It is quickly shown that Z = MAX{60%, 50%} = 60% (i.e. the "raw" claims/earnings ratio is 60% credible) and therefore the credibility adjusted claims/earnings ratio projection is

$$(60\% \times 1.20\%) + (40\% \times 0.90\%) = 1.08\%$$

If the IRG claims/earnings ratio had not been fully credible we would have credibility weighted its value with the claims/earnings ratio at the industry level (and then with the account level value if necessary). In this way we guarantee that each projected claims/earnings ratio has been fully credibility adjusted.

There is one final adjustment after all credibility adjusting has been done to ensure that the credibility adjusted claims/earnings ratios still generate the correct account-wide claims/earnings ratio (0.71% and 1.27%). This is a small constant factor applied to the set of credibility adjusted claims/earnings ratios in each account.

Grossing up risk levy for expenses and reserve adjustment
At this point we can "gross up" the claims/earnings ratios by the implied loss ratios for employed and self-employed to give preliminary full funded "office" levy rates.

ACC does not currently have both risk-rated and non-risk-rated expense components to its levy rates. The reserve adjustment is fully risk-rated. Hence the simple gross up by implied account loss ratios.

The pricing models this year did allow us to take advantage of the fact that the ABC model of expenses could identify expenses that were risk related (e.g. injury prevention and claims management) and those that weren't (e.g. levy collection costs). However, the ACC Board did not wish to pursue this option for 2003/04.

The bottom line is that the fixed expense component of a low risk levy rate becomes quite large and would have resulted in some significant (and "commercially" unacceptable) changes in levy rates. Naturally it would have resulted in some small, but nonetheless welcome, reductions for the higher risk groups.

Step 7 – developing "pure" income and non-income rates for the self-employed

For the self-employed account we have separate income and non-income benefit rates. The rationale for this is that rehabilitation, independence allowance, non-income related death benefits (e.g. funeral grants) and medical benefits are independent of income level (in complete contrast to non-fatal weekly compensation and spouse/dependents death benefits) and so the non-income component for a risk group should not depend so heavily on income.

There is a small level of dependency in that any income less than $15,000 per annum is deemed to be representative of less than full-time work status and therefore implies a lower level of exposure to the risk of work accidents.

In fact, in every risk group, the non-income rate is applied to the lesser of actual income and $15,000 and the resulting non-income ("NI") levy is subject to a minimum of $32.

$$\text{NI Levy} = \text{MAX}\{\$32, \text{NI Rate} \times \text{MIN}(\text{Actual Earnings}, \$15{,}000)\}$$

Account Level Income/Non-income split

From the results of the aggregate ("top-down") pricing we have a view on the split of claims expenditure on income and non-income related benefits. For the 2003/04 year these results were (all figures in actual dollars):

Self-Employed claim cost split	
Weekly Compensation - Non Fatal	55,290,482
Weekly Compensation - Fatals	2,093,541
Lump Sum	2,590,510
Medical (Long Tail)	1,538,572
Medical (Short Tail)	8,175,407
Hospital Rehabilitation	8,331,843
Other Rehabilitation	2,412,004
Vocational Rehabilitation	2,757,592
Social Rehabilitation Serious Injury	1,234,916
Social Rehabilitation - Non Serious Injury	6,480,331
Sub-total	90,905,199
Bulk-billed hospital, pharmaceutical and ambulance	6,214,281
Total Claims Cost	$97,119,480
Income related benefits	57,384,024
Non-income related benefits	33,521,175
Bulk-billed	6,214,281
TOTAL	97,119,480

Transposing this table and splitting expenses pro-rata to claims costs we get the following results (in $millions):

		TOTAL	INCOME	NON-INCOME
Total fully funded premium ($m):				
	Total claims cost	97.119	57.384	39.735
	Expenses: risk	5.885	3.477	2.408
	Expenses: non-ris	11.846	6.999	4.847
	Reserve Adjustme	7.673	4.533	3.139
	Bad Debt Loading	8.830	5.217	3.613
	TOTAL	131.353	77.611	53.742
Total fully funded premium rate:				
	Risk premium rat	1.271%	0.751%	0.520%
	Expenses: risk	0.077%	0.045%	0.032%
	Expenses: non-ris	0.155%	0.092%	0.063%
	Reserve Adjustme	0.100%	0.059%	0.041%
	Bad Debt Loading	0.116%	0.068%	0.047%
	Total average pre:	1.719%	1.015%	0.703%
			59.086%	40.914%

This shows us that our target level of income benefit levy is 59.086% of the total self-employed levy. This is a constraint we will apply to the set of income benefit levy rates we generate.

Income/non-income split at the risk group level

In our pricing "master data set" we have a summary of the total income related ("W" and "D") and non-income related ("M", "R" and "I") incurred claim costs for each CU and hence each risk group (LRG or IRG level) for the self-employed (and employers).

The historic average level of income benefit incurred claim cost for the self-employed in a risk group, credibility weighted with the corresponding employer value, is expressed as a percentage of the total incurred claims cost in the risk group. These are the unadjusted income-related benefit percentages of total benefit expenditure.

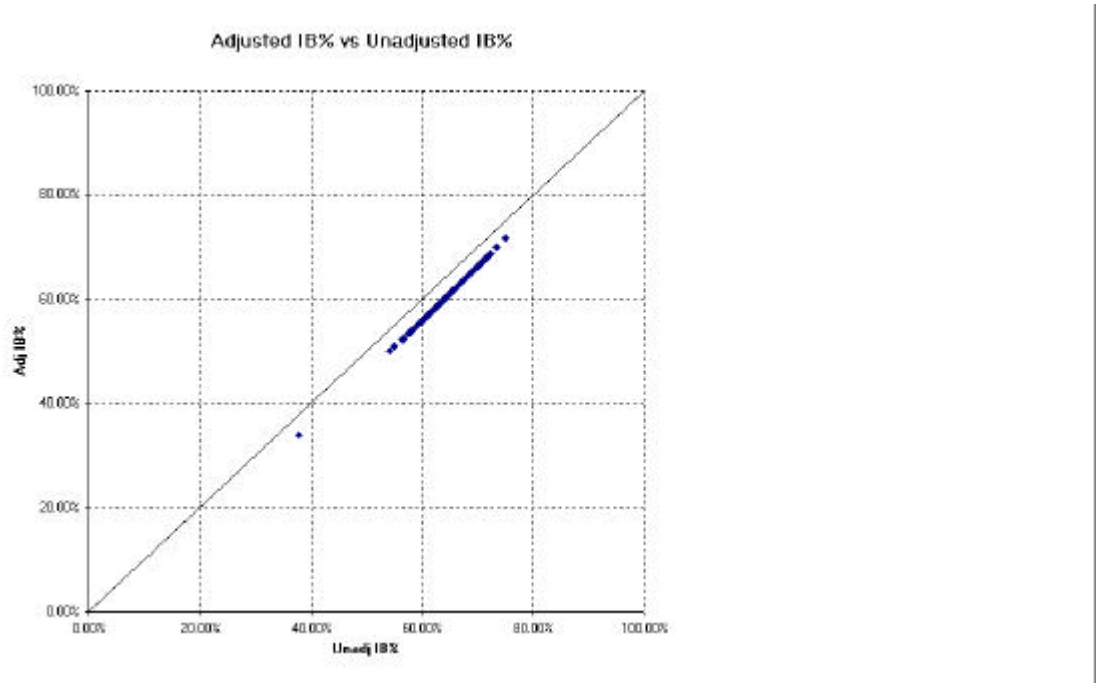
These figures are referred to as "unadjusted" because, in general, they do not give rise to exactly 59.086% of the total claims expenditure when combined with the projected self-employed liable earnings in each risk group.

