

Interim report from Working Party on Claims runoff patterns  
presented to GISG Convention October 1988.

A. INTRODUCTION

A1 Timing

A1.1 The working party regrets that they could not complete their work in time to present a fully considered report to this convention. However we feel that the results so far obtained are of interest to a wider audience and that our work will benefit from comments and criticisms from such a wider circle. The working party wish to continue their work over the next twelve months in order to present a fuller report to GISG in October 1989. There are many areas of interest yet to be addressed.

A1.2 All readers of this report should bear in mind that it is only an interim report. Accordingly any conclusions that can be drawn from it are at best tentative and none of the figures tabulated should be regarded as definitive.

A2 Structure of report

The report consists of five sections:

- A. Introduction
- B. Description of the calculations underlying the data presented in section C. *(To be distributed at Harrogate.)*
- C. Run off patterns derived from DTI returns for UK employers liability and private motor, together with some associated data.
- D. Sensitivity analyses etc based on data in section C, relevant to use of that data for discounting purposes.
- E. *(This short section was not yet in draft at the time the remainder of our interim report was completed. It will be distributed at Harrogate.)* Interim conclusions and comments on sections A-D.

### A3 Origin of Working Party

A3.1 The General Insurance Convention held in Torquay at the end of October 1987 discussed a paper produced by a working party on the discounting of general business claims reserves.

A3.2 That paper suggested in paragraphs 5.3 and 9.2 that standard payment patterns might be appropriate for discounting claims reserves in certain circumstances. Alternatively standard patterns might be used as a starting point against which a company's experience could be assessed. It was suggested that these possibilities be investigated further.

A3.3 This suggestion met with general approval and the conference decided to set up this working party to examine claim run-off patterns.

### A4 DTI run off data

A4.1 The most comprehensive set of claims run-off data available in the UK is the data in Forms 33 (Forms 35 for 3 year business) of the returns which have to be made to the DTI by companies authorised to write business in the UK. We restricted our investigations to UK risk groups because it was thought that it would unduly complicate our study to include business from other countries.

A4.2 The possibility of examining the net run-off patterns shown in Form 23 was considered. However net run-offs can be distorted by (changes in) reinsurance arrangements, and it was thought that such distortions would lead to additional difficulties in identifying the underlying run off pattern. We consider it preferable for each company to assess the impact of reinsurance on cash flow separately, having regard to the particular reinsurance arrangements in place. Also Form 23 applies to the entire accounting class and differences in run-off patterns for individual risk groups and distortions from currency movements

can be considerable. We therefore did not consider net run off patterns further.

#### A5 Other data sources

A5.1 Various other sources of claims run-off data were also considered before deciding to restrict the study to the DTI data.

A5.2 These sources included ABI, ROA and ISO (US) data, some of which were available to the companies of individual members of the Working Party. Generally, however, such data are circulated only to member companies of the various organisations and may only be to the level to which the company contributes. They are usually circulated on a strictly confidential basis, whereas any report on discounting presented to this Convention was likely to receive wide circulation as indeed has happened with the report on discounting presented last year.

A5.3 The use of data not publicly available could in any case only be undertaken with the specific authority of the respective organisations. Even where granted, such availability was likely to be subject to various conditions.

A5.4 In view of the above and time pressures it was agreed that, in the first instance, it was sufficient to concentrate on the DTI data and restrict the study to the motor and employers liability classes.

A5.5 The possibility of exploring the availability of alternative data sources remains, for the time being, a future option. Use of alternative sources would naturally depend inter alia on their form and completeness, which we have not investigated.

#### A6 Lines examined

A6.1 Property business was not examined because it is normally short tail and therefore not very interesting in the context of discounting. Private motor is a category of business in which the risks are relatively homogenous, compared with some non-life classes and in which the run-off pattern of the claims can be very stable from one year to the next even if the portfolio is not particularly large. It was thought that if standard run-off tables are to be useful for any type of business then they are likely to be so for private motor. Employers' liability was examined as an example of a reasonably well-conditioned long-tail class.

A6.2 We restricted the examination to three risk groups to ensure in the time available to us that sufficient companies could be compared, to avoid missing significant variation between companies.

#### A7 Three year accounting

A few companies use the 3 year accounting convention for their motor or liability business and accordingly report their claims run-off on Form 35 instead of on Form 33. It would be interesting to compare run-offs on a year of occurrence basis (corresponding to Form 33) and a year of underwriting basis (corresponding to Form 35). However this would have complicated our analysis and obscured the intercompany comparisons. In any case the risks assumed by companies accounting using the underwriting year convention may well be atypical. We therefore restricted ourselves to analysis of the Form 33 data.

#### A8 Numbers

We considered analysing the run-off of numbers of settlements as well as patterns by monetary amount. However this would have further complicated our study. The run-off of settlements by

number can easily be distorted by changes in office procedures whereas payments are more objective and likely to be less affected by operational changes. Since run off patterns by claim amount are clearly those relevant to the question of discounting which originally led to the formation of this working party, we did not proceed with any analysis of the run-off of settlements by number.

#### A9 Terms of reference

Following these considerations we agreed the following terms of reference:

The working party will examine the claims run-off patterns, for gross amounts of claim, of a number of insurance companies for UK private motor and employers' liability business using run-off data from DTI returns. The effect of adjusting for inflation on the run-off patterns will be examined. The use of standard tables to discount outstanding claims for the risk groups examined will be considered. Recommendations for further work will be made.

#### A10 DTI database

A10.1 The DTI enter data from most of the forms in companies' returns into their database. We initially explored the possibility of obtaining data directly from this database. While the DTI were agreeable in principle, their computer system was designed some years ago and proved insufficiently flexible to make this practical.

A10.2 In the event therefore, it was not possible to obtain data directly from the DTI database. However one consequence of that initial exploration needs further consideration. Run-off data from pre-1981 returns were not held on the main DTI database and it was decided to restrict our analysis to the trapezium of data submitted in the years 1981-86 rather than to look at the full

run-off triangle. (DTI did have a facility for accessing run-off data from earlier returns but this is only for chain-ladder calculations used as part of the screening of the returns and would not have been of assistance).

A10.3 Data from the 1987 returns were not available when we commenced work. We intend to use this additional data as we continue work over the coming year.

#### A11 Comp/non-comp split

A11.1 Most companies did not distinguish between comprehensive and non-comprehensive motor business prior to 1981. For these companies, the motor data for the years of occurrence 1980 and earlier is for a combined risk group, private motor. It is quite possible, on the assumption that in the later stages the run-offs of comprehensive and non-comprehensive are similar (because virtually all own damage claims should be settled quite early), to use the data for these earlier years.

A11.2 However although a lot of work has been done on these lines it was not possible to complete it in time for this convention. It was also felt that further comparison between comprehensive and non-comprehensive run-offs for those companies was needed before results could be presented publicly. Accordingly the motor data in this interim report is based only on the occurrence years 1981-86, except for those companies which distinguished the two categories prior to 1981.

#### A12 Companies analysed

A12.1 Because it was not possible to obtain data direct from the DTI database it was necessary to input the data manually and the working party wish to thank those who assisted with this task. It was however possible to obtain a computer printout of the data on the relevant forms (this was part of the DTI system presumably intended to assist in checking the data) and this was helpful in

supplementing those individual company returns which we had to hand.

A12.2 To keep the drudgery of manual input within reasonable limits the number of companies was restricted. Data from 19 companies were used for the employers liability analyses. 22 companies' data were used for the motor analyses. Since many companies write both employers liability and motor business, data were examined from a total of 24 companies. This set of companies included those with the largest shares of the respective markets together with a sprinkling of companies with smaller shares.

### A13 Data errors and inconsistencies

A13.1 In common with most (if not all) other forms of statistical reporting, errors have crept into the claims run off forms submitted by companies. In some cases this is obvious, where for instance the amount in 33.19.3 (amount of payments in previous financial years) is not consistent with the payments shown in earlier returns. In other cases errors would not be (readily) apparent from examination of the returns.

A13.2 There may also be inconsistencies from one year to another, which may or may not show up in the returns, which it would not be correct to classify as errors. Readers are warned that, without detailed knowledge of the procedures and events within individual companies, caution must be exercised when drawing conclusions about individual companies from run off data.

A13.3 The working party decided to treat the particular discrepancy noted in A13.1 by ignoring any figure in 33.19.3 which conflicted with data in earlier returns.

#### A14 Statistical variation

A14.1 It is well known that stochastic variation can lead to quite large differences between one set of run off statistics and another. This is particularly the case for gross claims run-offs, where single large claims can be significant.

A14.2 In the tail of the run-off (or for small accounts, throughout) variation in numbers of claims settled at each duration can be large in proportion to the expected number. When the variability of claim amount is considered also it will be appreciated that in many cases quite large differences in run-off patterns of claims amounts between companies or, within a company, between years of occurrence might be due primarily to chance.

#### A15 Identification of companies

A15.1 We have not presented enough data in this interim report to enable the reader to consider the impact of statistical variation on an individual company's run off. Partly for this reason, partly because of possible errors discussed in A13, and partly because we ourselves have not yet considered the variation from company to company in detail, we have not named the individual companies in the tables in Section C. No attempt has been made to disguise the individual companies by doctoring the data in any way, but in order to identify individual companies one would generally need to have access to their full run off data.

A15.2 It is intended that individual companies will be identified in our final report. In the tables in Section C companies are ordered by the size of the account, which we have taken as total claims paid to the end of 1986 for the years analysed. These amounts (in £K) are the "weights" shown.



A15.3 The employers liability and motor data are labelled independently. However the same labelling system (in order of decreasing total private motor account) has been used for the two motor risk groups to enable readers to make comparisons between the comprehensive and non-comprehensive risk groups for individual companies.

#### A16 Standard deviations

In order to provide some insight into the variability of the run offs, between years standard deviations have been calculated from each company's run off data and shown in Section C for two of the methods (see Section B for a definition of those standard deviations). It is not clear to the members of working party what the precise significance of these particular standard deviations is. They are intended to provide only a rough indication of variability. For the purpose of computing the standard deviations the complete run-off pattern has been used, so they are not directly comparable with the run-off patterns shown (see 17.1).

#### A17 Tail factors

A17.1 Tail factors were obtained by averaging from company estimates for the three earliest years (75-77 or 81-83). They assume that the company estimates are correct, are not discounted (explicitly or implicitly) and make full allowance for future inflation. To the extent that this set of assumptions is incorrect, the tail factors are wrong. To prevent errors in tail factors distorting the run off at earlier durations, expected payments after the twelfth (sixth for motor) year of run off are excluded from the denominator when displaying the run off pattern.

A17.2 For the employers liability data the working party noted considerable variation between companies in the proportion of claims outstanding after the twelfth year of run off. It was

thought that one factor that might help account for this was the presence or absence of industrial deafness or other industrial disease (e.g. asbestosis) exposure. However whether this applied in a particular case could have been determined only by consulting the company concerned.

A17.3 Companies with a large amount of industrial disease claims outstanding would be expected to have relatively large proportions outstanding at the longer durations. Industrial disease was also noted as a possible source of distortion in the statistics since there is often no uniquely correct way of allocating degenerative industrial disease claims to a year of origin.

#### A18 Mean terms

A18.1 The working party considered that the mean term of outstanding claims provided a simple means of consolidating the length of a run off pattern into a simple figure. Knowledge of the mean term would enable the approximate impact of discounting to be estimated.

A18.2 We assumed that all payments were evenly spread throughout the year in calculating the mean terms. This is of course an oversimplification, and it was noted that certain companies make other assumptions in their own analyses. However for the particular purpose of inter company comparison it was not thought that our assumption was likely to cause serious distortions. Alternative assumptions can be investigated in the future as our work progresses.

A18.3 Assumptions were necessary regarding the mean terms of the tails of the available run off patterns. It would have been possible to fit curves to the run offs and from these to estimate mean terms for the tail. However we considered that the results were likely to be of doubtful accuracy and might introduce spurious differences between companies. It was thought

preferable to make an arbitrary assumption, rather than to use a more sophisticated procedure of dubious accuracy.

A18.4 It was thought that in most cases the precise assumption about the mean term of the tail of the distribution would not have a great effect when discounting. It was assumed that the mean term of outstanding claims at the end of the twelfth year was 4 years for employers liability, and for motor at the end of the sixth year was 2 years.

A18.5 Where no further payments are outstanding, the mean term has no meaning. As the calculation reduces to 0/0 the table shows "ERROR".

#### A19 Estimation of run-off patterns

A19.1 The problem of estimating run off patterns from a set of run-off data is most commonly met in the context of the estimation of outstanding claims or the validation of an outstanding claims provision. Most methods of estimating outstanding claims statistically, generate, implicitly or explicitly, an assumed run-off pattern.

A19.2 The working party used four methods of estimation. Three of them are familiar in the context of outstanding claims estimation/verification: basic chain ladder, inflation adjusted chain ladder and an average claim method. The fourth was an ad hoc method based inter alia on the assumption that a company's outstanding claims estimate was correct (this seemed appropriate since our genesis was in the context of the discounting of outstanding claims). The methods are described in more detail in Section B.

A19.3 There is a basic difference between using the run off pattern to estimate outstanding claims given knowledge of paid claims, and using it to allocate a given estimate of outstanding claims between years of payment for the purpose of discounting.

This is that the effect of data fluctuations on the reserve is much less in the second case and therefore objections to using (say) the basic chain ladder for estimating claims have much less force when allocation of claims between years of payment is considered.

A19.4 The run off patterns presented are those appropriate to such an allocation between years of payments. In the case of the inflation adjusted chain ladder and the average claim method where it is assumed that future earnings and claims inflation respectively will be at a constant rate of 8% pa, the run off patterns presented assume inflation of 8% throughout.

#### A20 Inflation

The 8% inflation assumption was essentially arbitrary but it was thought to be a not unreasonable assumption to make in the early part of 1987. This was when the 1986 returns were finalised and the 8% assumption was thought to be likely to be reasonably consistent with most companies' claims estimates.

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### B DESCRIPTION OF CALCULATIONS

#### B1 Data

B1.1 This section sets out the formulae used to produce the tables displayed in Section C. All of the data was extracted from DTI Form 33, one of which appears each reporting year for each accident year until that accident year's claims have been run off. A database was created using all of column 1 (numbers of claims) and line 19 (amounts of payments).