To adjust these figures we sought a transformation "*g*" with the following properties:

1. $P_1 > P_2 \Rightarrow g(P_1) > g(P_2)$ - g preserves order in the unadjusted percentages
2. g(0%) = 0%
3. g(100%) = 100%
4. If we calculate the levy weighted average of the g(P) values across the risk groups we get exactly 59.086%

There are many possible candidates for g. We chose to use a semi-circle that met the above 4 criteria as well as being symmetrical about the line "y = 1 – x" where y is the adjusted percentage axis and x is the unadjusted percentage axis. Imposing this symmetry condition enabled us to express the centre (or equivalently the radius) of the circle in terms of one unknown and the unknown could be found by "goal seeking" so that the overall income benefit percentage was 59.086%.

In other words, the semi-circle puts a slight "bend" in the set of income benefit percentages (IB%).



The above graph shows that the transformation has moved the unadjusted percentages below the line "y = x". In other words, the unadjusted percentages generated too much income benefit levy.

Applying these adjusted percentages to the provisional fully funded rates developed at the end of the previous step gives us the "pure" income benefit levy rates.

The non-income levy rate

As stated above, the non-income levy (NI Levy) is calculated using

$$\text{NI Levy} = \text{MAX}\{\$32, \text{NI Rate} \times \text{MIN}(\text{Actual Earnings}, \$15{,}000)\}$$

This is clearly a non-linear function of the NI Rate, which makes finding the NI Rate a little trickier.

The method used is a simple "bisection" method:

Using the adjusted income benefit percentages for each risk group, we can easily determine the non-income benefit percentage (100% - IB%). Applying this percentage to the overall provisional fully funded levy rate (from the end of step 6, above) multiplied by risk group earnings gives the target dollars of non-income levy in the risk group.

To set the NI Rate for a risk group choose a starting value and apply it to each self-employed person's earnings in the risk group in accordance with the above NI Levy formula. If you get less (more) than the target dollars of non-income levy, double (halve) the starting value. Keep doubling or halving until you get a pair of values that "bracket" the desired level (that is, one value of NI Rate gives you less than the target dollars of non-income levy and twice that value gives you more).

Having bracketed the "root", you then bisect the interval repeatedly, keeping the half of the interval bracketing the root, until the interval is sufficiently narrow.

This is done for all risk groups (55 IRGs or 130 LRGs).

At this point we have the "pure" income and non-income rates (we call them the "A" rates). These rates generate the desired level of income and non-income levy dollars in each risk group and consequently across the entire account.

Step 8 – setting the Workplace Safety Management Practices (WSMP) loadings by risk group

ACC provides an incentive for employers to provide a safer working environment for their employees. The incentive is to provide 3 levels of discount:

- Primary (10% discount on standard levy)
- Secondary (15% discount on standard levy)
- Tertiary (20% discount on standard levy)

Naturally, a higher safety standard is required as you get more discount. To fund these WSMP discounts the standard rates must be loaded so that the total levy dollars collected from the risk group is preserved. In effect, the WSMP loading puts a "tilt" on the levy rates in the risk group and provides an incentive for employers to better manage accident risk compared to other employers in their risk group.

At first glance, an employer who dominates the group may feel that they are being duped because ACC appears to load up the rate before discounting it. However, such dominant employers are effectively rated entirely on their own experience and so the effect of loading and discounting does not change the levy they are, and should be, charged. No group should receive more discount than it can support.

Setting the WSMP loadings by risk group

The methodology used to set the WSMP loadings was to look at the distribution of earnings across the 4 discount levels (don't forget the 0% discount level) over time and estimate "transition probabilities" for movements between discount levels based on past movements.

By projecting these forward 2 years from the latest complete year we get an estimate of the distribution of earnings across the 4 discount levels in the 2003/04 year.

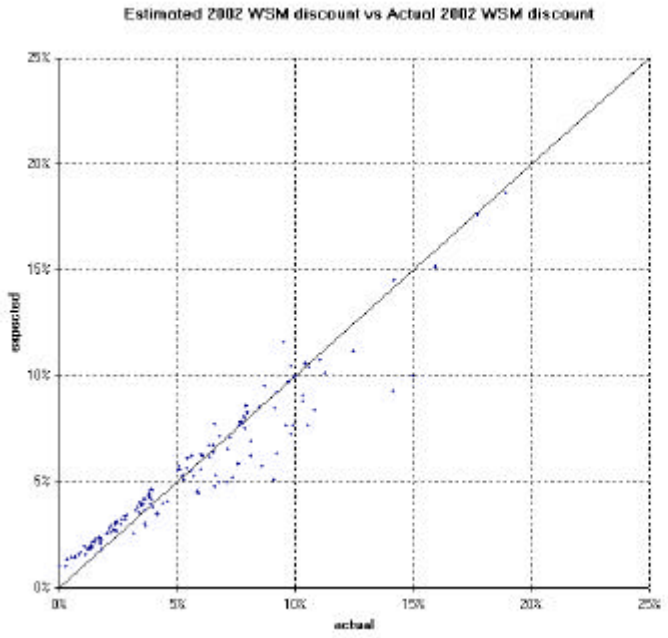
We used a simple transition probability model where the same transition probabilities between discount levels were used for all risk groups. The transition probabilities were found by starting with the 2001 earnings distribution across discount levels, at the account level, and finding a set of transition probabilities that would give exactly the actual account level distribution across discount levels for the 2002 year.

The set of transition probabilities we chose was found my making two simplifying assumptions: (i) any transition is either to the discount level immediately below or immediately above the current discount level (or to stay at the same level) (ii) the

probability of a transition to the next highest discount level was twice the probability of a downwards transition (for the 10% and 15% levels anyway).

These two simplifying assumptions were made because, in general, there are many possible sets of transition probabilities that will work. These two assumptions were necessary simplifications in terms of being both reasonable and recognising that this is a fairly insoluble problem of little material value to get "exactly" right.

As a check of the validity of this simple model, we plotted the estimated average 2002 WSMP discount level by risk group (transition probability matrix applied to 2001 earnings distribution across discount levels in each risk group) versus the actual 2002 WSMP discount by risk group to give the following graph:



The above graph shows that the approach taken was probably providing a reasonable model of movements between discount levels for the risk groups. Having projected the earnings at each discount level forward 2 years to the 2003/04 year, we then calculated the projected earnings weighted average discount in the risk group and hence the loading required to restore the total levy to what it would have been had the discounts not been offered (a “1/(1-discount)” factor).

Adjusting the risk group WSMP loadings to provide the aggregate target loading

These loadings by risk group are the “bottom up” (unadjusted) loadings and these need to be compared with our aggregate analyses which suggest that WSMP discounts cost us 0.05% of earnings from the total levy pool. For the 2003/04 year, the overall employer levy rate is 0.81% of earnings after WSMP discounts. This means the “standard” levy rate for employers is 0.86% of earnings and therefore the overall WSMP loading required is 86/81 = 1.0617.

Again, a simple transformation of the unadjusted WSMP loadings was required so that the liable earnings weighted average loading was 1.0617.