B1.2 The notation adopted for the data is as follows:-

(i,j)(AY, DY) is the item from line i, column j of Form 33 for accident year AY as reported in development year DY (note that  $AY+DY \leq 86$ )

B1.3 As explained in A13 above, cumulative payments to date (19.3) (AY,DY) are sometimes inconsistent with prior year's returns. For EL (and six companies' MC and MN) the cumulative figure for prior years was used from the 1981 returns, but in all other circumstances the payments in each financial year (19.2) (AY,DY) were used. Although all the data in column 1 was captured, no sophisticated treatment of re-opened or nil claims was attempted and so the data items actually used reduce to:

(19.2) (AY,DY) - Payments in financial year  
(19.3) (AY, 1981-AY) - Payments in years prior to 1981 for EL and 6 Motor companies

(19.4) (AY,1986-AY) - Companies estimate of outstanding payments as reported at end of 1986.

(19.1) (AY,0) - Total no. of claims as at end of development year 0, including estimated no. of IBNR.

(The number of claims is only used in the Average Claim method, and it was decided that the variation in total number of claims after year 0 was insignificant in the context of this method).

## B2 Employers Liability

B2.1 Data was used from DTI Returns 1981 to 1986 in respect of accident years 1975 to 1986. This creates a trapezium of data for 12 accident years leading to a run off pattern over 13 intervals after allowing for the "outstanding" item. Results are presented in Section C for the full run off over 13 periods.

## B3 Motor

B3.1 Since the introduction of new DTI Forms from 1981 onwards, private motor is always split into 2 classes - Comprehensive (MC) and Non-Comprehensive (MN). For 6 companies the data in respect of accident years prior to 1981 has also been split in subsequent returns, and for these companies the same calculations were carried out over 12 years (13 periods) 1975-1986 as for EL. For the majority of companies, however, a split is not available and so the tables presented in Section 6 are for run off pattern over 6 years (7 periods) 1981-1986. The six companies with longer patterns available are however also presented in the same 6/7 year tables but can be distinguished by the existence of standard deviations for development year 5 (see also Section A11).

## B4 Inflation

B4.1 For two of the methods - Inflation Adjusted Chain Ladder and Average Claim - inflation assumptions are needed in order to adjust past payments to 1986 values. The inflation rates chosen are based on the DOE Average Earnings Index, all employees, whole economy, June values.

B4.2 The rates of inflation assumed from mid-year (Y-1) to mid year Y are as follows:-

<u>Y</u>	<u>I(Y)</u>	<u>Y</u>	<u>I(Y)</u>
1976	16.77%	1982	9.76%
1977	9.47%	1983	8.24%
1978	16.51%	1984	5.21%
1979	16.10%	1985	9.14%
1980	19.55%	1986	8.03%
1981	12.00%		

## B5 Calculations and Formulae

B5.1 The following four methods of claims estimation were used and the calculations and formulae are set out later in this section :

1. Basic Claim Ladder (BCL)
2. Inflation Adjusted Claim Ladder (IACL)

3. Average Claim  
Method (AC)

4. Company Incurred  
Method (CI)

B5.2 The stage by stage outputs from the spreadsheet system are attached. The corresponding formulae have been set out alongside in manuscript. It is hoped that this will give readers a full specification of how the calculations were performed. Certain stages of the spreadsheet system were either superfluous or ignored and therefore not every triangle or line of output has been described by a formula.

B5.3 The caveat in Section D12 must be repeated here: this section of the Interim Report was completed just prior to the convention and has not been fully scrutineered by the members of the Working Party.

BCL ①

Company No. 10

Comp. motor

## BASIC CHAIN LADDER

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## PAYMENTS

=====

offset = 11

	<u>DY</u>						
	Development years						
	0	1	2	3	4	5	6-ULT
81	14,041	5,419	905	584	505	503	434
82	14,483	5,400	868	1,003	539		
<u>AY</u> 83	17,237	6,844	1,378	1,242			
84	20,875	7,804	1,247				
85	23,024	8,796					
86	27,786						

Note

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1. The sum of these payments is inconsistent with that shown in the returns as cumulative payments.

## CUMULATIVE PAYMENTS

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	Development years						
	0	1	2	3	4	5	ULT
81	14,041.0	19,460.0	20,365.0	20,949.0	21,454.0	21,962.0	22,396.0
82	14,483.0	19,883.0	20,751.0	21,754.0	22,293.0		
83	17,237.0	24,081.0	25,459.0	26,701.0			
84	20,875.0	28,679.0	29,926.0				
85	23,024.0	31,820.0					
86	27,786.0						

A	123,923	96,501	69,404	43,747	21,962
B	89,660	92,103	66,575	42,703	21,454

Development factors	1.3821	1.0478	1.0425	1.0244	1.0237
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COMPANY	O/S	PROJ.	ADJUSTED	CUM. PAID	GROWTH
O/S END		PAYMENTS	TO YR 5	TO YR 5	FACTOR
YEAR	END 86				
====	=====	=====	=====	=====	=====
	(1)	(2)	(3)	(4)	(5)
81	434.0		434.0	21,962.0	1.0198 = a
82	1,314.0	527.9	786.1	22,820.9	1.0344 = b
83	2,132.0	1,300.5	831.5	28,001.5	1.0297 = c
					=====
			AVERAGE :	1.0280	

(19.4)(AY, 86-AY)Payment Data:

(19.2)(AY, DY)

For 12 year tables this is a trapezium. Oldest diagonal is (19.3)(AY, 1981-AY).

Standard Chain Ladder:

$$CPAY(AY, DY) = \sum_{d=0}^{DY} (19.2)(AY, d)$$

Development factors DF(DY) for DY = 0 to 4

$$= \frac{\sum_{a=81}^{85-DY} CPAY(a, DY+1)}{\sum_{a=81}^{85-DY} CPAY(a, DY)}$$

3 year average for tail factor DF(5):

$$\text{Let } a = \frac{(19.4)(81, 5)}{CPAY(81, 5)}$$

$$b = \frac{(19.4)(82, 4) - (DF(4) - 1) \cdot CPAY(82, 4)}{CPAY(82, 4) \times DF(4)}$$

$$c = \frac{(19.4)(83, 3) - (DF(3) - 1) \cdot CPAY(83, 3)}{CPAY(83, 3) \times DF(3) \times DF(4)}$$

$$\text{Then } DF(5) = \frac{a + b + c}{3}$$



## FUTURE CUMULATIVE PROJECTION

=====

Development years	UPAY (AY)					
	0	1	2	3	4	5 ULT
81						22,576.2
82					22,820.9	23,459.1
83				27,353.8	28,001.5	28,784.6
84			31,197.7	31,960.4	32,717.2	33,632.2
85		33,339.4	34,756.1	35,605.9	36,449.0	37,468.4
86	38,404.2	40,238.1	41,947.9	42,973.5	43,991.0	45,221.4

Calculate Ultimate:

$$UPAY(AY) = \frac{5}{CPAY(AY, 86-AY) \cdot \prod DF(n)} \quad n = 86-AY$$

## FUTURE NON CUMULATIVE PROJECTION

=====

Development years						
	0	1	2	3	4	5 6-ULT
81						614.2
82					527.9	639.3
83				652.8	647.7	783.2
84			1,271.7	762.7	755.8	915.0
85		1,519.4	1,416.7	849.7	843.1	1,019.4
86	10,618.2	1,833.8	1,709.9	1,025.5	1,017.6	1,230.4

ACCIDENT YEAR	PROJECTED OUTSTANDING	CUMULATIVE PAID	PROJECTED INCURRED
81	614	21,962	22,576
82	1,166	22,293	23,459
83	2,084	26,701	28,785
84	3,706	29,926	33,632
85	5,648	31,820	37,468
86	17,435	27,766	45,221

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160,488

## PAYMENTS AS % OF ULT. FROM BASIC C-L

=====

Development years						
	0	1	2	3	4	5 6-ULT
81	.6219	.2400	.0401	.0259	.0224	.0225
82	.6174	.2302	.0370	.0428	.0230	
83	.5988	.2378	.0479	.0431		
84	.6207	.2320	.0371			
85	.6145	.2348				
86	.6144					

AVERAGE .6145 .2350 .0405 .0373 .0227 .0225 .0272

STANDARD DEVIATION .0083 .0040 .0051 .0099 .0004

Standard Deviation  
by (n-1) Method:

$$PCULT(AY, DY) = \frac{(19.2)(AY, DY)}{UPAY(AY)}$$

Calculate Standard Deviation

$$AVEPC(DY) = \left[ \sum_{a=81}^{86-DY} PCULT(a, DY) \right] \div (6-DY)$$

$$SD(DY) = \sqrt{\frac{\sum_{a=81}^{86-DY} (PCULT(a, DY) - AVEPC(DY))^2}{(6-DY) - 1}}$$

## CUMULATIVE PAYMENTS AS % OF ULT. FROM BASIC C-L

=====

	Development years						
	0	1	2	3	4	5	ULT
B1	.6219	.8620	.9021	.9279	.9503	.9728	1.0000
B2	.6174	.8476	.8846	.9273	.9503		
B3	.5988	.8366	.8845	.9276			
B4	.6207	.8527	.8898				
B5	.6145	.8492					
B6	.6144						

RUN OFF							
PATTERN	.6144	.8492	.8898	.9276	.9503	.9728	1.0000

MEAN TERM	1.34	1.67	2.49	2.23	2.13	1.87	2.00
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Only the leading diagonal is needed

$$CPCULT(DY) = \sum_{d=0}^{DY} PCULT(26-DY, d)$$

Non cum							
run patt	.6144	.2348	.0406	.0378	.0227	.0225	.0272
weights	1.3366	.6438	.3757	.2452	.1539	.0929	.0544
outst	1.0000	.3856	.1508	.1102	.0724	.0497	.0272

$$ROP(0) = CPCULT(0) \text{ For } DY=166$$

$$ROP(DY) = CPCULT(DY) - CPCULT(DY-1)$$

Aliter: (and easier!)

$$ROP(DY) = \frac{1}{\sum_{n=DY}^5 DF(n)} - \frac{1}{\sum_{n=DY-1}^5 DF(n)}$$

Run off patterns tabulated in Section C are adjusted so that development years 0-5 sum to one. Thus tabulated r.o. pattern:

$$TROP(DY) = \frac{ROP(DY)}{CPCULT(5)}$$

## (\*) Calculation of Mean Terms

Arbitrary assumption is made, for Motor, that Mean Term at ultimate stage is 2 years (for EL, 4 years). Other payments are assumed midway through the year. Thus:

$$MT(DY) = \frac{\sum_{d=DY}^5 ROP(d) \cdot (d-DY + \frac{1}{2}) + ROP(0) \cdot (3-DY)}{\sum_{d=DY}^5 ROP(d)}$$

Comp motor Company No. 10

IACL ①

PAYMENTS  
=====

offset = 11

	Development years						
	0	1	2	3	4	5	5-Ult
81	14,041	5,419	905	584	505	508	434
82	14,483	5,400	868	1,003	539		
83	17,237	6,844	1,378	1,242			
84	20,875	7,804	1,247				
85	23,024	8,796					
86	27,786						

(19.2)(AY,DY)

Note

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1. The sum of these payments is inconsistent with that shown in the Returns as cumulative p

CUMULATIVE PAYMENTS  
=====

	Development years						
	0	1	2	3	4	5	5-Ult
81	14,041.0	19,460.0	20,365.0	20,949.0	21,454.0	21,962.0	22,396.0
82	14,483.0	19,883.0	20,751.0	21,754.0	22,293.0		
83	17,237.0	24,081.0	25,459.0	26,701.0			
84	20,875.0	28,679.0	29,926.0				
85	23,024.0	31,820.0					
86	27,786.0						

C PAY (AY,DY)

~~Eagle star : C213~~      ~~Cornhill~~  
~~Employers Liability~~      ~~Comp motor~~

INFLATION ADJUSTED CHAIN LADDER  
=====

YEAR	INFLATION	YEAR	CUMULATIVE
Y	I(Y) RATE		INFLATION CI(Y)
81/82	9.76%	81/86	1.4737
82/83	8.24%	82/86	1.3427
83/84	5.21%	83/86	1.2405
84/85	9.14%	84/86	1.1790
85/86	8.03%	85/86	1.0803
		86/86	1.0000

NOTE

----

1. DoE Average Earnings Index, all employees, whole economy, June value

FUTURE INFLATION: 8.00%

Inflation Assumptions

$I(Y)$  = Inflation from year Y-1 to

$$CI(Y) = \prod_{x=86}^{86} (1 + I(x))$$

$$x = Y+1$$

Future Inflation assumed  
at 8%

# PAYMENTS IN 1986 PRICES

=====

IACL ②

Development years		0	1	2	3	4	5	6-Ult
81	20,692.6		7,276.0	1,122.6	688.6	545.6	508.0	434.0
82	19,446.1		6,698.5	1,023.4	1,083.5	539.0		
83	21,381.9		8,069.3	1,488.7	1,242.0			
84	24,612.4		8,430.7	1,247.0				
85	24,872.8		8,796.0					
86	27,786.0							

Inflation Adjusted Payments

$$IAPAY(AY,DY) = (1+I)(AY,DY) \cdot CI(AY,DY)$$

## NOTES

-----

1. 5-Ult is in money not real prices

## CUMULATIVE PAYMENTS IN 1986 PRICES

=====

Development years		0	1	2	3	4	5	Ult
81	20,692.6		27,968.6	29,091.2	29,779.8	30,325.3	30,833.3	31,267.3
82	19,446.1		26,144.6	27,168.0	28,251.5	28,790.5		
83	21,381.9		29,451.3	30,939.9	32,181.9			
84	24,612.4		33,043.1	34,290.1				
85	24,872.8		33,668.8					
86	27,786.0							

$$IACPAY(AY,DY) = \sum_{d=0}^{DY} IAPAY(AY,d)$$

A	150,276	121,489	90,213	59,116	30,833
B	111,006	116,608	87,199	58,031	30,325

As for BCL Method

Development factors		1.3538	1.0419	1.0346	1.0187	1.0168	← DF(DY) DY = 0.64	
Cum pymts	1.0000	1.3538	1.4104	1.4592	1.4865	1.5114	1.5540	
Payments	1.0000	.3538	.0567	.0488	.0273	.0249	.0426	
With infl	1.0000	.3821	.0661	.0614	.0371	.0366	.0626	