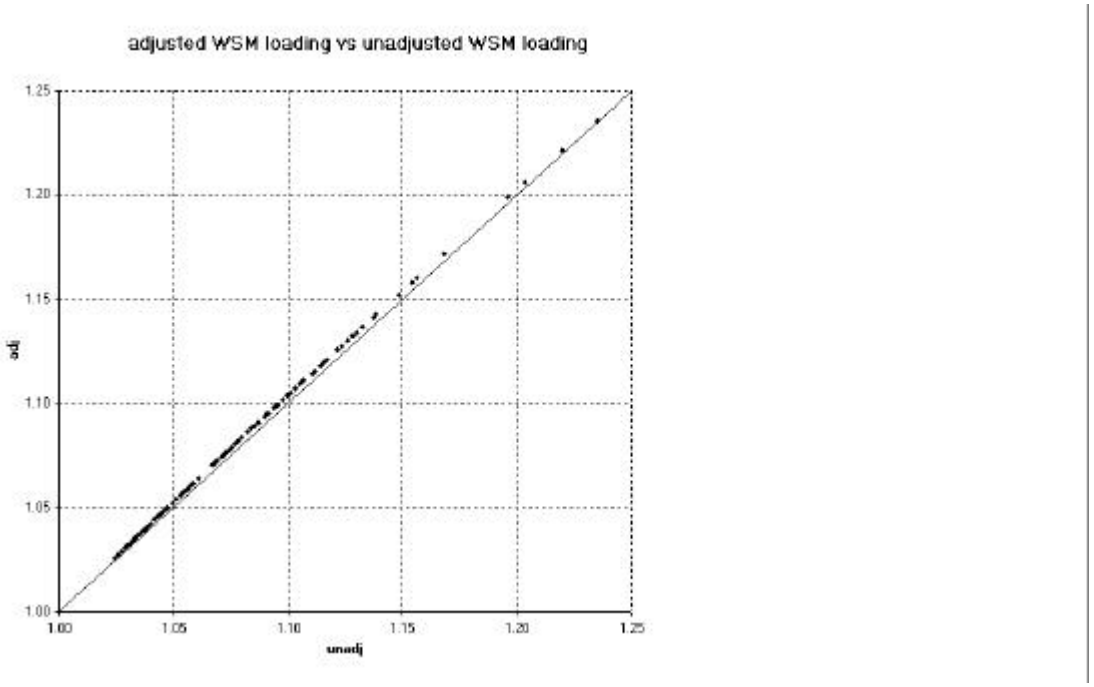
The transformation required needed to satisfy the following conditions:

1. $L_1 > L_2 \Rightarrow h(L_1) > h(L_2)$ - h preserves the order of the loadings
2. $h(1.00) = 1.00$
3. $h(1.25) = 1.25$
4. The earnings weighted average of the h(L) values should equal 1.0617.

The 1.25 factor is the loading required if the entire risk group has a 20% discount.

Looks familiar?

Again, we used a "circle" transformation (with a centre on the line $y = 2.25 - x$) to adjust the unadjusted WSMP loadings:



The WSMP loading factors suggested at the risk group level were slightly less than the target 1.0617 level and so the loadings by risk group were all increased slightly by "h".

Step 9 – "Commercial" Decisions
ACC makes 2 important adjustments to the rates as they stand at present.

1. Invoice minimums (where the cost of raising an invoice exceeds the levy received - $30 for employers, $50 for self-employed)

2. Increase caps (no composite levy rate for a CU should increase by more than (for 2003/04) 25% over last year's composite levy rate

The composite levy rate is

- Employer work cover levy rate plus Residual Claims levy rate plus OSH levy for employers

- Self-employed work cover combined income/non-income levy rate plus residual claims levy rate plus earner levy rate plus OSH levy for self-employeds

In other words, the composite rate is the "invoiced" total rate for each employer and self-employed person.

The purpose of the increase cap is to provide stability in the rates from year to year.

These 2 constraints need to be factored into the final rates that are set as both of them result in a loss of levy income if the loss isn't loaded back in.

This step of the process is by far the most complicated in mathematical terms (especially for the self-employed and that mathematically awkward non-income rate) and it is at this point that we nominate David Stein for the 2002 actuarial Nobel Prize for SAS programming and actuarial skill generally!

The philosophy behind these two constraints is that the losses will be spread over all risk groups and not contained just within the risk group. This decision was made on the back of the experience of the 2002/03 pricing where, in the interests of avoiding cross-subsidisation, we tried to contain the losses due to invoice minimums within the risk group.

What ended up happening in 2002/03 was that, in low risk, low earnings groups, a large percentage of the risk group failed to be invoiced leaving an unacceptably large loading for the rest of the group to bear. This effect was exacerbated when the risk group was also hitting or nearing the increase cap as well.

Another difference between 2002/03 and 2003/04 is that our increase cap is at the individual levy payer level. No levy payer will be invoiced more than 25% more than they would have been last year, *on their current earnings*. Last year the cap was on the total pool of levy dollars generated by the risk group. Again, this produced unacceptably large increases for those unfortunate individuals in a risk group where a large percentage of the levy payers were not invoiced.

Cross-subsidisation?

Those concerned at cross-subsidisation levels inherent in these processes will be pleased to know that the effects of the 2 commercial decisions were slight. In dollar terms, the cost of funding these 2 commercial decisions were to load levies payable by about 1% for each of the two decisions.

At this point we have suitable rates to go to the market with for standard employers and self-employed work cover.

Partnership Programme Employers

1. General Background

The ACC Partnership Programme encourages eligible employers to take responsibility for their own workplace health and safety, and injury management. This includes rehabilitation and claims management of employees' work injuries. Employers who are accepted into the Programme are referred to as 'accredited employers' in the legislation. The underlying philosophy of the programme is that it offers employers incentives to adopt injury prevention and rehabilitation initiatives. Thus, providing the opportunity to reduce work-related injury costs and levies and encouraging employers to help employees return to work after an injury. Employers joining the Partnership Programme are effectively agreeing to act on behalf of ACC in their own workplace.

The ACC Partnership Programme plans include:

- The ACC **Partnership Discount Plan (PDP)** option**,** under which accredited employers assume responsibility and cost for workplace health and safety and injury management for a nominated claims management period of either one or two years in respect of injuries incurred in an annual cover period (i.e. one or two years further management after the end of the accident year). In return for assuming this responsibility, the employer receives a discount from the industry levy they would otherwise pay. If at the expiry of the agreed claims management period an injured employee is still in receipt of statutory entitlements, financial and management responsibility for the claim transfers to ACC at no additional cost to the employer.

- The ACC **Full Self Cover Plan (FSC)** option which allows accredited employers to self manage for periods of up to five years (following a workplace injury). Any continuing claims at the end of the self-management period are transferred back to ACC. The accredited employer makes a payment to ACC reflecting ongoing costs of transferred long-term claimants. Rather than receiving a discount from their standard levy, the FSC option is priced using a bottom-up approach.

Partnership Discount Plan Option
The levy payable by a Partnership Discount Plan employer will depend on the industry concerned and is calculated by applying the relevant discount to the standard employer levy payable. In addition to the discounted standard levy, Partnership Discount Plan employers will pay the following fees:

- Partnership Programme Administration fee to cover administrative costs that are specific to the operation of the programme.

- Unallocated Primary Health Cost fee to cover primary health costs that should be paid by the Partnership Discount Plan employer but are instead paid by ACC due to the claimant failing to provide details at the point of service.

While this option requires the Partnership Discount Plan employer to meet all the costs of work related claims for the management period agreed, Stop Loss cover is available that will cap claim liabilities at either 150% or 200% of the standard industry levy. If selected, the Stop Loss levy will be added to the total levies payable to ACC.