COMPANY		O/S		GROWTH	
O/S END		PROJ. ADJUSTED CUM. PAID		FACTOR	
YEAR	END 86	PAYMENTS	TO YR 5	TO YR 5	
=====	=====	=====	=====	=====	=====
	(1)	(2)	(3)	(4)	(5)
81	434.0		434.0	21,962.0	1.0198
82	1,314.0	520.9	793.1	22,813.9	1.0348
83	2,132.0	1,290.1	841.9	27,991.1	1.0301
					=====
					1.0282

As for BCL Method

$$= DF(5)$$

## GROWTH RATIOS

=====

Development years		1/0	2/1	3/2	4/3	5/4	ULT/5
81	1.3516		1.0401	1.0237	1.0183	1.0168	1.0282
82	1.3445		1.0391	1.0399	1.0191		
83	1.3774		1.0505	1.0401			
84	1.3425		1.0377				
85	1.3536						
86							

Assumed mean term to payment at 5 :

2 years

## FUTURE CUMULATIVE PROJECTION - NO FUTURE INFLATION

=====

Development years							Ult
	0	1	2	3	4	5	
81							31,702.9
82						29,272.8	30,098.3
83				32,783.4	33,332.6		34,272.6
84			35,475.4	36,138.4	36,743.8		37,780.0
85		35,078.3	38,290.9	36,969.1	37,588.4		38,648.4
86	37,615.8	39,190.6	40,545.3	41,303.0	41,994.9		43,179.2

$$FCPAY(AY,DY) = IACPAY(AY,86-AY)$$

$$\times \prod_{n=86-AY}^{DY} DF(n)$$

## FUTURE NON CUMULATIVE PROJECTION WITH FUTURE INFLATION

=====

Development years							6-Ult
	0	1	2	3	4	5	
81							869.5
82						520.9	891.6
83					649.6	640.6	1,096.4
84			1,280.1	773.3	762.6		1,305.3
85		1,522.3	1,414.3	854.4	842.5		1,442.2
86	10,616.2	1,836.8	1,706.5	1,030.9	1,016.6		1,740.1

$$FIAPAY(AY,DY) = [FCPAY(AY,DY) - FCPAY(AY,DY-1)] \times 1.08^{AY}$$

ACCIDENT YEAR	PROJECTED OUTSTANDING IN MONEY TERMS	CUMULATIVE PAID IN MONEY TERMS	PROJECTED INCURRED IN MONEY TERMS	} UPAY(AY)
81	870	21,962	22,832	
82	1,412	22,293	23,705	
83	2,387	26,701	29,088	
84	4,121	29,926	34,047	
85	6,076	31,820	37,896	
86	17,947	27,786	45,733	

$$UPAY(AY) = \sum_{d=87-AY}^5 FIAPAY(AY,d) + FCPAY(AY,86-AY)$$

## ACTUAL PAYMENTS AS % OF ULT. FROM I-A-C-L

=====

Development years							6-Ult
	0	1	2	3	4	5	
81	.6150	.2373	.0396	.0256	.0221	.0222	.0381
82	.6110	.2278	.0366	.0423	.0227		
83	.5926	.2353	.0474	.0427			
84	.6131	.2292	.0366				
85	.6076	.2321					
86	.6076						

As for BCL Method

AVERAGE	.6078	.2324	.0401	.0369	.0224	.0222	.0381
---------	-------	-------	-------	-------	-------	-------	-------

STANDARD DEVIATION	.0080	.0040	.0051	.0098	.0004		
--------------------	-------	-------	-------	-------	-------	--	--

Not Used for IACL

COEFF. OF VARIATION	1.32%	1.73%	12.67%	26.52%	1.95%		
---------------------	-------	-------	--------	--------	-------	--	--

Note

=====

1. The projected outstanding is used.

ACTUAL CUMULATIVE PAYMENTS AS % OF ULT. FROM I-A-C-L

=====

IACL ④

	Development years						Ult
	0	1	2	3	4	5	
81	.6150	.8523	.8920	.9175	.9397	.9619	1.0000
82	.6110	.8388	.8754	.9177	.9404		
83	.5926	.8279	.8753	.9180			
84	.6131	.8423	.8790				
85	.6076	.8397					
86	.6076						
RUN OFF PATTERN	.6076	.8397	.8799	.9172	.9397	.9620	1.0000
MEAN TERM	1.41	1.82	2.74	2.48	2.38	2.08	2.00
As for BCL Method							
Non cum run patt	.6076	.2321	.0402	.0373	.0225	.0222	.0380
weights	1.4111	.7149	.4385	.2983	.1968	.1253	.0761
outst	1.0000	.3924	.1603	.1201	.0828	.0603	.0380

Tabulated Run Off pattern, TROP(DY), adjusted so that  
development years 0-5 sum to one - see BCL Method

Comp motor Company No. 10

AC ①

PAYMENTS  
=====

offset = 11

		Development years						
		0	1	2	3	4	5	5-Ult
81	14,041	5,419	905	534	505	508		434
82	14,483	5,400	868	1,003	539			
83	17,237	6,844	1,378	1,242				
84	20,875	7,804	1,247					
85	23,024	8,796						
86	27,786							

Note

----

1. The sum of these payments is inconsistent with that shown in the Returns as cumulative

CUMULATIVE PAYMENTS  
=====

		Development years						
		0	1	2	3	4	5	Ult
81	14,041	19,460	20,365	20,949	21,454	21,962		22,396
82	14,483	19,883	20,751	21,754	22,293			
83	17,237	24,081	25,459	26,701				
84	20,875	28,679	29,926					
85	23,024	31,820						
86	27,786							

Cornhill  
Comp motor

AVERAGE CLAIM METHOD  
=====

YEAR	INFLATION RATE	YEAR	CUMULATIVE INFLATION
81/82	9.76%	81/86	1.4737
82/83	8.24%	82/86	1.3427
83/84	5.21%	83/86	1.2405
84/85	9.14%	84/86	1.1790
85/86	8.03%	85/86	1.0803
		86/86	1.0000

*I(Y), CI(Y) as for IACL*

NOTE

----

1. DoE Average Earnings Index, all employees, whole economy, June value

FUTURE INFLATION: 8.00%

ESTIMATE OF ULTIMATE CLAIMS REPORTED  
=====

offset = 10

		Development years				
		0	1	2	3	4

82	58,591	57,356	57,386	57,393	57,402
83	62,765	63,068	63,107	63,124	
84	68,227	69,136	69,294		
85	71,471	73,041			
86	82,173				

AC (2)

(Not Used)

A	320,160	247,362	178,127	115,013	57,617
B	319,114	247,119	178,088	115,003	57,611

(Not Used)

Development factor	1.0033	1.0011	1.0002	1.0001	1.0001
--------------------	--------	--------	--------	--------	--------

Estimate of ult. claims  
at end of dev year 0

=====

Ultimate Number of Claims

81	58,060.0
82	58,591.0
83	62,765.0
84	68,227.0
85	71,471.0
86	82,173.0

(19.1)(AY,0)

AVERAGE PAYMENT IN 1986 PRICES

=====

Development years

	0	1	2	3	4	5	6-Ult	
81	356.4	125.3	19.3	11.9	9.4	8.7	7.5	AVPAY(AY,DY)
82	331.9	114.3	17.5	18.5	9.2			
83	340.7	128.6	23.7	19.8				
84	360.7	123.6	18.3					
85	348.0	123.1						
86	338.1							

$\frac{(19.2)(AY,DY)}{(19.1)(AY,0)} \times CI(AY,DY)$

Average	346.0	123.0	19.7	16.7	9.3	8.7	= Simple Average of col. above	
With Infl	346.0	132.8	23.0	21.1	12.6	12.9	16.7	(*) see below
Normalised	.6123	.2350	.0407	.0373	.0224	.0228	.0296	= ROP(DY)

1. Average payments for cal. year 1980 are based on those emanating from the adjusted chain

COMPANY	O/S	O/S	O/S	O/S
YEAR	END 86	PROJ. PAYMENTS	ADJUSTED TO YR 11	AVERAGE QUIST.
====	=====	=====	=====	=====
	(1)	(2)	(3)	(4)
81	434.0		434.0	7.5
82	1,314.0	553.7	760.3	13.0
83	2,132.0	1,270.8	861.2	13.7
				=====
		AVERAGE :		11.4

3 year Average Method for  
DY=6 as for BCL

(\*) This line derived from  
Line above  $\times (1.08)^{DY}$ ;  
Last term  
=  $11.4 \times (1.08)^5$

Assumed mean term to payment at 12 :

2 years

Tabulated Run Off pattern,  $TROP(DY)$ , derived from  $ROP(DY)$  above  
so that years 0-5 sum to one - as for BCL.

Mean Terms derived as for BCL



CI ①

Company No. 10

Long motor

COMPANY'S ESTIMATED INCURRED

=====

offset = 14

Development years

	0	1	2	3	4	5
81	24,180	22,191	22,039	22,169	22,233	22,396
82	24,215	22,854	22,796	23,353	23,607	
83	28,836	28,043	28,458	28,833		
84	31,735	32,277	32,575			
85	35,622	35,847				
86	44,349					

Only latest Diagonal Used

$$= (19.4)(A_4, 86 - A_4)$$

NOTE

====

1. Incurred = the sum of payments made in each SY + the Company's estimate of outstan
2. Some differences may exist between this figure and that which can be deduced from the company Form 33 for the relevant year of runoff

Assumed mean term to payment at 12 : 1 years

PAYMENTS AS % OF LATEST INCURRED ESTIMATE

=====

Development years

	0	1	2	3	4	5	6-ULT
81	.6269	.2420	.0404	.0261	.0225	.0227	.0194
82	.6135	.2287	.0368	.0425	.0228		
83	.5978	.2374	.0478	.0431			
84	.6408	.2396	.0383				
85	.6423	.2454					
86	.6265						
AVERAGE	.6247	.2386	.0408	.0372	.0227	.0227	.0194
STANDARD DEVIATION	.0169	.0063	.0049	.0096	.0002		
COEFF. OF VARIATION	2.70%	2.62%	11.97%	25.93%	.88%		

$$PCLI(A_4, D_4) = \frac{(19.2)(A_4, D_4)}{(19.4)(A_4, 86 - A_4)}$$

SD(DY) - See BCL Formula

dev year paid	3.7479	1.1930	.1633	.1116	.0454	.0227	.0194	④ PD(DY)
corres. total paid		3.1214	3.4267	1.6713	1.8569	.9579	.9806	⑤ TPD(DY)
count	6	5	4	3	2	1	1	= PD CNT(DY)

$$\text{Line ④} = \text{Sum of column above} = \sum_{a=81}^{86-DY} PCLI(a, DY) = PD(DY)$$

$$\text{Line ⑤} = \text{Sum of earlier proportions for the accident years in the column above} = \sum_{a=81}^{86-DY} \sum_{d=1}^{DY-1} PCLI(a, d) = TPD(DY)$$

# PAYMENTS ADJUSTMENT TRIANGLE =====

CI (2)

	Development years						
	0	1	2	3	4	5	6
81							
82						.0300	.0250
83					.0234	.0272	.0233
84				.0276	.0170	.0198	.0169
85			.0320	.0273	.0168	.0195	.0167
86		.2372	.0388	.0331	.0204	.0237	.0203
proj. paid	.0000	.2372	.0708	.0980	.0777	.1203	.1027
count	0	1	2	3	4	5	5
run-off pattern	.6247	.2384	.0390	.0333	.0205	.0238	.0204

PR (AY, DY)

- See Below

(\*) TPR (DY)

= ES CNT (DY)

= ROP (DY)

- See Below

## CUMULATIVE PAYMENTS AS A %AGE OF ULT =====

(\*) = Sum of column above

$$TPR(DY) = \sum_{a=87-DY}^{86} PR(a, DY)$$

	Development years						
	0	1	2	3	4	5	6
81	.6269	.8689	.9093	.9354	.9579	.9806	1.0000
82	.6135	.8423	.8790	.9215	.9443		
83	.5978	.8352	.8830	.9261			
84	.6408	.8804	.9187				
85	.6423	.8877					
86	.6265						

RUN OFF							
PATTERN	.6247	.8630	.9020	.9353	.9558	.9796	1.0000
MEAN TERM	1.27	1.55	2.38	2.13	1.97	1.65	2.00

- See BCL Meth

## Calculation of PR (AY, DY)

COMPANYS	
LATEST	
INCURRED	
81	22,396
82	23,607
83	28,833
84	32,575
85	35,847
86	44,349

$$PR(AY, DY) = [1 - PCL(AY, 86 - AY)]$$

$$\times \frac{\frac{PD(DY)}{PDCNT(DY)}}{1 - \frac{PD(DY)}{TPD(DY)}}$$

Non cum							
run patt	.6247	.2384	.0390	.0333	.0205	.0238	.0204
weights	1.2701	.5824	.3262	.2087	.1274	.0730	.0407
outst	1.0000	.3753	.1370	.0980	.0647	.0442	.0204

$$\text{Calculation of } ROP(DY) : ROP(DY) = \frac{TPR(DY) + PD(DY)}{6}$$

Rationale: Outstanding payments for an accident year, according to the company's latest estimate, are spread over future years according to the average proportion that payments in that development year have been for paid accident years. The run-off pattern ROP(DY) is obtained by averaging paid and estimated proportions over 6 years.

Tabulated Run Off pattern, TROP(DY), adjusted so that development years

CLAIMS      RUNOFF      PATTERNS

WORKING PARTY

GISG      1988

INTERIM REPORT

SECTION C

RUNOFF      TABLES

Table 1. Run-off patterns from basic chain ladder adjusted so years 0-5 sum to one.