Full Self Cover Plan Option
Under the Full Self-Cover (FSC) plan option employers assume the financial risk of claim costs up to the nominated stop loss level. Stop loss cover is mandatory and employers must choose between two levels of stop loss protection, either 150% or 200% of the standard industry levy. At the end of the claims management period, management responsibility for claims revert back to ACC and any residual cost of claim remains the liability of the employer. This liability is settled by the payment of a lump sum to ACC at the end of the claims management period.

The levy payable under FSC includes the following items:

- Bulk funded Public Health Care costs.
- Partnership Programme Administration fee to cover administrative costs that are specific to the operation of the programme.
- Unallocated Primary Health Cost fee to cover primary health costs that should be paid by the FSC employer but are instead paid by ACC due to the claimant failing to provide details at the point of service.
- Stop Loss levies.

FSC employers also have the option of purchasing High Cost Claim Cover. This cover provides financial protection for individual high cost claims that may occur. This cover is provided for claim costs in excess of $250,000; $500,000; $750,000 and $1,000,000 respectively. This cover is expected to reduce FSC employer's financial exposure and thereby reduce barriers to employer's participation in the ACC Partnership Programme.

2. PDP Discounts

PDP employers receive a discount from their standard levy, reflecting the cost of claims (including management of the claims) they will pay in the "management period" in respect of those claims arising during the accident year. The "management period" is comprised of the accident year plus a one year (PDP1) or two year (PDP2) claims management period, depending on the PDP option the employer selects.

Specifically, a PDP employer will receive a discount on:

- Direct claim costs
- Claims handling expenses
- Any margins added to the standard levy
- The reserve adjustment

- Provision for doubtful debts

A PDP employer will pay the same amount as an equivalent standard employer for:

- Bulk-billed claim costs
- Administration expenses (i.e. ACC overheads, not the programme specific administration expenses)
- Levy collection expenses

Calculation of the Partnership Discount Plan levy discount rates is a three stage process:

1. Calculate the average levy discount rate for the PDP1 and PDP2 options.
2. Calculate credible relativities by levy risk group (LRG) in respect of the ratios of claims paid, in the first two and three development years for the PDP1 and PDP2 options respectively, over ultimate claims paid.
3. Apply the LRG specific relativities to the "variable" components of the average discount rate and add in the "fixed" components to arrive at LRG specific discount rates for the PDP1 and PDP2 options.

Average Levy Discounts

Direct Claim Costs

We have used the claim costs and payment pattern from the standard employers pricing calculation for the 2003/04 accident year. We have calculated the amount of claims a PDP employer will expect to pay in the claims management period using the payment pattern across all benefit types. The exception to this is for lump sum benefits as ACC will calculate, administer and pay these on behalf of PDP employers.

The table below sets out the expected payment patterns by benefit type and development year. All amounts are expressed as a percentage of liable earnings.

	Development Year							
Benefit Type	**1**	**2**	**3**	**4**	**5**	**6**	**7+**	**TOTAL**
Weekly Comp	0.096	0.069	0.032	0.022	0.020	0.017	0.132	0.387
Death Benefit	0.000	0.001	0.001	0.001	0.001	0.001	0.005	0.012
Lump Sum	0.000	0.000	0.000	0.023	0.000	0.000	0.000	0.023
Rehab & Other	0.026	0.048	0.015	0.007	0.006	0.006	0.070	0.179
Medical	0.040	0.017	0.004	0.002	0.001	0.001	0.005	0.069
TOTAL	0.162	0.135	0.052	0.056	0.029	0.025	0.211	0.670

Therefore, direct claims costs of 0.373% of earnings (= 0.670 – 0.162 – 0.135) will be paid by ACC under PDP1, assuming the claim costs follow the standard employer pricing model. For PDP2, the direct claim costs paid by ACC will be 0.321% (= 0.373 – 0.052).

Claims Handling Expenses

We have assumed that claims handling expenses are 5% of the direct claim costs.

Margins Added to the Standard Levy

There are currently no margins added to the standard levy.

Reserve Adjustment

Future Component:

The "future component" of the reserve adjustment is designed to build up assets backing the levy year's claims to meet the funding target. This margin is designed to provide a buffer should experience prove to be worse than expected. This suggests that it should be spread in proportion to claim costs.

The major sources of uncertainty in the claims cost projection include claim incidence and the cost of long term claims. PDP employers share some of the risk in claims incidence, but ACC maintains the bulk of the risk from the long term cost of claims. To reflect this, we have added a loading to the proportional margin of 40% for PDP1 and 50% for PDP2. These loadings are subjective and are unchanged from 2002/03.

The calculations are therefore:

PDP1 = 0.048 * (0.373 / 0.670) * 140% = 0.037
PDP2 = 0.048 * (0.321 / 0.670) * 150% = 0.034

Past Component:

The "past component" of the reserve adjustment is a release or build-up of assets over and above the funding target at the beginning of the levy period. For the Employers' Account, for the past two years this has been a negative amount, indicating the account is over-funded. We have spread the amount of the past component among PDP employers in proportion to the discount on the standard levy (i.e. it had no effect on the actual discount percentage calculation).

The sum of fixed costs, direct claim costs, claim management costs and the reserve adjustment – future component for the "average" employer under PDP1 amounts to 0.541% of earnings (= 0.113% + 0.373% + 0.019% + 0.037%). The corresponding amount for the "average" employer under PDP2 is 0.484% and for the "average" standard employer it is 0.864% of earnings. The resulting "past component" rates are:

PDP1 = -0.079% * 0.541% / 0.864% = –0.049%
PDP2 = -0.079% * 0.484% / 0.864% = –0.044%

Provision for Doubtful Debts

We have treated the provision for doubtful debts in the same way as the "past component" of the reserve adjustment (i.e. allocated in proportion to the PDP discount).

The provisions for doubtful debts are therefore::

PDP1 = 0.025% * 0.541% / 0.864% = 0.016%
PDP2 = 0.025% * 0.484% / 0.864% = 0.014%

Summary of PDP Discount Calculations

The table below summarises the calculation of the average 2003/04 levy discounts applicable to the ACC Partnership Discount Plan. The discounts are 37% and 44% respectively for the one and two year claims management options of the ACC Partnership Discount Plan.

Average ACC Partnership Discount Plan Discounts [1]

		Management Period	
	Standard	**1yr**	**2yr**
	%	**%**	**%**
Direct Claim Costs [2,3]	0.67	0.373	0.321
Bulk-Billed Claim Costs [4]	0.04	0.038	0.038
Claims Handling Expenses	0.03	0.019	0.016
Administration Expenses	0.06	0.058	0.058
Levy Collection Costs	0.02	0.017	0.017
Provision for Doubtful Debts	0.03	0.016	0.014
Reserve Adjustment – Future Component	0.05	0.037	0.034
Reserve Adjustment – Past Component	-0.08	-0.049	-0.044
Total	0.82	0.508	0.454
Discount [5]		37%	44%

1 Figures expressed as %ge of earnings

2 Based on 12month injury period

3 Includes Allowance for Impact of Entitlement Changes

4 Acute Levy and Ambulance

5 Discount on Standard Premium

Credible Relativities by Levy Risk Group

The key determinant of the levy discounts applicable to the ACC Partnership Discount Plan is the proportion of direct claim costs expected to be paid during the selected claims management period. Due to the differing nature of claims across industries, this proportion varies considerably according to Levy Risk Group (LRG). For example, an industry with a relatively high proportion of small claims should receive a larger discount, as the employer will pay a higher proportion of ultimate claim payments in the management period.