Company	Weight	Year 0	1	2	3	4	5	Later	Co.	Weight	Year 0	1	2	3	4	5	Later
1	482742	.6529	.2397	.0364	.0344	.0210	.0157	.0378	2	69404	.3135	.2786	.1654	.1145	.0804	.0476	.1125
2	445577	.6353	.2489	.0427	.0360	.0241	.0130	.0343	3	66858	.2586	.2778	.1587	.1231	.1040	.0779	.1196
3	426950	.6365	.2374	.0435	.0368	.0199	.0259	-.0035	1	64203	.3037	.2492	.1256	.1198	.1123	.0894	.0995
4	277442	.6381	.2293	.0446	.0393	.0303	.0185	.0249	6	57442	.3039	.2440	.1385	.1323	.1036	.0777	.1099
5	251302	.6382	.2400	.0435	.0360	.0270	.0153	.0316	15	36746	.3682	.3014	.1305	.0964	.0537	.0498	.0891
7	213892	.6656	.2257	.0360	.0289	.0305	.0134	.0205	9	32420	.2700	.2580	.1538	.1424	.1028	.0730	.1557
6	208483	.5947	.2803	.0416	.0390	.0290	.0154	.0187	13	32159	.3434	.2979	.1336	.1038	.0852	.0362	.1325
8	199356	.6362	.2488	.0410	.0318	.0298	.0124	.0376	5	27253	.2697	.2458	.1639	.1510	.0923	.0773	.1442
9	172901	.6329	.2240	.0421	.0413	.0347	.0250	.0592	11	22046	.3604	.2804	.0919	.1168	.0933	.0572	.0407
10	160488	.6316	.2414	.0417	.0389	.0233	.0231	.0280	8	21493	.3220	.2722	.1332	.1224	.0830	.0671	.0915
11	152356	.6288	.2542	.0386	.0343	.0272	.0169	.0175	4	20478	.3050	.2741	.1589	.1086	.0910	.0623	.0492
12	121651	.6279	.2544	.0422	.0403	.0236	.0116	.0418	10	17803	.3512	.2769	.1339	.1038	.1121	.0222	.0307
13	102510	.6250	.2477	.0407	.0298	.0236	.0332	.0302	7	16195	.3188	.2647	.1529	.1230	.0928	.0478	.0892
14	94332	.6272	.2340	.0365	.0467	.0277	.0279	.0724	12	15242	.3054	.2879	.1564	.1403	.0738	.0361	.1178
16	68568	.6554	.2455	.0409	.0242	.0225	.0115	.0282	14	13660	.3306	.2398	.1181	.1600	.0871	.0644	.1876
17	59445	.5629	.2466	.0374	.0351	.0210	.0970	-.0144	19	7278	.4003	.2353	.1075	.0800	.0472	.1298	.2598
15	55804	.6143	.2676	.0450	.0555	.0116	.0060	.0601	16	5358	.3543	.3116	.1741	.1011	.0465	.0124	.2034
18	33899	.5674	.2364	.0636	.0345	.0330	.0651	.0047	17	4853	.2783	.2574	.1277	.1969	.0632	.0765	.1556
19	25195	.6646	.2361	.0394	.0397	.0148	.0054	.0759	18	4817	.1865	.1954	.2124	.1304	.1655	.1097	.0833
20	13640	.6006	.2468	.0460	.0548	.0281	.0238	.0081	21	2134	.2566	.2345	.0991	.2266	.1140	.0691	.1854
21	9000	.6500	.2314	.0383	.0368	.0416	.0019	.0401	22	826	.3465	.2175	.1420	.1035	.1461	.0444	.0230
22	4789	.6115	.2117	.0373	.0395	.0052	.0948	.0725	20	649	.4596	.3696	.0693	.0867	.0075	.0073	.2042
Average		.6272	.2422	.0418	.0379	.0250	.0260	.0330			.3185	.2668	.1385	.1265	.0890	.0607	.1220
Weightd av		.6347	.2429	.0412	.0364	.0253	.0196	.0286			.3089	.2682	.1435	.1224	.0924	.0646	.1111
Aggregate	3580322	.6368	.2428	.0407	.0353	.0249	.0195	.0307		539317	.3099	.2685	.1423	.1201	.0888	.0704	.1213
Std devn		.0270	.0147	.0057	.0073	.0079	.0260	.0242			.0564	.0362	.0309	.0343	.0338	.0293	.0613

Table 2. Within-company std devns of the incremental payments as % of ultimate payments estimated by the BCL.  
Private Motor  
Comprehensive

Company	Weight	Year 0	1	2	3	4	5	Later	Co.	Weight	Year 0	1	2	3	4	5	Later
1	482742	.0171	.0144	.0029	.0038	.0025			2	69404	.0147	.0126	.0167	.0207	.0067		
2	445577	.0136	.0063	.0049	.0084	.0015			3	66858	.0127	.0140	.0180	.0148	.0174		
3	426950	.0153	.0184	.0025	.0018	.0039			1	64203	.0148	.0092	.0092	.0081	.0016		
4	277442	.0128	.0129	.0036	.0088	.0139	.0045		6	57442	.0153	.0097	.0139	.0222	.0308	.0346	
5	251302	.0155	.0101	.0085	.0113	.0070	.0046		15	36746	.0225	.0073	.0078	.0197	.0160		
7	213892	.0096	.0103	.0047	.0021	.0021			9	32420	.0178	.0119	.0130	.0236	.0186	.0078	
6	208483	.0112	.0065	.0076	.0094	.0131	.0052		13	32159	.0079	.0114	.0092	.0108	.0240		
8	199356	.0125	.0113	.0031	.0085	.0041			5	27253	.0240	.0178	.0282	.0353	.0275	.0306	
9	172901	.0167	.0110	.0083	.0075	.0095	.0079		11	22046	.0599	.0382	.0293	.0419	.0423	.0583	
10	160488	.0083	.0040	.0051	.0099	.0004			8	21493	.0109	.0150	.0158	.0245	.0687		
11	152356	.0493	.0501	.0132	.0058	.0023	.0135		4	20478	.0291	.0233	.0331	.0222	.0288	.0220	
12	121651	.0264	.0258	.0041	.0071	.0045			10	17803	.0361	.0240	.0254	.0034	.0125		
13	102510	.0071	.0071	.0077	.0073	.0052			7	16195	.0187	.0089	.0224	.0022	.0137		
14	94332	.0091	.0044	.0065	.0132	.0038			12	15242	.0131	.0252	.0258	.0126	.0272		
16	68568	.0195	.0275	.0070	.0073	.0058			14	13660	.0592	.0415	.0185	.0522	.0153		
17	59445	.0261	.0232	.0101	.0140	.0038			19	7278	.0818	.0251	.0510	.0615	.0224		
15	55804	.0137	.0133	.0040	.0158	.0035			16	5358	.0323	.0420	.0166	.0347	.0108		
18	33899	.0196	.0100	.0291	.0026	.0128			17	4853	.0344	.0236	.0193	.0358	.0757		
19	25195	.0163	.0115	.0080	.0177	.0022			18	4817	.0238	.0257	.0553	.0561	.0438		
20	13640	.0529	.0431	.0198	.0418	.0286	.0221		21	2134	.0486	.0295	.0287	.1352	.0387		
21	9000	.0247	.0158	.0262	.0278	.0136			22	826	.0793	.0621	.0526	.0116	.1562		
22	4789	.0320	.0178	.0331	.0372	.0014			20	649	.0969	.0543	.0370	.0594	.0113	.0191	
Average s.d.		.0195	.0161	.0100	.0122	.0066					.0343	.0242	.0248	.0322	.0323		
Weightd av s.d.		.0161	.0138	.0057	.0073	.0052					.0211	.0156	.0178	.0210	.0209		
SD of aggregate		.0103	.0077	.0026	.0029	.0005					.0138	.0036	.0101	.0092	.0010		

Table 3. Mean payment terms from basic chain ladder using ultimate mean term of 2 years.

Company	Weight	Year 0	1	2	3	4	5	Later	Co.	Weight	Year 0	1	2	3	4	5	Later
1	482742	1.33	1.74	2.78	2.54	2.49	2.27	2.00	2	69404	2.62	2.45	2.49	2.42	2.34	2.26	2.00
2	445577	1.33	1.66	2.58	2.40	2.36	2.31	2.00	3	66858	2.88	2.60	2.60	2.38	2.15	2.01	2.00
3	426950	1.12	1.22	1.60	1.21	.82	.11	2.00	1	64203	2.78	2.64	2.62	2.26	1.95	1.82	2.00
4	277442	1.32	1.66	2.35	2.09	1.93	1.93	2.00	6	57442	2.79	2.66	2.59	2.28	2.09	1.96	2.00
5	251302	1.33	1.68	2.52	2.32	2.20	2.19	2.00	15	36746	2.32	2.25	2.51	2.42	2.38	2.10	2.00
7	213892	1.21	1.55	2.38	2.10	1.82	2.01	2.00	9	32420	3.04	2.82	2.77	2.50	2.36	2.20	2.00
6	208483	1.30	1.42	2.21	1.91	1.78	1.87	2.00	13	32159	2.61	2.53	2.76	2.61	2.47	2.46	2.00
8	199356	1.36	1.72	2.70	2.50	2.30	2.38	2.00	5	27253	3.00	2.77	2.66	2.43	2.35	2.13	2.00
9	172901	1.58	2.17	3.03	2.69	2.45	2.26	2.00	11	22046	2.21	2.12	2.25	1.77	1.54	1.54	2.00
10	160488	1.34	1.67	2.49	2.23	2.13	1.87	2.00	8	21493	2.57	2.44	2.50	2.23	2.10	1.94	2.00
11	152356	1.25	1.45	2.25	1.96	1.77	1.77	2.00	4	20478	2.37	2.14	2.09	1.90	1.66	1.60	2.00
12	121651	1.39	1.74	2.71	2.50	2.55	2.46	2.00	10	17803	2.10	1.92	1.90	1.60	1.29	1.95	2.00
13	102510	1.38	1.73	2.68	2.43	2.10	1.69	2.00	7	16195	2.54	2.38	2.36	2.17	2.07	2.13	2.00
14	94332	1.66	2.29	3.27	2.84	2.70	2.31	2.00	12	15242	2.63	2.43	2.49	2.34	2.47	2.41	2.00
16	68568	1.24	1.54	2.53	2.50	2.27	2.28	2.00	14	13660	3.05	3.04	3.03	2.62	2.63	2.36	2.00
17	59445	1.40	1.60	2.14	1.58	.95	.07	2.00	19	7278	3.26	3.54	3.69	3.36	2.88	2.17	2.00
15	55804	1.49	1.86	2.90	2.71	3.28	2.77	2.00	16	5358	2.77	2.72	3.01	3.22	3.26	2.86	2.00
18	33899	1.46	1.70	2.10	1.84	1.29	.67	2.00	17	4853	3.01	2.81	2.77	2.36	2.60	2.18	2.00
19	25195	1.51	2.15	3.37	3.20	3.32	2.83	2.00	18	4817	3.13	2.67	2.28	2.05	1.62	1.58	2.00
20	13640	1.29	1.45	1.91	1.48	1.37	1.14	2.00	21	2134	3.29	3.06	2.92	2.33	2.45	2.32	2.00
21	9000	1.36	1.80	2.68	2.38	2.20	2.89	2.00	22	826	2.25	2.15	1.93	1.57	1.08	1.35	2.00
22	4789	1.85	2.63	3.44	2.96	2.52	1.58	2.00	20	649	2.46	2.68	3.82	3.58	3.80	2.91	2.00
Average runoff		1.39	1.76	2.62	2.35	2.19	1.90	2.00			2.73	2.61	2.66	2.41	2.30	2.17	2.00
Weighted av runoff		1.32	1.65	2.51	2.26	2.13	1.98	2.00			2.70	2.55	2.58	2.35	2.19	2.08	2.00
Runoff of aggregate		1.33	1.68	2.57	2.33	2.19	2.03	2.00			2.76	2.62	2.67	2.44	2.26	2.08	2.00

Table 4. Run-off patterns from inflation-adjusted chain ladder adjusted so years 0-5 sum to one.

Company	Weight	Year 0	1	2	3	4	5	Later	Co.	Weight	Year 0	1	2	3	4	5	Later
1	482742	.6518	.2396	.0367	.0350	.0212	.0157	.0532	2	69404	.3111	.2771	.1664	.1162	.0812	.0481	.1469
2	445577	.6342	.2487	.0429	.0368	.0244	.0131	.0482	3	66858	.2561	.2756	.1597	.1244	.1054	.0788	.1526
3	426950	.6346	.2387	.0435	.0373	.0200	.0260	.0047	1	64203	.3016	.2481	.1262	.1211	.1130	.0899	.1280
4	277442	.6420	.2307	.0442	.0384	.0286	.0160	.0208	6	57442	.3088	.2451	.1392	.1314	.1026	.0728	.0936
5	251302	.6438	.2395	.0432	.0352	.0246	.0138	.0264	15	36746	.3664	.3002	.1306	.0978	.0545	.0505	.1178
7	213892	.6643	.2262	.0361	.0291	.0308	.0134	.0290	9	32420	.2745	.2621	.1540	.1420	.1001	.0674	.1387
6	208483	.5975	.2808	.0415	.0383	.0277	.0143	.0160	13	32159	.3429	.2971	.1343	.1045	.0850	.0361	.1764
8	199356	.6364	.2478	.0412	.0324	.0298	.0124	.0530	5	27253	.2751	.2477	.1642	.1503	.0902	.0725	.1314
9	172901	.6383	.2246	.0422	.0398	.0323	.0227	.0484	11	22046	.3554	.2817	.0930	.1170	.0951	.0577	.0389
10	160488	.6316	.2413	.0418	.0388	.0234	.0231	.0396	8	21493	.3231	.2715	.1344	.1230	.0814	.0666	.1223
11	152356	.6267	.2584	.0395	.0340	.0259	.0155	.0145	4	20478	.3151	.2819	.1615	.1034	.0837	.0545	.0419
12	121651	.6287	.2526	.0423	.0409	.0239	.0116	.0587	10	17803	.3491	.2759	.1347	.1044	.1134	.0225	.0398
13	102510	.6242	.2471	.0411	.0304	.0239	.0332	.0424	7	16195	.3159	.2639	.1538	.1241	.0940	.0483	.1157
14	94332	.6264	.2339	.0371	.0470	.0278	.0279	.1016	12	15242	.3044	.2852	.1575	.1414	.0752	.0363	.1541
16	68568	.6548	.2456	.0407	.0247	.0228	.0115	.0399	14	13660	.3241	.2403	.1184	.1636	.0876	.0660	.2421
17	59445	.5617	.2465	.0381	.0351	.0212	.0975	.0195	19	7278	.3871	.2338	.1106	.0839	.0488	.1358	.3317
15	55804	.6131	.2681	.0450	.0560	.0118	.0060	.0846	16	5358	.3516	.3114	.1734	.1039	.0473	.0124	.2729
18	33899	.5676	.2355	.0640	.0349	.0329	.0650	.0072	17	4853	.2795	.2540	.1266	.1970	.0656	.0772	.1986
19	25195	.6633	.2370	.0394	.0401	.0149	.0054	.1076	18	4817	.1895	.1983	.2117	.1283	.1639	.1083	.1079
20	13640	.6060	.2471	.0445	.0531	.0270	.0222	.0064	21	2134	.2514	.2301	.0978	.2365	.1138	.0704	.2323
21	9000	.6465	.2316	.0389	.0386	.0424	.0020	.0561	22	826	.3407	.2167	.1419	.1036	.1512	.0458	.0247
22	4789	.6145	.2123	.0352	.0385	.0052	.0943	.1016	20	649	.4702	.3646	.0709	.0796	.0064	.0083	.1790
Average		.6276	.2424	.0418	.0379	.0247	.0256	.0423			.3179	.2665	.1391	.1272	.0891	.0603	.1449
Weightd av		.6351	.2432	.0413	.0365	.0249	.0191	.0352			.3086	.2681	.1443	.1230	.0924	.0637	.1310
Aggregate	3580322	.6359	.2428	.0409	.0358	.0251	.0196	.0432		539317	.3080	.2672	.1429	.1215	.0895	.0709	.1574
Std devn		.0265	.0147	.0057	.0071	.0077	.0261	.0343			.0559	.0354	.0306	.0359	.0339	.0295	.0779

Table 6. Mean payment terms from inflation-adjusted chain ladder using ultimate mean term of 2 years.  
Private Motor  
Comprehensive

Company	Weight	Year 0	1	2	3	4	5	Later	Co.	Weight	Year 0	1	2	3	4	5	Later
1	482742	1.43	1.94	3.08	2.83	2.74	2.43	2.00	2	69404	2.79	2.64	2.70	2.64	2.54	2.38	2.00
2	445577	1.42	1.84	2.86	2.68	2.62	2.47	2.00	3	66858	3.04	2.77	2.77	2.56	2.32	2.15	2.00
3	426950	1.12	1.20	1.56	1.15	.73	-.05	2.00	1	64203	2.92	2.80	2.78	2.42	2.13	1.97	2.00
4	277442	1.27	1.57	2.24	1.99	1.86	1.91	2.00	6	57442	2.69	2.55	2.48	2.17	1.99	1.91	2.00
5	251302	1.28	1.58	2.39	2.21	2.14	2.14	2.00	15	36746	2.48	2.44	2.73	2.64	2.58	2.25	2.00
7	213892	1.27	1.68	2.60	2.34	2.07	2.21	2.00	9	32420	2.94	2.71	2.67	2.42	2.31	2.18	2.00
6	208483	1.27	1.37	2.13	1.83	1.71	1.82	2.00	13	32159	2.81	2.77	3.02	2.87	2.70	2.57	2.00
8	199356	1.46	1.92	2.99	2.80	2.58	2.53	2.00	5	27253	2.92	2.70	2.59	2.36	2.31	2.11	2.00
9	172901	1.49	2.02	2.87	2.56	2.36	2.20	2.00	11	22046	2.21	2.10	2.23	1.75	1.51	1.51	2.00
10	160488	1.41	1.82	2.74	2.48	2.38	2.08	2.00	8	21493	2.71	2.61	2.69	2.44	2.33	2.12	2.00
11	152356	1.22	1.38	2.14	1.86	1.68	1.71	2.00	4	20478	2.26	2.03	1.99	1.84	1.62	1.59	2.00
12	121651	1.50	1.95	3.02	2.80	2.80	2.59	2.00	10	17803	2.16	1.99	1.99	1.70	1.42	2.10	2.00
13	102510	1.46	1.89	2.90	2.66	2.32	1.90	2.00	7	16195	2.68	2.54	2.54	2.36	2.26	2.26	2.00
14	94332	1.83	2.58	3.59	3.15	2.94	2.46	2.00	12	15242	2.81	2.63	2.71	2.57	2.67	2.52	2.00
16	68568	1.32	1.70	2.82	2.78	2.54	2.44	2.00	14	13660	3.29	3.27	3.26	2.84	2.81	2.46	2.00
17	59445	1.37	1.54	2.02	1.46	.80	-.12	2.00	19	7278	3.56	3.81	3.90	3.52	3.01	2.27	2.00
15	55804	1.64	2.13	3.27	3.05	3.45	2.83	2.00	16	5358	3.07	3.05	3.35	3.48	3.41	2.89	2.00
18	33899	1.47	1.73	2.14	1.90	1.36	.75	2.00	17	4853	3.20	3.02	2.98	2.57	2.76	2.30	2.00
19	25195	1.70	2.49	3.77	3.54	3.49	2.88	2.00	18	4817	3.22	2.78	2.41	2.20	1.78	1.75	2.00
20	13640	1.26	1.40	1.86	1.42	1.30	1.06	2.00	21	2134	3.49	3.26	3.10	2.49	2.62	2.42	2.00
21	9000	1.47	2.00	2.96	2.65	2.48	2.92	2.00	22	826	2.29	2.18	1.95	1.59	1.10	1.38	2.00
22	4789	2.00	2.89	3.74	3.22	2.74	1.80	2.00	20	649	2.33	2.54	3.70	3.53	3.78	2.89	2.00
Average runoff		1.44	1.87	2.80	2.54	2.38	2.06	2.00			2.83	2.73	2.79	2.54	2.43	2.27	2.00
Weightd av runoff		1.36	1.73	2.65	2.42	2.30	2.12	2.00			2.80	2.66	2.70	2.47	2.32	2.18	2.00
Runoff of aggregate		1.41	1.84	2.82	2.59	2.44	2.22	2.00			2.93	2.81	2.87	2.64	2.46	2.22	2.00



Table 7. Run-off patterns from Average Claim Method adjusted so years 0-5 sum to one.

Company	Weight	Year 0	1	2	3	4	5	Later	Co.	Weight	Year 0	1	2	3	4	5	Later
1	482742	.6437	.2418	.0377	.0368	.0228	.0173	.0412	2	69404	.3059	.2741	.1664	.1177	.0845	.0513	.1172
2	445577	.6288	.2497	.0437	.0382	.0254	.0142	.0365	3	66858	.2553	.2726	.1604	.1229	.1073	.0814	.1168
3	426950	.6301	.2394	.0439	.0382	.0204	.0280	-.0057	1	64203	.2887	.2450	.1258	.1257	.1208	.0939	.1048
4	277442	.6337	.2335	.0458	.0403	.0299	.0169	.0217	6	57442	.3203	.2511	.1392	.1282	.0978	.0635	.0714
5	251302	.6377	.2386	.0445	.0365	.0274	.0153	.0306	15	36746	.3655	.2966	.1299	.0986	.0562	.0532	.0923
7	213892	.6581	.2273	.0370	.0303	.0327	.0146	.0217	9	32420	.2760	.2624	.1558	.1412	.1001	.0644	.1263
6	208483	.5968	.2812	.0418	.0385	.0280	.0137	.0153	13	32159	.3354	.2957	.1358	.1067	.0891	.0373	.1431
8	199356	.6368	.2470	.0411	.0321	.0299	.0131	.0393	5	27253	.2755	.2473	.1630	.1460	.0919	.0762	.1385
9	172901	.6313	.2247	.0433	.0419	.0341	.0247	.0506	11	22046	.3173	.2744	.1017	.1246	.1135	.0684	.0475
10	160488	.6310	.2422	.0419	.0384	.0231	.0234	.0305	8	21493	.3243	.2692	.1359	.1242	.0824	.0641	.1035
11	152356	.6131	.2655	.0449	.0352	.0252	.0162	.0157	4	20478	.2858	.2745	.1607	.1102	.0980	.0707	.0522
12	121651	.6312	.2480	.0423	.0413	.0247	.0126	.0439	10	17803	.3264	.2742	.1431	.1115	.1213	.0235	.0363
13	102510	.6226	.2475	.0415	.0304	.0240	.0341	.0329	7	16195	.3122	.2584	.1553	.1246	.0979	.0515	.0884
14	94332	.6099	.2348	.0400	.0527	.0325	.0301	.0829	12	15242	.3122	.2807	.1604	.1374	.0737	.0355	.1223
16	68568	.6549	.2466	.0407	.0243	.0217	.0117	.0316	14	13660	.2837	.2415	.1197	.1826	.0987	.0738	.1838
17	59445	.5436	.2437	.0400	.0363	.0226	.1138	-.0281	19	7278	.3364	.2218	.1236	.1052	.0601	.1529	.2872
15	55804	.6146	.2673	.0446	.0555	.0121	.0060	.0645	16	5358	.3506	.3033	.1704	.1153	.0475	.0129	.2175
18	33899	.5645	.2356	.0637	.0348	.0340	.0674	.0011	17	4853	.2696	.2548	.1226	.1977	.0609	.0944	.1415
19	25195	.6491	.2420	.0411	.0454	.0170	.0055	.0931	18	4817	.1954	.2033	.2169	.1292	.1600	.0952	.0959
20	13640	.6118	.2427	.0417	.0518	.0271	.0249	.0060	21	2134	.2369	.2183	.0935	.2231	.1301	.0980	.2007
21	9000	.6389	.2323	.0395	.0409	.0461	.0022	.0435	22	826	.3229	.2026	.1408	.1110	.1598	.0629	.0183
22	4789	.6158	.2136	.0357	.0384	.0050	.0915	.0878	20	649	.4198	.3927	.0692	.1009	.0061	.0114	.1821
Average		.6226	.2429	.0426	.0390	.0257	.0271	.0344			.3053	.2643	.1405	.1311	.0935	.0653	.1222
Weightd av		.6296	.2441	.0423	.0376	.0259	.0204	.0288			.3020	.2661	.1453	.1248	.0960	.0658	.1083
Aggregate	3580322	.6312	.2436	.0416	.0367	.0260	.0209	.0326		539317	.3043	.2655	.1433	.1223	.0920	.0726	.1268
Std devn		.0270	.0146	.0054	.0074	.0083	.0280	.0297			.0466	.0401	.0307	.0316	.0354	.0319	.0638

Table 9. Mean payment terms for Average Claim Method using ultimate mean term of 2 years.

Private Motor Comprehensive									Private Motor Comprehensive								
Company	Weight	Year 0	1	2	3	4	5	Later	Co.	Weight	Year 0	1	2	3	4	5	Later
1	482742	1.38	1.80	2.82	2.56	2.49	2.26	2.00	2	69404	2.68	2.50	2.52	2.43	2.32	2.24	2.00
2	445577	1.37	1.70	2.60	2.41	2.37	2.30	2.00	3	66858	2.89	2.60	2.58	2.36	2.10	1.97	2.00
3	426950	1.12	1.20	1.55	1.12	.68	-15	2.00	1	64203	2.86	2.70	2.65	2.25	1.94	1.82	2.00
4	277442	1.30	1.59	2.25	1.98	1.86	1.91	2.00	6	57442	2.51	2.37	2.31	2.01	1.85	1.82	2.00
5	251302	1.33	1.67	2.48	2.28	2.17	2.17	2.00	15	36746	2.36	2.30	2.54	2.42	2.37	2.09	2.00
7	213892	1.24	1.59	2.40	2.11	1.81	1.99	2.00	9	32420	2.87	2.64	2.59	2.35	2.24	2.16	2.00
6	208483	1.26	1.35	2.10	1.80	1.68	1.82	2.00	13	32159	2.69	2.60	2.81	2.65	2.50	2.48	2.00
8	199356	1.37	1.75	2.73	2.54	2.33	2.37	2.00	5	27253	2.96	2.74	2.64	2.42	2.33	2.11	2.00
9	172901	1.52	2.07	2.88	2.56	2.34	2.18	2.00	11	22046	2.41	2.24	2.30	1.81	1.52	1.52	2.00
10	160488	1.35	1.70	2.55	2.30	2.19	1.91	2.00	8	21493	2.62	2.50	2.56	2.31	2.21	2.04	2.00
11	152356	1.25	1.39	2.11	1.89	1.75	1.73	2.00	4	20478	2.46	2.19	2.14	1.93	1.65	1.56	2.00
12	121651	1.41	1.80	2.75	2.52	2.55	2.44	2.00	10	17803	2.21	1.99	1.93	1.63	1.33	2.02	2.00
13	102510	1.40	1.78	2.72	2.48	2.14	1.73	2.00	7	16195	2.57	2.41	2.36	2.15	2.02	2.08	2.00
14	94332	1.77	2.41	3.29	2.85	2.70	2.33	2.00	12	15242	2.64	2.47	2.51	2.38	2.50	2.44	2.00
16	68568	1.26	1.58	2.63	2.60	2.38	2.32	2.00	14	13660	3.18	3.02	2.95	2.49	2.51	2.28	2.00
17	59445	1.41	1.56	1.95	1.36	.64	-.32	2.00	19	7278	3.56	3.65	3.61	3.24	2.82	2.13	2.00
15	55804	1.52	1.91	2.98	2.78	3.31	2.79	2.00	16	5358	2.86	2.82	3.06	3.18	3.29	2.86	2.00
18	33899	1.45	1.67	2.05	1.77	1.19	.54	2.00	17	4853	3.01	2.79	2.74	2.29	2.49	2.00	2.00
19	25195	1.65	2.32	3.51	3.28	3.37	2.86	2.00	18	4817	3.11	2.68	2.31	2.13	1.73	1.75	2.00
20	13640	1.26	1.43	1.91	1.45	1.29	.99	2.00	21	2134	3.49	3.23	3.02	2.39	2.37	2.18	2.00
21	9000	1.42	1.86	2.70	2.36	2.18	2.88	2.00	22	826	2.37	2.24	1.96	1.55	1.03	1.06	2.00
22	4789	1.91	2.75	3.62	3.12	2.66	1.72	2.00	20	649	2.43	2.49	3.61	3.32	3.75	2.85	2.00
Average runoff		1.41	1.79	2.64	2.36	2.19	1.90	2.00			2.78	2.63	2.65	2.38	2.25	2.13	2.00
Weightd av runoff		1.34	1.66	2.49	2.24	2.11	1.96	2.00			2.72	2.55	2.55	2.31	2.15	2.05	2.00
Runoff of aggregate		1.36	1.72	2.59	2.34	2.20	2.02	2.00			2.81	2.66	2.69	2.45	2.27	2.09	2.00

Table 10. Run-off Pattern for Company Incurred Method adjusted so years 0-5 sum to one.