To allow for this variation, we have analysed the proportion of costs historically paid in the management periods by LRG and adjusted the average PDP discounts accordingly.

We used historical claim information to derive the proportion of ultimate discounted claim costs which are paid in both the first two development years (PDP1 option) and the first three development years (PDP2 option). We then converted the proportion for each LRG to a relativity against an average of 100. In determining a LRG relativity we have taken the relativity over the six year period from 1995/96 to 2000/01 for the PDP1 option, and over the five year period from 1995/96 to 1999/00 for the PDP2 option. We then applied a credibility factor according to the number of weekly compensation claims over the five year period from 1995/96 to 1999/00. Full credibility is given to LRG's which have more than 1,000 weekly compensation claims over the five years.

The calculation of credible relativities is set out in more detail in the steps below:

1. Calculate the following amounts by classification unit and accident year:
   D.1 = Payments in development years 0 & 1 discounted to start of accident year
   D.2 = Payments in development years 0, 1 & 2 discounted to start of accident year
   D.3 = Ultimate claim costs discounted to start of accident year
   D.4 = Number of weekly comp claims over the 5 year period from 1995/96 to 1999/00.

2. Using the latest classification unit to LRG mapping, calculate the following ratios of paid to ultimate claim costs for each LRG and accident year:

$$R.1 = \frac{D.1}{D.3}$$

   and

$$R.2 = \frac{D.2}{D.3}$$

   These give the one-year (R.1) and two-year (R.2) ratios respectively for each LRG and accident year.

3. Calculate the one-year and two-year raw relativities for each LRG and accident year:

$$Rel.1 = \frac{R.1\ (LRG)}{R.1\ (All)}$$

   and

$$Rel.2 = \frac{R.2\ (LRG)}{R.2\ (All)}$$

   These give the one-year (Rel.1) and two-year (Rel.2) relativities respectively for each LRG and accident year.

4. Calculate the weighted average one-year and two-year raw relativities for each PRG:

$$TR.1 = \frac{SUM(Rel.1 * D.3)}{SUM\ (D.3)}$$

   and

$$TR.2 = \frac{SUM(Rel.2 * D.3)}{SUM\ (D.3)}$$

   Where the summation is over all accident years. These give the one-year (TR.1) and two-year (TR.2) weighted average relativities respectively for each LRG (weighted by the ultimate discounted claim costs for each accident year).

5. Calculate the credibility factors for each LRG:

$$CF = MIN[1, SQRT(Sum(No.\ WC\ Claims)/1{,}000)]$$

   For the 2003/04 pricing the summation of weekly compensation (WC) claims was over the five year period 1995/96 to 1999/00.

6. Calculate the total one-year and two-year credible relativities for each LRG:
7.

$$CR.1 = (CF * TR.1) + (1 - CF) * 100$$

   and

$$CR.2 = (CF * TR.2) + (1 – CF) * 100$$

These give the one-year (CR.1) and two-year (CR.2) credible relativities respectively for each LRG.

Levy Risk Group Specific Discount Rates

To illustrate how we derived LRG specific discount rates from the average discount rates and the relativities, consider the example of an accredited employer in LRG 110 under the PDP1 option.

Direct Claim Costs

For LRG 110 the relativity for PDP1 is 121.19. That is, if ACC incurs direct claims costs of 0.373% of earnings in respect of the "average" PDP employer under PDP1, then ACC will incur direct claim costs of 0.310% (= 0.67% - (0.67% - 0.373%) * 1.2119) of earnings in respect of a PDP employer in LRG 110.

Claims Handling Expenses

Claims handling expenses amount to 0.015% (= 0.31% * 5%) of earnings.

Fixed Costs

Fixed costs, being bulk-billed claim costs, administration costs and levy collection costs, amount to 0.113% (= 0.038% + 0.058% + 0.017%) of earnings.

Reserve Adjustment

Future Component:

The "future component" of the reserve adjustment amounts to 0.031% of earnings (= 0.037% * 0.310% / 0.373%).

Past Component:

The sum of fixed costs, direct claim costs, claim management costs and the reserve adjustment – future component for the "average" employer under the PDP1 option is 0.541% of earnings (= 0.113% + 0.373% + 0.019% + 0.037%). The corresponding figure for those PDP employers in LRG 110 is 0.469% (= 0.113% + 0.310% + 0.015% + 0.031%) of earnings.

The "past component" of the reserve adjustment is therefore –0.043% (= -0.049% * 0.469% / 0.541%) of earnings.

Provision for Doubtful Debts

By allocating the provision for doubtful debts in proportion to the PDP discount, as we did for the past component of the reserve adjustment, the resulting rate is 0.014% (= 0.016% * 0.469% / 0.541%) of earnings.

Summary of PDP Discount Calculations

The PDP discount for accredited employers in LRG 110 under the PDP1 option is 46%, compared with the "average" 1 year discount of 37%, as summarised below.

LRG 110 - ACC Partnership Discount Plan Discount [1]

		1 Year Option	
	Standard	**Average**	**LRG 110**
	%	**%**	**%**
Direct Claim Costs [2,3]	0.67	0.373	0.310
Bulk-Billed Claim Costs [4]	0.04	0.038	0.038
Claims Handling Expenses	0.03	0.019	0.015
Administration Expenses	0.06	0.058	0.058
Levy Collection Costs	0.02	0.017	0.017
Provision for Doubtful Debts	0.03	0.016	0.014
Reserve Adjustment – Future Component	0.05	0.037	0.031
Reserve Adjustment – Past Component	-0.08	-0.049	-0.043
Total	0.82	0.508	0.440
Discount [5]		37%	46%

1 Figures expressed as %ge of earnings

2 Based on 12month injury period

3 Includes Allowance for Impact of Entitlement Changes

4 Acute Levy and Ambulance

5 Discount on Standard Premium

3. Full Self Cover Stop Loss and High Cost Claim Cover

Stop Loss

The FSC employer is obliged to purchase stop loss cover from ACC for any accident year. The high cost claim cover (individual excess of loss) is optional.

Stop loss cover works as follows:

For any given cover period (usually a March year) the total dollars of claim payment made by the FSC employer in respect of accidents incurred in the cover period, including the payment they must make to ACC at the end of the claims management period, is capped by the stop loss limit.

There are two available levels of stop loss cover - 150% and 200%.

For 150% cover, as soon as the total dollars of claims paid by the FSC employer in respect of accidents incurred in the cover period exceeds 150% of the standard levy they would otherwise have had to pay if they were not a FSC employer, the FSC employer has no further liability for claim payments. This responsibility rests with ACC.

Naturally, the 150% cover is more expensive than the 200% cover as there is a greater chance of breaching a lower stop loss limit.

High Cost Claim Cover (Individual Excess of Loss)

There are two main ways to breach your stop loss limit:

1. Have a large number of “small” claims
2. Have a small number of “large” claims

It is generally far more likely that a small number of very large claims would be the cause, especially for a smaller FSC employer. To help provide protection against this possibility, FSC employers have the option to purchase high cost claim cover ("HCCC") in addition to the compulsory stop loss cover.

ACC currently offers 4 levels of high cost claim ("per event") cover - $250,000, $500,000, $750,000 and $1,000,000. That is, if any single event in the workplace gives rise to claims resulting in payments in excess of the HCCC limit then ACC takes responsibility for the amount in excess of the HCCC limit selected.

Naturally, the lower the HCCC limit the more expensive the cover as lower HCCC limits provide more protection.

Interaction between stop loss and HCCC
The two cover types interact – having HCCC reduces the chances of breaching the stop loss limit so the stop loss component of the total levy charged reduces as you take on more HCCC.

Also, the HCCC is applied before the calculation of the stop-loss loss (if any).

Rates vary by standard levy
The rates generated by the stop-loss model vary by the amount of standard employer levy that the employer would have been required to pay had they not been a FSC employer.

The greater the standard levy otherwise payable the lower the stop-loss levy rate. This is a reflection of the lower variance in claims experience for larger employers.

Consequently, stop-loss and HCCC rates are calculated for 34 standard levy bands ranging from $0 – 49,999 up to the $4,500,000 plus category.

They also vary according to the risk band the employer falls into. As discussed below, there are 3 risk bands for each levy band (Low, Medium and High) reflecting different average claim sizes for classification units (CUs) in the 3 risk bands.

Calculating the stop-loss and HCCC levies
Here's the fun bit.

Our approach was to use an empirical claim size distribution based on historic incurred claim sizes with a translated pareto distribution for the tail of the claim size distribution.

As usual, most of the work is in the preparation. Firstly, for the 2003/04 pricing there was an assumed average total claim cost per entitlement claim ($10,979 on a fully discounted basis).

Using the last 6 years' claims values (over 400,000 claims, fully discounted) each claim was calibrated (by a constant factor different for each accident year) so that the total cost per entitlement claim in each of the 6 accident years was $10,979.

The next stage was to adjust the claim sizes so that they reflected the effect of no discounting during the claims management period. Most FSC employers manage the first 5 years of claims and so the stop-loss loss is undiscounted for the first 5 years with discounting on the liability reverting back to ACC at the end of the claims management period. An appropriate scale factor to adjust for this period of no discounting was found from the Employers' Account claim payment run-off.

The risk levy in the employer account was 0.71% of earnings including bulk-billed costs and 0.67% of earnings excluding bulk-billed costs. The effect of no discounting in the claim management period was to increase the 0.67% figure to 0.77%. In other words, with the full levy rate being 0.81% (after WSMP discounts), the loss ratio on this "stop-loss" basis was 77/81 = 95%.

Consequently, the average total cost per entitlement claim ("TCPEC") with a "stop-loss" claim size definition was $10,979 \times 77/67 = \$12,618$.

Risk bands – High, Medium and Low

However, the FSC portfolio is not a homogeneous pool of risks in terms of average TCPEC. There is justification for 3 risk bands based on individual claim size distribution (Low, Medium, High).

Each CU is mapped into one of these 3 bands and using the 400,000 individual claim sizes we map the historic claims into the 3 bands according to the claim's CU to get an empirical claim size distribution for each of the L, M and H bands.

So, at this point we have 3 empirical claim size distributions giving the total cost per entitlement claim (TCPEC) values. For the 2003/04 pricing the summary statistics for these 3 claim size distributions were as shown in the following table:

Risk Band	Average TCPEC	Std Dev TCPEC
Low	\$9,586	\$42,756
Medium	\$13,733	\$61,150
High	\$16,831	\$70,224

Pareto Tail

We decided that pareto distributions should be fitted to the 3 claim size distributions above \$100,000. This was to ensure that the tail was both smooth and representative of the high cost claims.

The pareto parameters were fitted to the TCPEC's above \$100,000 by the method of moments. That is, we fitted the pareto over the range TCPEC $\geq$ \$100,000 with the same mean and standard deviation of TCPEC values as the empirical distribution.

The pareto density was chosen because it does not have an exponential decay factor and therefore has sufficient "probability density" out in the tail. Use of the pareto distribution in reinsurance settings is fairly commonplace.

By using the method of moments we ensured that the "hybrid" claim size distributions (empirical below \$100,000, pareto above \$100,000) had the same means and standard deviations as set out in the above table.

Simulating a value from the claim size distribution is achieved by using 2 steps:

1. In the full empirical TCPEC distribution for a risk band, the number of entitlement claims in the $100,000+ category is divided by the total number of entitlement claims in the risk band. This gives the probability of a claim in this range. Any U(0,1) random realisation below this value can be taken as equivalent to directing us to the pareto tail, otherwise one of the values from the empirical TCPEC distribution below $100,000 is selected.

2. If a claim from the pareto tail is sought, generate a pareto simulation using the inverse of the pareto's cumulative distribution function (easily calculated for a pareto) applied to a new U(0,1) value. If the claim comes from the empirical part of the claim size distribution then a value is randomly selected from this list of values.

For each of the 3 claim size distributions, the pareto parameters were such that a U(0,1) value very close to 1 could give rise to an enormous claim size. To prevent this happening we capped any simulated value at $5 million.

Aggregate Claims

We used a compound poisson aggregate claims model to model the total claim cost for a particular standard-levy-band/risk-band cell.

The compound poisson has some mathematically convenient properties:

If N is the number of entitlement claims occuring with $N \sim Po(\lambda)$ and X is the TCPEC then the aggregate claims (S) is such that

$$\boldsymbol{E}(S) = \lambda.\boldsymbol{E}(X)$$
$$\boldsymbol{Var}(S) = \lambda.\boldsymbol{E}(X^2)$$

This means the expected aggregate claims can be found by equating $\lambda.E(X)$ with the middle of the levy band times the stop-loss basis loss ratio (95%). As we know $\boldsymbol{E}(X)$ for each of the 3 risk bands, we can back out the implied poisson parameter for each combination of the 3 risk-bands and 34 standard-levy-bands.

Having now got the poisson parameter for each of the $3 \times 34 = 102$ combinations of risk-band and standard-levy-band ("cells"), and having the TCPEC distribution for each of the 3 risk bands we can proceed to simulate outcomes from the aggregate claims distribution in each of the 102 cells.

Note

The nature of the variance formula $\boldsymbol{Var}(S) = \lambda.\boldsymbol{E}(X^2)$ is such that two cells with the same value of $\boldsymbol{E}(S)$ but different values of λ. are such that the one with the lower λ.has the higher value of $\boldsymbol{Var}(S)$. This concurs with the earlier point about HCCC providing protection against small numbers of high cost claims whereas the lower variance associated with "lots of small claims" (high λ, low $\boldsymbol{E}(X)$) is not such a concern.

The steps to simulate the aggregate claims cost are essentially

1. Simulate a realisation from the Po(λ) distribution for the cell in question. This will be a non-negative integer.

2. If it is zero then no claims are simulated and the aggregate claims for this simulation will be zero.

3. If it is a positive integer then that number of claims are simulated from the TCPEC distribution

4. In step 3, each individual claim can be subjected to a maximum of the actual size and any HCCC limit before contributing to the FSC employer's aggregate claims. Any excess over the HCCC limit will contribute to ACC's aggregate claims.

5. By adding together the simulated claim values (above and below any HCCC limit) we get the FSC employer and ACC aggregate claims before application of the stop-loss.

6. Next we subject the FSC employer's simulated aggregate claims (after any HCCC) to be capped at 150% or 200% of the mid-point of their premium band and add any excess over the stop-loss limit onto ACC's aggregate claims.

7. The total ACC aggregate claims after any HCCC and stop-loss is what the FSC employer must pay for.

8. By simulating a large number of times in each cell (we did 250,000 in each – the power of SAS on Unix!!) we get a very accurate picture of the distribution of the ACC aggregate claim size distribution and hence the distribution from which we determine the stop-loss/HCCC risk premium.