Company	Weight	Year 0	1	2	3	4	5	Later	Co.	Weight	Year 0	1	2	3	4	5	Later
1	482742	.6491	.2482	.0371	.0336	.0188	.0133	.0402	2	69404	.2989	.2706	.1709	.1177	.0905	.0514	.1040
2	445577	.6284	.2516	.0430	.0373	.0256	.0140	.0328	3	66858	.2627	.2747	.1619	.1214	.1009	.0783	.1167
3	426950	.6399	.2434	.0439	.0358	.0174	.0195	.0039	1	64203	.3161	.2606	.1251	.1157	.1034	.0791	.1071
4	277442	.6343	.2322	.0459	.0405	.0306	.0165	.0242	6	57442	.3036	.2420	.1386	.1292	.1047	.0818	.0968
5	251302	.6369	.2390	.0441	.0358	.0277	.0165	.0301	15	36746	.3734	.2897	.1209	.0906	.0577	.0676	.0529
7	213892	.6665	.2282	.0355	.0274	.0266	.0158	.0188	9	32420	.2679	.2533	.1497	.1409	.1091	.0791	.2233
6	208483	.5957	.2805	.0417	.0383	.0291	.0148	.0243	13	32159	.3289	.2948	.1350	.1133	.0931	.0350	.1479
8	199356	.6525	.2493	.0370	.0264	.0251	.0097	.0316	5	27253	.2741	.2483	.1609	.1485	.0914	.0769	.1239
9	172901	.6267	.2242	.0434	.0422	.0353	.0281	.0724	11	22046	.3356	.2743	.0994	.1191	.1069	.0647	.0597
10	160488	.6376	.2433	.0398	.0340	.0209	.0243	.0208	8	21493	.3488	.2906	.1303	.1100	.0724	.0479	.0958
11	152356	.6208	.2607	.0432	.0335	.0246	.0172	.0351	4	20478	.2913	.2719	.1626	.1140	.0938	.0665	.0631
12	121651	.6423	.2479	.0405	.0387	.0222	.0085	.0426	10	17803	.3331	.2779	.1417	.1060	.1116	.0297	.0287
13	102510	.6127	.2567	.0422	.0307	.0271	.0306	.0305	7	16195	.3377	.2701	.1537	.1146	.0832	.0408	.0900
14	94332	.6131	.2365	.0383	.0470	.0330	.0322	.0624	12	15242	.3007	.2725	.1605	.1498	.0796	.0370	.1271
16	68568	.6590	.2371	.0368	.0255	.0263	.0152	.0221	14	13660	.3101	.2440	.1140	.1774	.0902	.0643	.1940
17	59445	.5761	.2557	.0402	.0360	.0242	.0679	.0156	19	7278	.4224	.2315	.0966	.0815	.0349	.1331	.1764
15	55804	.6266	.2685	.0421	.0480	.0101	.0047	.0534	16	5358	.3857	.3015	.1532	.0929	.0364	.0302	.1361
18	33899	.5852	.2425	.0610	.0357	.0259	.0496	.0291	17	4853	.2804	.2582	.1281	.2098	.0449	.0787	.1707
19	25195	.6326	.2375	.0393	.0360	.0207	.0340	.0300	18	4817	.2261	.2203	.2142	.1199	.1424	.0771	.1022
20	13640	.6214	.2444	.0400	.0465	.0246	.0231	.0241	21	2134	.3314	.2762	.1131	.1579	.0941	.0274	.2077
21	9000	.6582	.2394	.0378	.0307	.0326	.0012	.0362	22	826	.4233	.2264	.1097	.1089	.1101	.0216	.0541
22	4789	.6141	.2161	.0306	.0298	.0070	.1024	.0297	20	649	.4541	.3910	.0616	.0785	.0062	.0087	.1914
Average		.6286	.2447	.0411	.0359	.0243	.0254	.0323			.3276	.2700	.1364	.1235	.0844	.0580	.1213
Weightd av		.6343	.2460	.0413	.0356	.0245	.0183	.0304			.3088	.2674	.1439	.1218	.0929	.0654	.1111
Aggregate	3580322	.6363	.2460	.0409	.0345	.0239	.0184	.0307		539317	.3110	.2689	.1427	.1191	.0873	.0709	.1186
Std devn		.0232	.0144	.0057	.0063	.0068	.0227	.0152			.0566	.0348	.0319	.0309	.0313	.0281	.0546

Table 11. Within-company std devns of the incremental payments as % of the company's estimated ultimate payments.

Company	Weight	Year 0	1	2	3	4	5	Later	Co.	Weight	Year 0	1	2	3	4	5	Later
1	482742	.0313	.0134	.0025	.0034	.0024			2	69404	.0223	.0179	.0203	.0210	.0063		
2	445577	.0161	.0074	.0050	.0085	.0015			3	66858	.0195	.0164	.0171	.0131	.0187		
3	426950	.0204	.0166	.0029	.0015	.0040			1	64203	.0213	.0159	.0063	.0058	.0026		
4	277442	.0157	.0132	.0034	.0087	.0139	.0046		6	57442	.0199	.0226	.0115	.0202	.0323	.0359	
5	251302	.0135	.0116	.0086	.0114	.0070	.0046		15	36746	.0362	.0165	.0120	.0226	.0181		
7	213892	.0166	.0090	.0045	.0025	.0025			9	32420	.0121	.0169	.0191	.0285	.0207	.0062	
6	208483	.0198	.0059	.0076	.0091	.0132	.0053		13	32159	.0209	.0135	.0153	.0092	.0263	.0294	
8	199356	.0216	.0176	.0031	.0084	.0042			5	27253	.0196	.0181	.0322	.0368	.0263	.0587	
9	172901	.0260	.0134	.0083	.0071	.0096	.0075		11	22046	.0619	.0383	.0290	.0378	.0439		
10	160488	.0169	.0063	.0049	.0096	.0002			8	21493	.0241	.0346	.0140	.0234	.0721		
11	152356	.0713	.0482	.0126	.0056	.0020	.0135		4	20478	.0474	.0159	.0314	.0233	.0295	.0213	
12	121851	.0294	.0264	.0040	.0074	.0040			10	17803	.0433	.0201	.0266	.0035	.0148		
13	102510	.0138	.0080	.0080	.0079	.0048			7	16195	.0326	.0092	.0219	.0008	.0128		
14	94332	.0225	.0057	.0070	.0140	.0040			12	15242	.0217	.0130	.0309	.0134	.0266		
16	68568	.0396	.0246	.0067	.0076	.0060			14	13660	.0585	.0448	.0217	.0513	.0170		
17	59445	.0451	.0177	.0101	.0130	.0025			19	7278	.1378	.0509	.0477	.0679	.0292		
15	55804	.0264	.0121	.0040	.0161	.0034			16	5358	.0818	.0531	.0194	.0333	.0185		
18	33899	.0384	.0174	.0274	.0027	.0126			17	4853	.0370	.0245	.0177	.0289	.0745		
19	25195	.0485	.0166	.0057	.0175	.0016			18	4817	.0385	.0255	.0809	.0606	.0520		
20	13640	.0576	.0430	.0202	.0413	.0281	.0211		21	2134	.0839	.0638	.0418	.0921	.0615		
21	9000	.0405	.0168	.0261	.0272	.0130			22	826	.1380	.0889	.0384	.0192	.1438		
22	4789	.0675	.0333	.0346	.0324	.0017			20	649	.1482	.0488	.0304	.0508	.0106	.0191	
Average s.d.		.0327	.0175	.0099	.0120	.0065											
Weighted av s.d.		.0248	.0141	.0056	.0072	.0051											
SD of aggregate		.0131	.0078	.0025	.0028	.0005											

Table 12. Mean payment terms for Company Incurred Method using ultimate mean term of 2 years.  
Private Motor  
Comprehensive

Company	Weight	Year 0	1	2	3	4	5	Later	Co.	Weight	Year 0	1	2	3	4	5	Later
1	482742	1.33	1.71	2.82	2.64	2.63	2.38	2.00	2	69404	2.64	2.44	2.42	2.32	2.19	2.17	2.00
2	445577	1.34	1.65	2.54	2.33	2.28	2.25	2.00	3	66858	2.86	2.58	2.57	2.38	2.15	2.00	2.00
3	426950	1.13	1.25	1.75	1.47	1.31	.92	2.00	1	64203	2.73	2.62	2.67	2.33	2.07	1.94	2.00
4	277442	1.31	1.63	2.30	2.04	1.92	1.99	2.00	6	57442	2.74	2.60	2.53	2.21	1.98	1.85	2.00
5	251302	1.33	1.67	2.49	2.28	2.14	2.12	2.00	15	36746	2.18	2.10	2.30	2.10	1.92	1.60	2.00
7	213892	1.19	1.51	2.36	2.11	1.83	1.86	2.00	9	32420	3.35	3.14	3.10	2.80	2.59	2.35	2.00
6	208483	1.33	1.49	2.35	2.08	1.97	2.05	2.00	13	32159	2.73	2.63	2.82	2.63	2.50	2.52	2.00
8	199356	1.26	1.58	2.65	2.51	2.31	2.41	2.00	5	27253	2.90	2.67	2.57	2.32	2.25	2.04	2.00
9	172901	1.68	2.33	3.19	2.84	2.57	2.30	2.00	11	22046	2.42	2.30	2.40	1.94	1.68	1.70	2.00
10	160488	1.27	1.55	2.38	2.13	1.97	1.65	2.00	8	21493	2.44	2.35	2.53	2.34	2.27	2.17	2.00
11	152356	1.37	1.66	2.63	2.47	2.32	2.18	2.00	4	20478	2.49	2.25	2.20	2.01	1.79	1.72	2.00
12	121651	1.36	1.74	2.75	2.56	2.65	2.59	2.00	10	17803	2.14	1.93	1.88	1.59	1.27	1.73	2.00
13	102510	1.40	1.71	2.64	2.40	2.06	1.75	2.00	7	16195	2.46	2.34	2.36	2.23	2.16	2.22	2.00
14	94332	1.64	2.20	3.10	2.67	2.46	2.15	2.00	12	15242	2.72	2.52	2.52	2.34	2.48	2.44	2.00
16	68568	1.22	1.52	2.45	2.25	1.95	1.98	2.00	14	13660	3.13	3.05	3.03	2.58	2.63	2.38	2.00
17	59445	1.48	1.77	2.53	2.10	1.64	.97	2.00	19	7278	2.88	3.21	3.41	3.07	2.68	1.93	2.00
15	55804	1.41	1.75	2.87	2.74	3.31	2.80	2.00	16	5358	2.44	2.44	2.74	2.90	3.00	2.55	2.00
18	33899	1.51	1.85	2.47	2.33	1.95	1.43	2.00	17	4853	3.06	2.87	2.83	2.43	2.80	2.21	2.00
19	25195	1.38	1.77	2.65	2.35	2.14	1.67	2.00	18	4817	2.98	2.62	2.33	2.21	1.85	1.92	2.00
20	13640	1.34	1.63	2.38	2.02	2.00	1.78	2.00	21	2134	3.02	2.98	3.12	2.72	2.79	2.71	2.00
21	9000	1.29	1.66	2.66	2.46	2.33	2.92	2.00	.22	826	2.14	2.24	2.21	1.85	1.64	2.29	2.00
22	4789	1.60	2.22	3.08	2.54	1.98	1.06	2.00	20	649	2.39	2.56	3.88	3.61	3.79	2.89	2.00
Average runoff		1.37	1.73	2.63	2.37	2.19	1.90	2.00			2.69	2.59	2.66	2.43	2.33	2.19	2.00
Weighted av runoff		1.33	1.65	2.54	2.32	2.20	2.06	2.00			2.71	2.56	2.58	2.35	2.19	2.07	2.00
Runoff of aggregate		1.32	1.65	2.57	2.35	2.22	2.06	2.00			2.74	2.60	2.65	2.43	2.26	2.06	2.00

Table 1. Run-off patterns from basic chain ladder adjusted so years 0-11 sum to one.  
Employers' Liability

Company	Weight	Year	0	1	2	3	4	5	6	7	8	9	10	11	Later
A	271672		.0259	.1804	.2176	.1877	.1358	.0896	.0571	.0396	.0221	.0198	.0124	.0120	.0582
B	189060		.0416	.2237	.2175	.1724	.1264	.0786	.0524	.0403	.0262	.0106	.0087	.0017	.0115
C	106915		.0403	.2125	.2205	.1654	.1268	.0935	.0555	.0364	.0266	.0156	.0031	.0039	.0247
D	85232		.0544	.1957	.2200	.1881	.1397	.0889	.0487	.0282	.0170	.0094	.0087	.0012	.0013
E	71976		.0311	.1697	.2259	.1890	.1465	.0885	.0569	.0321	.0183	.0170	.0220	.0029	.0326
F	67189		.0219	.1491	.2020	.1978	.1556	.1044	.0692	.0449	.0256	.0133	.0087	.0074	.1177
G	40190		.0239	.1590	.2096	.1932	.1373	.1101	.0711	.0491	.0306	.0073	.0072	.0016	.0683
H	38037		.0356	.1978	.2060	.1753	.1268	.0981	.0693	.0415	.0183	.0155	.0117	.0041	.1225
I	23421		.0221	.1409	.2229	.2273	.1601	.1080	.0444	.0300	.0309	.0072	.0056	.0006	.0620
J	17308		.0513	.1548	.2066	.1949	.1425	.0897	.0614	.0400	.0419	.0046	.0054	.0069	.0020
K	16613		.0231	.1667	.2097	.1785	.1349	.0963	.0777	.0361	.0528	.0243	.0011	.0014	.0147
L	16220		.0187	.1280	.2083	.2065	.1591	.0971	.0950	.0488	.0161	.0134	.0056	.0034	.0638
M	12502		.0273	.1750	.2290	.2132	.1231	.0890	.0493	.0348	.0540	.0054	.0000	.0000	.0049
N	11316		.0356	.1561	.1868	.1700	.1653	.1246	.0958	.0328	.0190	.0055	.0020	.0065	.0060
O	10085		.0231	.1852	.2635	.1891	.1213	.0837	.0689	.0210	.0277	.0085	.0030	.0050	.0058
P	4496		.0199	.0997	.2266	.2132	.1666	.1177	.0432	.0409	.0556	.0151	.0015	.0000	.0660
Q	4232		.0114	.0973	.1873	.1750	.1152	.0601	.1219	.1830	.0488	.0000	.0000	.0000	.0057
R	2128		.0251	.1414	.1592	.2220	.0950	.2350	.1055	.0168	.0000	.0000	.0000	.0000	.0045
S	110		.0145	.1377	.1015	.0634	.3850	.0000	.2979	.0000	.0000	.0000	.0000	.0000	.0000
Average			.0288	.1616	.2064	.1854	.1507	.0975	.0811	.0419	.0280	.0101	.0056	.0029	.0352
Weighted avge			.0335	.1868	.2166	.1844	.1363	.0913	.0587	.0388	.0247	.0142	.0095	.0054	.0421
Aggregate	988702		.0331	.1858	.2174	.1852	.1368	.0914	.0587	.0389	.0245	.0138	.0094	.0048	.0409
Std devn			.0117	.0340	.0329	.0345	.0597	.0423	.0568	.0361	.0164	.0069	.0056	.0034	.0393