9. There are a number of approaches for loading the stop-loss risk premium to provide an acceptably low probability of ruin. Our stop-loss model also produced accurate estimates of the coefficient of variation in each cell so that a loading pro-rata to this could be added if desired. We chose instead to just assume that the actual claim sizes would be 30% bigger than they actually were in the claim size distribution. This was consistent with the approach our consultants had used last year (2002/03).

The stop loss model (a SAS program) output a number of text files which gave us an indication of how well our model performed. We checked that the expected aggregate claims for FSC employers and ACC combined equated to a 95% loss ratio in each cell and that the stop-loss/HCCC rates produced followed smooth curves with no “bumps”.

At this point we had the 2003/04 "pure" stop-loss/HCCC rates.

Commercial Decisions

The final stage of setting the stop-loss/HCCC rates was to compare the "pure" results with last year's rates and cap any increase at 25%.

By comparing the expected stop-loss/HCCC levy we would have generated using the "pure" rates generated by the above model we were able to determine the stop-loss levy lost by capping at 25% and to apply a constant loading to all rates below the cap to make up the shortfall.

The loading required was about 6.5%.

Consequently the stop-loss/HCCC rate in any cell was

$$\text{MIN}(1.065 \times \text{2003/04 pure rate}, 1.25 \times \text{2002/03 rate})$$

4. Partnership Discount Plan ("PDP") Stop Loss

PDP employers have the option of purchasing stop loss cover (as opposed to FSC employers for whom stop loss is compulsory).

Again, there are two levels of cover, "150% and "200%". However, these stop loss limits are harder to breach for a PDP employer because the only payments made by the PDP employer are either for payments in the cover period plus 1 additional year (PDP1) or payments in the cover period plus 2 additional years (PDP2), whereas the stop loss limits are percentages of the full standard premium the employer would have otherwise paid had they not been in the Partnership Discount Programme.

Consequently, the likelihood of the first 2-3 years' payments leading to a breach of the PDP stop loss limit is far lower than for the FSC employer because of the extra years payments that the FSC employer makes and the liability reversion to ACC at the end of the FSC claims management period.

One consequence of the fact that we are now "truncating" the claim payment stream for the PDP employers (as opposed to the FSC employers where the liability reversion effectively "commutes" all remaining payments) is that there would appear, at first glance, to be the possibility that some employers might pay a greater percentage of the ultimate claim cost in the first 2-3 years and hence would have a higher chance of breaching the PDP stop loss limit.

If it were true that the ultimate cost of claims were the same for all PDP employers, with some paying a greater percentage in the first 2-3 years than others, then higher rates for those who settle a greater percentage in the first 2-3 years would be warranted. This was the rationale for the 5 "settlement speed" bands for the 2002/03 PDP stop loss rates (where "fast" (F) meant a high percentage of ultimate costs settled in the first 2-3 years, and "slow" (S) meant a lower percentage).

However, our investigations for the 2003/04 pricing revealed that the ultimate cost of claims was <u>not</u> the same for the "fast" versus the "slow". In fact, the "slow" employers had the highest ultimate claim cost and the "fast" employers the lowest.

On balance, this is not surprising because more serious injuries (i.e. higher ultimate claim cost) take longer to settle as we pay weekly and other ongoing benefits rather than settle with a lump sum. In other words, a more seriously injured person gets payments for longer so we settle a smaller percentage of ultimate cost in the first 2-3 years for serious injuries compared to less serious.

At the end of the day, it's the distribution of the dollars paid out in the first 2-3 years that matters.

What we found was that there were two opposing effects that offset each other:

The average amount paid out in the first 2-3 years was lower for "fast" employers but they had a higher number of such claims in any given levy band (i.e. high λ, low $\boldsymbol{E}(X)$) whereas it was the opposite for "slow" employers (i.e. low λ, high $\boldsymbol{E}(X)$).

Overall, the aggregate payments for "fast" employers were greater, on average, than for "slow" employers BUT the variance of the aggregate payments for "slow" employers was that much higher than for "fast" employers that it had the effect of making stop loss breaches about the same for fast and slow alike.

In other words, if S_{FAST} is the aggregate PDP claims for a "fast" employer and S_{SLOW} is the aggregate PDP claims for a "slow" employer, and L is the stop loss limit then

1. $\boldsymbol{E}(S_{FAST}) > \boldsymbol{E}(S_{SLOW})$

2. $\boldsymbol{Var}(S_{FAST}) < \boldsymbol{Var}(S_{SLOW})$

3. $\boldsymbol{Pr}(S_{FAST} > L) \,.\, \boldsymbol{E}(S_{FAST} \mid S_{FAST} > L) \approx \boldsymbol{Pr}(S_{SLOW} > L) \,.\, \boldsymbol{E}(S_{SLOW} \mid S_{SLOW} > L)$

The upshot of all this is that we got rid of the 5 "risk" bands and ended up with a set of rates that only varied by standard levy (otherwise payable), the stop loss limit selected (150% more expensive than 200%) and the claims management period (2 years beyond cover period (PDP2) more expensive than 1 year beyond cover period (PDP1)).

Residual Claims Levy

The Residual Account includes all work-related claims incurred before 1 July 1999 and all non-work claims for workers incurred before 1 April 1992 that are still outstanding. Since its inception on 1 July 1999 the Residual Account has had a significant unfunded liability. That is, the assets held in the account are less than 115% of the outstanding claims liability.

The residual claims levy is designed specifically to fund this unfunded liability by 31 March 2014.

The annual valuation of liabilities gives us an estimate of the outstanding claims liability in respect of the work-related and non-work claims separately.

By comparing these values to the assets held in the account we can determine the size of the unfunded liability and consequently the aggregate levy rate (as a % of the projected future earnings base) we need to charge all employers and self-employeds until 2014 to amortise this deficit.

The overall residual levy rate is revised every year and "re-sighted" on the 115% funding target by 31 March 2014. This is because the pattern of claims run-off and investment returns is never in exact accordance with the assumptions made in the previous year.

The aggregate residual levy rate

Setting the aggregate residual levy rate is essentially one of projecting out the claims, expense and investment earnings cashflows until 31 March 2014 and determining what constant % of the projected future earnings base is needed to ensure we achieve assets equal to 115% of liabilities by 2014.

The following spreadsheet extract shows the setting of the aggregate residual levy rate for the 2003/04 year (resulting in an overall rate of 0.30% of earnings):