Table 2. Within-company std devns of the incremental payments as % of ultimate payments estimated by the BCL.  
Employers' Liability

Company	Weight	Year	0	1	2	3	4	5	6	7	8	9	10	11	Later
A	271672		.0034	.0101	.0176	.0189	.0174	.0107	.0060	.0110	.0052	.0019	.0013		
B	189060		.0106	.0165	.0093	.0148	.0090	.0108	.0110	.0067	.0038	.0049	.0008		
C	106915		.0046	.0056	.0076	.0072	.0151	.0087	.0094	.0095	.0119	.0056	.0020		
D	85232		.0526	.0197	.0169	.0318	.0227	.0147	.0160	.0118	.0100	.0040	.0077		
E	71976		.0116	.0171	.0174	.0219	.0203	.0193	.0097	.0132	.0070	.0110	.0233		
F	67189		.0011	.0038	.0207	.0209	.0267	.0222	.0082	.0188	.0113	.0078	.0031		
G	40190		.0035	.0074	.0323	.0281	.0130	.0164	.0117	.0064	.0115	.0102	.0020		
H	38037		.0048	.0140	.0217	.0254	.0259	.0148	.0266	.0119	.0055	.0085	.0096		
I	23421		.0034	.0279	.0457	.0390	.0577	.0343	.0102	.0182	.0250	.0039	.0045		
J	17308		.0295	.0254	.0285	.0613	.0528	.0306	.0442	.0187	.0686	.0036	.0066		
K	16613		.0044	.0228	.0375	.0377	.0330	.0315	.0227	.0352	.0378	.0180	.0013		
L	16220		.0064	.0270	.0242	.0467	.0670	.0274	.0345	.0127	.0139	.0082	.0064		
M	12502		.0074	.0341	.0251	.0210	.0319	.0347	.0208	.0316	.0149	.0035	.0000		
N	11316		.0068	.0267	.0252	.0450	.0462	.0592	.0388	.0223	.0077	.0076	.0034		
O	10085		.0060	.0387	.0400	.0276	.0356	.0359	.0512	.0268	.0211	.0024	.0017		
P	4496		.0132	.0263	.0357	.0464	.0659	.0852	.0493	.0581	.0529	.0116	.0028		
Q	4232		.0047	.0380	.0523	.0266	.0456	.0449	.1592	.3362	.0430	.0000	.0000		
R	2128		.0162	.0894	.0875	.1148	.0539	.2281	.0417	.0236	.0000	.0000	.0000		
S	110		.0367	.1766	.0786	.0896	.4001	.0000	.3572	.0000	.0000	.0000	.0000		
Average s.d.			.0119	.0330	.0328	.0381	.0547	.0384	.0489	.0354	.0185	.0059	.0040		
Weighted avge s.d.			.0104	.0141	.0179	.0217	.0208	.0162	.0131	.0135	.0098	.0053	.0042		
S.D. of aggregate			.0044	.0042	.0089	.0122	.0121	.0087	.0014	.0040	.0023	.0008	.0005		

Table 3. Mean payment terms from basic chain ladder using ultimate mean term of 4 years.  
Employers' Liability

Company	Weight	Year 0	1	2	3	4	5	6	7	8	9	10	11	Later
A	271672	4.57	3.67	3.34	3.31	3.50	3.80	4.14	4.41	4.65	4.55	4.52	4.23	4.00
B	189060	3.72	2.86	2.57	2.42	2.35	2.36	2.33	2.30	2.54	3.18	3.47	4.42	4.00
C	106915	3.94	3.08	2.79	2.70	2.65	2.69	2.93	3.15	3.46	4.13	4.91	4.39	4.00
D	85232	3.53	2.70	2.28	2.01	1.84	1.76	1.75	1.68	1.56	1.44	1.23	2.83	4.00
E	71976	4.22	3.33	2.91	2.81	2.86	3.14	3.42	3.76	3.88	3.72	3.67	4.63	4.00
F	67189	5.28	4.37	3.98	3.93	4.16	4.62	5.12	5.59	5.92	5.86	5.39	4.73	4.00
G	40190	4.70	3.80	3.39	3.28	3.40	3.55	3.98	4.48	5.19	5.89	5.39	4.90	4.00
H	38037	5.12	4.27	4.11	4.20	4.48	4.80	5.29	5.85	6.14	5.81	5.40	4.86	4.00
I	23421	4.51	3.60	3.08	2.93	3.17	3.65	4.53	4.84	5.07	5.94	5.51	4.96	4.00
J	17308	3.80	2.98	2.47	2.16	1.99	1.84	1.61	1.31	.88	.93	.13	-1.28	4.00
K	16613	4.17	3.26	2.82	2.61	2.47	2.35	2.22	2.26	1.95	2.93	5.99	5.46	4.00
L	16220	4.76	3.83	3.30	3.12	3.20	3.45	3.61	4.57	5.52	5.45	5.36	4.77	4.00
M	12502	3.79	2.88	2.40	2.16	2.14	1.99	1.89	1.58	1.16	3.60	6.00	5.00	4.00
N	11316	3.99	3.12	2.62	2.26	1.91	1.71	1.60	2.08	2.40	3.20	3.23	2.67	4.00
O	10085	3.70	2.77	2.30	2.19	2.12	1.99	1.89	2.23	1.96	2.77	3.18	2.93	4.00
P	4496	4.83	3.91	3.27	3.14	3.25	3.60	4.24	4.14	4.21	5.71	5.88	5.00	4.00
Q	4232	4.73	3.77	3.13	2.82	2.58	2.16	1.43	.91	1.29	7.00	6.00	5.00	4.00
R	2128	3.99	3.07	2.51	1.98	1.70	1.01	.97	2.29	8.00	7.00	6.00	5.00	4.00
S	110	4.36	3.42	2.89	2.21	1.37	1.50	.50	ERROR	ERROR	ERROR	ERROR	ERROR	4.00
Average runoff		4.32	3.42	2.98	2.79	2.72	2.83	2.94	3.54	4.09	4.96	4.99	4.65	4.00
Weighted avge runoff		4.27	3.40	3.05	2.97	3.05	3.27	3.58	3.92	4.31	4.63	4.66	4.49	4.00
Runoff of aggregate		4.25	3.38	3.03	2.94	3.01	3.23	3.53	3.88	4.28	4.63	4.67	4.53	4.00

Table 4. Run-off patterns from inflation-adjusted chain ladder adjusted so years 0-11 sum to one.  
Employers' Liability

Company	Weight	Year	0	1	2	3	4	5	6	7	8	9	10	11	Later
A	271672	.0272	.1869	.2243	.1900	.1360	.0866	.0533	.0372	.0203	.0176	.0106	.0100	.0555	
B	189060	.0430	.2335	.2229	.1754	.1249	.0753	.0481	.0361	.0229	.0093	.0072	.0014	.0114	
C	106915	.0419	.2188	.2264	.1678	.1267	.0908	.0513	.0331	.0239	.0136	.0026	.0031	.0253	
D	85232	.0626	.2024	.2242	.1869	.1376	.0834	.0453	.0254	.0153	.0082	.0075	.0010	.0009	
E	71976	.0311	.1754	.2328	.1926	.1484	.0864	.0530	.0293	.0163	.0145	.0178	.0023	.0342	
F	67189	.0229	.1558	.2090	.2012	.1547	.1007	.0652	.0420	.0229	.0119	.0075	.0061	.1098	
G	40190	.0255	.1672	.2168	.1962	.1373	.1061	.0660	.0447	.0271	.0058	.0060	.0013	.0655	
H	38037	.0365	.2018	.2135	.1789	.1278	.0953	.0643	.0380	.0164	.0139	.0102	.0034	.1144	
I	23421	.0229	.1457	.2275	.2302	.1621	.1019	.0414	.0290	.0281	.0061	.0046	.0005	.0610	
J	17308	.0547	.1582	.2068	.1997	.1449	.0858	.0582	.0367	.0405	.0041	.0049	.0055	-.0019	
K	16613	.0239	.1739	.2184	.1811	.1327	.0934	.0725	.0347	.0477	.0220	.0009	-.0012	.0141	
L	16220	.0191	.1269	.2091	.2095	.1645	.0966	.0918	.0459	.0160	.0126	.0051	.0029	.0591	
M	12502	.0287	.1827	.2357	.2172	.1225	.0870	.0449	.0295	.0473	.0045	.0000	.0000	.0048	
N	11316	.0376	.1620	.1909	.1765	.1631	.1257	.0870	.0288	.0168	.0045	.0018	.0052	.0071	
O	10085	.0238	.1910	.2723	.1909	.1177	.0823	.0639	.0196	.0245	.0076	.0025	.0040	.0058	
P	4496	.0194	.1009	.2281	.2157	.1698	.1222	.0400	.0405	.0487	.0133	.0014	.0000	.0658	
Q	4232	.0116	.0987	.1847	.1685	.1109	.0579	.1211	.1973	.0493	.0000	.0000	.0000	.0059	
R	2128	.0259	.1423	.1600	.2134	.0887	.2561	.0983	.0154	.0000	.0000	.0000	.0000	.0046	
S	110	.0166	.1510	.1029	.0670	.4119	.0000	.2506	.0000	.0000	.0000	.0000	.0000	.0000	
Average		.0303	.1671	.2109	.1873	.1517	.0965	.0745	.0402	.0255	.0089	.0048	.0024	.0338	
Weighted avge		.0353	.1936	.2225	.1869	.1360	.0881	.0546	.0358	.0223	.0125	.0080	.0044	.0404	
Aggregate	988702	.0348	.1926	.2235	.1879	.1366	.0881	.0545	.0358	.0220	.0122	.0080	.0039	.0392	
Std devn		.0130	.0358	.0347	.0340	.0663	.0467	.0477	.0396	.0151	.0062	.0047	.0028	.0370	

Table 6. Mean payment terms from inflation-adjusted chain ladder using ultimate mean term of 4 years.  
Employers' Liability

Company	Weight	Year	0	1	2	3	4	5	6	7	8	9	10	11	Later
A	271672	4.44	3.55	3.22	3.21	3.42	3.78	4.17	4.46	4.75	4.68	4.64	4.31	4.00	
B	189060	3.62	2.76	2.47	2.33	2.29	2.34	2.36	2.37	2.67	3.36	3.70	4.51	4.00	
C	106915	3.86	3.00	2.71	2.65	2.62	2.72	3.04	3.32	3.68	4.38	5.08	4.51	4.00	
D	85232	3.42	2.62	2.20	1.95	1.78	1.72	1.70	1.62	1.49	1.36	1.11	2.62	4.00	
E	71976	4.14	3.25	2.83	2.75	2.82	3.18	3.56	3.98	4.18	4.06	4.01	4.72	4.00	
F	67189	5.11	4.21	3.83	3.79	4.07	4.58	5.12	5.63	5.99	5.92	5.44	4.76	4.00	
G	40190	4.57	3.67	3.28	3.19	3.34	3.55	4.05	4.61	5.35	6.02	5.47	4.91	4.00	
H	38037	4.96	4.11	3.95	4.06	4.37	4.76	5.32	5.90	6.20	5.86	5.44	4.87	4.00	
I	23421	4.44	3.52	3.02	2.88	3.14	3.71	4.62	4.94	5.23	6.07	5.58	4.97	4.00	
J	17308	3.73	2.92	2.41	2.09	1.93	1.81	1.57	1.27	.80	.78	-.09	-1.88	4.00	
K	16613	4.07	3.16	2.73	2.54	2.42	2.32	2.22	2.27	2.01	3.01	6.01	5.41	4.00	
L	16220	4.68	3.76	3.21	3.01	3.08	3.37	3.55	4.53	5.46	5.45	5.38	4.79	4.00	
M	12502	3.68	2.78	2.30	2.07	2.06	1.94	1.90	1.63	1.22	3.87	6.00	5.00	4.00	
N	11316	3.91	3.05	2.56	2.20	1.88	1.69	1.67	2.25	2.68	3.64	3.64	3.09	4.00	
O	10085	3.62	2.69	2.22	2.12	2.07	1.95	1.88	2.26	2.04	2.93	3.43	3.16	4.00	
P	4496	4.78	3.86	3.22	3.08	3.19	3.57	4.35	4.26	4.44	5.83	5.89	5.00	4.00	
Q	4232	4.77	3.82	3.19	2.89	2.63	2.18	1.44	.89	1.30	7.00	6.00	5.00	4.00	
R	2128	3.99	3.08	2.52	2.00	1.69	.97	1.00	2.45	8.00	7.00	6.00	5.00	4.00	
S	110	4.21	3.27	2.77	2.10	1.26	1.50	.50	.00	.00	.00	.00	.00	4.00	
Average runoff		4.23	3.34	2.90	2.71	2.66	2.81	2.97	3.57	4.21	5.10	5.10	4.70	4.00	
Weighted avge runoff		4.16	3.29	2.95	2.88	2.99	3.26	3.62	4.00	4.44	4.78	4.79	4.55	4.00	
Runoff of aggregate		4.14	3.27	2.92	2.85	2.95	3.21	3.58	3.96	4.41	4.77	4.79	4.59	4.00	



Table 7. Run-off patterns from Average Claim Method adjusted so years 0-11 sum to one.  
Employers' Liability