	Years to amortise unfunded liability			11	Premium rate from 01/4/2003 on			0.302%	(tail levy only)						
					Premium rate from 4/02 to 3/03			0.350%	(total)						
		Prudential Margin	15.00%			Discount Rate		6.80%		Goal Seek Residual Levy Rate					
		Average Bad Debt Rate	3.41%			Investment Earnings Rate:		6.80%							
						Collection cost rate post 30/06/2		3.00%							
						Expense Loading		10.00%							
Date	Time	Outstanding Claims	OSC + Pru margin	Reserves	Unfunded Liability	Premium Income - Employers	Premium Income - Self Employed	Collection Costs	Claims Expenditure	CHE and Other Expenses	Investment Earnings	Net Income less Expenditure		Employers Premium Base	Self Employed Premium Base
30/06/2002	0	2,621.871	2,979.399	1,058.599	1,920.800										
31/03/2003	0.75	2,492.620	2,832.523	998.989	1,833.534	133.699	18.212	- 7.533	- 225.996	- 29.483	51.49	- 59.610		39.381	5.553
30/06/2003	1	2,448.092	2,781.922	972.995	1,808.928	39.616	5.407	- 2.511	- 75.332	- 9.828	16.65	- 25.994		13.523	1.911
31/03/2004	1.75	2,334.266	2,652.575	918.934	1,733.641	118.848	16.221	- 4.610	- 205.005	- 26.850	47.34	- 54.060		40.570	5.732
30/06/2004	2	2,295.052	2,608.014	901.876	1,706.138	40.812	5.570	- 1.537	- 68.335	- 8.950	15.38	- 17.059		13.932	1.968
31/03/2005	2.75	2,191.581	2,490.433	867.446	1,622.987	122.437	16.711	- 3.673	- 194.728	- 19.473	44.30	- 34.430		41.796	5.905
30/06/2005	3	2,155.934	2,449.925	857.138	1,592.787	42.045	5.739	- 1.261	- 64.909	- 6.491	14.57	- 10.308		14.353	2.028
31/03/2006	3.75	2,057.959	2,338.590	837.171	1,501.419	126.135	17.216	- 3.784	- 183.612	- 18.361	42.44	- 19.967		43.058	6.084
30/06/2006	4	2,024.206	2,300.234	831.877	1,468.357	43.315	5.912	- 1.299	- 61.204	- 6.120	14.10	- 5.294		14.786	2.089
31/03/2007	4.75	1,930.585	2,193.846	825.975	1,367.872	129.944	17.736	- 3.898	- 173.842	- 17.384	41.54	- 5.902		44.358	6.268
30/06/2007	5	1,898.331	2,157.195	825.564	1,331.631	44.623	6.090	- 1.339	- 57.947	- 5.795	13.96	- 0.410		15.233	2.152
31/03/2008	5.75	1,809.698	2,056.475	835.163	1,221.312	133.869	18.271	- 4.016	- 163.771	- 16.377	41.62	9.599		45.698	6.457
30/06/2008	6	1,779.163	2,021.776	840.138	1,181.639	45.970	6.274	- 1.379	- 54.590	- 5.459	14.16	4.975		15.693	2.217
31/03/2009	6.75	1,695.514	1,926.720	866.094	1,060.626	137.911	18.823	- 4.137	- 154.005	- 15.400	42.76	25.957		47.078	6.652
30/06/2009	7	1,666.696	1,893.973	876.757	1,017.216	47.359	6.464	- 1.421	- 51.335	- 5.133	14.73	10.662		16.167	2.284
31/03/2010	7.75	1,588.567	1,805.189	920.531	884.658	142.076	19.392	- 4.262	- 144.063	- 14.406	45.04	43.775		48.500	6.853
30/06/2010	8	1,561.650	1,774.603	937.392	837.210	48.789	6.659	- 1.464	- 48.021	- 4.802	15.70	16.861		16.655	2.353
31/03/2011	8.75	1,489.213	1,692.287	1,000.149	692.138	146.367	19.977	- 4.391	- 134.303	- 13.430	48.54	62.757		49.964	7.060
30/06/2011	9	1,464.257	1,663.929	1,023.618	640.310	50.262	6.860	- 1.508	- 44.768	- 4.477	17.10	23.469		17.158	2.424
31/03/2012	9.75	1,396.872	1,587.354	1,105.782	481.572	150.787	20.580	- 4.524	- 125.453	- 12.545	53.32	82.164		51.473	7.273
30/06/2012	10	1,373.656	1,560.973	1,136.015	424.958	51.780	7.067	- 1.553	- 41.818	- 4.182	18.94	30.232		17.676	2.497
31/03/2013	10.75	1,311.376	1,490.200	1,238.783	251.418	155.341	21.202	- 4.660	- 116.861	- 11.686	59.43	102.768		53.028	7.492
30/06/2013	11	1,289.920	1,465.818	1,276.200	189.618	53.344	7.281	- 1.600	- 38.954	- 3.895	21.24	37.417		18.210	2.573
31/03/2014	11.75	1,232.383	1,400.436	1,400.436	- 0.000	160.032	21.842	- 4.801	- 108.897	- 10.890	66.95	124.236		54.629	7.719

Residual levy rates by risk group

As stated above, the residual account's liabilities are all work-related claims incurred before 1 July 1999 and all non-work claims for workers incurred before 1 April 1992 that are still outstanding.

In setting the residual levy rate for a risk group, the non-work component of the rate is not risk rated. That is, there is a flat non-work component to the residual levy rate. However, there is a risk rated work component.

In a similar fashion to the employer and self-employed accounts, classification units are combined into industry-based residual risk groups ("RRGs") for the purpose of setting a rate.

The main difference between the residual account and the employer/self-employed accounts is in the number of claims we are dealing with. The residual account is in run-off and claim numbers are declining. In order to maintain statistical credibility (and hence stability in the rates) for a RRG from year to year, we elected to reduce the number of RRGs from 114 in 2002/03 to just 41 in 2003/04. We plan to reduce this number further in the future as the claim run-off continues.

As for the employer/self-employed accounts, RRGs are formed by pooling the experience of classification units ("CUs") in the same industry with similar levels of risk.

Setting the overall work and non-work rates

The annual liability valuation sets out the work and non-work claims liability in the residual account. Setting the overall work and non-work rates is one of dividing the overall rate (0.30% in 2003/04) between work and non-work in the same ratio as the claims liability.

The 30 June 2002 valuation results were (in $m):

Work accidents	1,563.688	(67%)
Non-work accidents	773.823	(33%)
Total liability	2,337.511	(100%)

Consequently, the work-related residual levy component was 67% of 0.30% = 0.20% and the non-work component was 0.10%.

The next step is to derive a suitable multiple to apply to the work component (0.20%) for each RRG. This multiple is known as "the risk relativity".

The risk relativity for the work component of the RRG levy

The main difference between the full funded levy for the employer/self-employed levies and the residual levy is that the residual levy is only for outstanding claim costs. That is, there is no need to concern ourselves with the claim costs paid to date for setting the residual levy.

Every (outstanding) claim in the residual account has an associated CU number and so we can allocate the total work-related outstanding claim liability in the residual account across the classification units and hence into residual risk groups.

By dividing the total work related outstanding claim cost liability in a RRG by the corresponding earnings base we get the outstanding work-related claims/earnings ratio. Doing the same thing for the entire account we get the residual work outstanding claims/earnings ratio. Dividing the RRG outstanding claims/earnings ratio by the residual work account outstanding claims/earnings ratio we get the risk relativity to apply to the aggregate work rate.

Notice that this methodology ensures we still generate the overall target rate of 0.20% for work accidents.

The residual levy rate for 2003/04 is then cast as

$$(\text{Risk Relativity} \times 0.20\%) + 0.10\%$$

Problems

There are a few problems with the residual account. The most common is where a RRG has a shrinking earnings base and the outstanding claims cost allocated to the CUs in that RRG become an ever larger percentage of the liable earnings. Clearly, there is also a problem with a growing earnings base. We test our RRGs to ensure that they have a stable historic earnings base to minimise this effect.

A related problem is where businesses redefine themselves under a different CU to what they have historically declared earnings under. In these circumstances, if our risk grouping is too fine, we run the risk of allowing those employers and self-employed who have given rise to residual claims to avoid paying for them. Hence we try and ensure that the RRGs are broad enough to capture the majority of these effects.

Increase cap

For the 2003/04 pricing round, ACC management decided to cap any increase in the residual levy rate for a CU at 25%. Any notional losses above the cap were spread across the remaining CUs that could soak it up.