Company	Weight	Year	0	1	2	3	4	5	6	7	8	9	10	11	Later
A	271672	.0260	.1857	.2248	.1909	.1352	.0874	.0535	.0377	.0205	.0175	.0105	.0102	.0545	
B	189060	.0442	.2300	.2247	.1749	.1249	.0741	.0488	.0367	.0233	.0095	.0075	.0015	.0111	
C	106915	.0445	.2178	.2299	.1784	.1277	.0887	.0475	.0302	.0195	.0109	.0022	.0027	.0206	
D	85232	.0522	.1738	.2202	.1974	.1497	.0938	.0492	.0282	.0163	.0092	.0087	.0012	.0011	
E	71976	.0290	.1849	.2430	.2029	.1511	.0789	.0458	.0240	.0132	.0109	.0144	.0021	.0259	
F	67189	.0265	.1860	.2308	.2019	.1432	.0877	.0526	.0320	.0178	.0099	.0063	.0053	.0904	
G	40190	.0237	.1533	.2083	.2000	.1489	.1155	.0674	.0432	.0264	.0057	.0061	.0015	.0652	
H	38037	.0380	.2079	.2150	.1770	.1252	.0947	.0616	.0375	.0161	.0135	.0102	.0034	.1136	
I	23421	.0231	.1497	.2225	.2300	.1649	.1017	.0405	.0289	.0278	.0060	.0045	.0005	.0597	
J	17308	.0564	.1643	.2130	.1957	.1412	.0830	.0596	.0331	.0411	.0039	.0044	.0045	.0012	
K	16613	.0211	.1610	.2153	.1824	.1352	.1018	.0753	.0373	.0479	.0229	.0010	.0010	.0142	
L	16220	.0201	.1417	.2196	.2061	.1542	.0929	.0884	.0428	.0155	.0115	.0047	.0025	.0527	
M	12502	.0273	.1848	.2590	.2223	.1211	.0748	.0414	.0288	.0370	.0035	.0000	.0000	.0038	
N	11316	.0328	.1512	.1915	.1600	.1624	.1430	.0933	.0315	.0199	.0054	.0025	.0065	.0098	
O	10085	.0211	.1750	.2618	.1972	.1271	.0882	.0667	.0210	.0263	.0082	.0026	.0048	.0056	
P	4496	.0236	.1062	.2418	.2129	.1704	.1179	.0358	.0360	.0411	.0132	.0012	.0000	.0665	
Q	4232	.0109	.0885	.1597	.1235	.0753	.0333	.0865	.3618	.0606	.0000	.0000	.0000	.0043	
R	2128	.0263	.1617	.1705	.2097	.0796	.2485	.0876	.0162	.0000	.0000	.0000	.0000	.0053	
S	110	.0204	.1636	.1418	.0851	.4570	.0000	.1320	.0000	.0000	.0000	.0000	.0000	.0000	
Average		.0299	.1677	.2154	.1868	.1523	.0950	.0649	.0477	.0247	.0085	.0046	.0024	.0317	
Weighted avge		.0346	.1924	.2252	.1896	.1365	.0877	.0531	.0355	.0213	.0119	.0078	.0044	.0375	
Aggregate	988702	.0340	.1919	.2249	.1899	.1367	.0873	.0543	.0352	.0217	.0121	.0080	.0041	.0385	
Std devn		.0119	.0341	.0311	.0342	.0779	.0478	.0241	.0767	.0153	.0060	.0042	.0028	.0346	

Table 9. Mean payment terms for Average Claim Method using ultimate mean term of 4 years.  
Employers' Liability

Company	Weight	Year	0	1	2	3	4	5	6	7	8	9	10	11	Later
A	271672	4.44	3.54	3.21	3.19	3.40	3.74	4.13	4.42	4.72	4.65	4.62	4.29	4.00	
B	189060	3.62	2.77	2.47	2.34	2.30	2.35	2.34	2.34	2.63	3.29	3.62	4.46	4.00	
C	106915	3.72	2.87	2.55	2.44	2.43	2.54	2.89	3.21	3.68	4.38	5.04	4.48	4.00	
D	85232	3.59	2.76	2.27	1.98	1.79	1.72	1.72	1.66	1.55	1.39	1.14	2.64	4.00	
E	71976	3.90	3.00	2.57	2.46	2.54	2.98	3.42	3.89	4.11	4.01	3.91	4.67	4.00	
F	67189	4.68	3.78	3.48	3.54	3.92	4.55	5.20	5.73	6.02	5.90	5.42	4.75	4.00	
G	40190	4.63	3.73	3.28	3.13	3.23	3.46	4.05	4.66	5.38	6.02	5.45	4.90	4.00	
H	38037	4.92	4.08	3.94	4.07	4.40	4.79	5.38	5.92	6.22	5.87	5.44	4.87	4.00	
I	23421	4.42	3.50	3.01	2.85	3.10	3.68	4.61	4.92	5.22	6.07	5.59	4.97	4.00	
J	17308	3.69	2.88	2.38	2.09	1.93	1.82	1.57	1.31	.82	.95	.19	-1.24	4.00	
K	16613	4.16	3.23	2.76	2.55	2.42	2.28	2.20	2.24	2.01	2.96	5.94	5.34	4.00	
L	16220	4.52	3.60	3.09	2.94	3.01	3.26	3.44	4.44	5.38	5.43	5.38	4.79	4.00	
M	12502	3.55	2.64	2.14	1.93	1.96	1.89	1.80	1.54	1.22	3.85	6.00	5.00	4.00	
N	11316	4.08	3.20	2.69	2.36	1.98	1.76	1.82	2.45	2.85	3.78	3.72	3.20	4.00	
O	10085	3.72	2.79	2.28	2.13	2.05	1.94	1.87	2.21	1.97	2.79	3.24	2.92	4.00	
P	4496	4.68	3.77	3.14	3.06	3.20	3.67	4.60	4.53	4.72	5.86	5.91	5.00	4.00	
Q	4232	5.33	4.38	3.76	3.46	3.05	2.40	1.52	.73	1.00	7.00	6.00	5.00	4.00	
R	2128	3.90	2.99	2.48	2.00	1.72	.99	1.11	2.59	8.00	7.00	6.00	5.00	4.00	
S	110	3.82	2.89	2.37	1.77	.95	1.50	.50	.00	.00	.00	.00	.00	4.00	
Average runoff		4.19	3.30	2.86	2.68	2.63	2.79	2.96	3.30	4.15	5.07	5.07	4.68	4.00	
Weighted avge runoff		4.11	3.24	2.89	2.81	2.91	3.18	3.55	3.92	4.39	4.73	4.74	4.53	4.00	
Runoff of aggregate		4.13	3.25	2.90	2.82	2.93	3.21	3.57	3.96	4.40	4.75	4.76	4.57	4.00	

Table 10. Run-off Pattern for Company Incurred Method adjusted so years 0-11 sum to one.  
Employers' Liability

Company	Weight	Year	0	1	2	3	4	5	6	7	8	9	10	11	Later
A	271672		.0245	.1720	.2116	.1856	.1392	.0959	.0610	.0443	.0242	.0199	.0115	.0102	.0598
B	189060		.0407	.2117	.2042	.1642	.1243	.0805	.0568	.0455	.0306	.0202	.0167	.0046	.0189
C	106915		.0431	.2119	.2154	.1649	.1268	.0940	.0555	.0374	.0263	.0127	.0040	.0080	.0143
D	85232		.0545	.1775	.2074	.1828	.1493	.1011	.0563	.0309	.0177	.0127	.0087	.0012	.0056
E	71976		.0277	.1669	.2241	.1908	.1524	.0890	.0576	.0312	.0185	.0133	.0254	.0032	.0208
F	67189		.0221	.1539	.2054	.1962	.1523	.1057	.0707	.0426	.0254	.0131	.0073	.0054	.1128
G	40190		.0246	.1627	.2185	.1954	.1382	.1086	.0679	.0445	.0255	.0059	.0064	.0018	.0625
H	38037		.0348	.1980	.2147	.1822	.1322	.0974	.0631	.0367	.0161	.0129	.0093	.0027	.1018
I	23421		.0209	.1356	.2161	.2143	.1626	.1095	.0512	.0388	.0352	.0074	.0077	.0007	.0665
J	17308		.0555	.1542	.2018	.1907	.1469	.0858	.0606	.0378	.0391	.0102	.0096	.0078	.0062
K	16613		.0204	.1530	.1947	.1676	.1313	.1115	.0888	.0495	.0563	.0268	.0011	.0009	.0151
L	16220		.0173	.1185	.2032	.2022	.1621	.1070	.1018	.0495	.0196	.0128	.0042	.0017	.0589
M	12502		.0259	.1699	.2317	.2096	.1235	.0924	.0510	.0313	.0550	.0098	.0000	.0000	.0095
N	11316		.0326	.1497	.1837	.1630	.1581	.1277	.0815	.0310	.0258	.0107	.0156	.0208	.0000
O	10085		.0194	.1564	.2325	.1799	.1243	.1060	.0792	.0300	.0408	.0181	.0059	.0074	.0147
P	4496		.0216	.0935	.2243	.2095	.1756	.1205	.0497	.0462	.0449	.0116	.0024	.0000	.0630
Q	4232		.0133	.1072	.1958	.1768	.1223	.0609	.1420	.1496	.0320	.0000	.0000	.0000	.0032
R	2128		.0278	.1541	.1903	.1854	.1005	.1751	.1046	.0621	.0000	.0000	.0000	.0000	.0619
S	110		.0428	.3567	.1433	.0735	.2899	.0000	.0938	.0000	.0000	.0000	.0000	.0000	.0000
Average			.0300	.1686	.2062	.1808	.1480	.0984	.0733	.0441	.0281	.0115	.0071	.0039	.0366
Weighted ave			.0329	.1799	.2107	.1812	.1383	.0951	.0615	.0412	.0261	.0159	.0112	.0059	.0413
Aggregate	988702		.0320	.1789	.2118	.1832	.1390	.0951	.0621	.0414	.0261	.0152	.0102	.0050	.0449
Std devn			.0122	.0550	.0203	.0303	.0389	.0330	.0240	.0284	.0153	.0070	.0067	.0053	.0353

Table 11. Within-company std devns of the incremental payments as % of the company's estimated ultimate payments.  
Employers' Liability

Company	Weight	Year	0	1	2	3	4	5	6	7	8	9	10	11	Later
A	271672		.0049	.0210	.0271	.0196	.0198	.0104	.0062	.0105	.0050	.0017	.0014		
B	189060		.0117	.0220	.0094	.0178	.0124	.0117	.0104	.0067	.0030	.0049	.0009		
C	106915		.0105	.0207	.0136	.0091	.0133	.0103	.0096	.0094	.0114	.0056	.0021		
D	85232		.0561	.0200	.0201	.0243	.0239	.0132	.0158	.0115	.0100	.0039	.0077		
E	71976		.0093	.0243	.0229	.0217	.0206	.0190	.0092	.0136	.0071	.0105	.0236		
F	67189		.0027	.0126	.0199	.0268	.0299	.0203	.0090	.0202	.0121	.0077	.0028		
G	40190		.0045	.0098	.0373	.0293	.0123	.0172	.0120	.0072	.0117	.0103	.0019		
H	38037		.0065	.0243	.0230	.0292	.0247	.0143	.0260	.0117	.0056	.0081	.0093		
I	23421		.0046	.0218	.0670	.0425	.0563	.0324	.0101	.0178	.0255	.0037	.0046		
J	17308		.0299	.0249	.0289	.0515	.0480	.0276	.0443	.0197	.0686	.0036	.0065		
K	16613		.0044	.0386	.0593	.0399	.0269	.0307	.0224	.0348	.0377	.0178	.0014		
L	16220		.0083	.0279	.0354	.0554	.0739	.0279	.0323	.0141	.0138	.0075	.0060		
M	12502		.0080	.0434	.0299	.0269	.0308	.0334	.0206	.0313	.0145	.0035	.0000		
N	11316		.0082	.0199	.0360	.0468	.0481	.0615	.0341	.0202	.0075	.0075	.0034		
O	10085		.0065	.0552	.0565	.0398	.0322	.0366	.0505	.0270	.0211	.0024	.0017		
P	4496		.0135	.0325	.0557	.0630	.0656	.0833	.0538	.0594	.0535	.0113	.0028		
Q	4232		.0066	.0590	.0522	.0459	.0662	.0495	.1590	.3382	.0433	.0000	.0000		
R	2128		.0147	.0382	.0836	.1230	.0526	.2319	.0440	.0226	.0000	.0000	.0000		
S	110		.0701	.3400	.2072	.1016	.4258	.0000	.3572	.0000	.0000	.0000	.0000		
Average s.d.			.0148	.0451	.0466	.0429	.0570	.0385	.0488	.0356	.0185	.0058	.0040		
Weighted ave s.d.			.0121	.0218	.0236	.0231	.0221	.0162	.0130	.0135	.0096	.0051	.0042		
S.D. of aggregate			.0052	.0120	.0140	.0144	.0137	.0082	.0015	.0040	.0024	.0008	.0005		

Table 12. Mean payment terms for Company Incurred Method using ultimate mean term of 4 years.  
Employers' Liability

Company	Weight	Year	0	1	2	3	4	5	6	7	8	9	10	11	Later
A	271672	4.64	3.74	3.39	3.33	3.45	3.71	4.04	4.31	4.65	4.65	4.66	4.34	4.00	
B	189060	4.04	3.19	2.93	2.82	2.77	2.80	2.76	2.70	2.80	2.96	3.20	4.12	4.00	
C	106915	3.84	2.98	2.68	2.54	2.43	2.40	2.52	2.62	2.83	3.40	3.79	3.38	4.00	
D	85232	3.72	2.91	2.46	2.18	1.98	1.92	1.99	2.09	2.15	2.19	2.57	4.19	4.00	
E	71976	4.11	3.21	2.76	2.60	2.57	2.79	2.99	3.27	3.33	3.17	2.88	4.40	4.00	
F	67189	5.19	4.28	3.90	3.86	4.09	4.51	5.04	5.60	5.93	5.92	5.49	4.80	4.00	
G	40190	4.56	3.65	3.24	3.15	3.27	3.46	3.96	4.56	5.32	5.93	5.38	4.87	4.00	
H	38037	4.83	3.97	3.76	3.83	4.12	4.52	5.14	5.77	6.13	5.84	5.45	4.88	4.00	
I	23421	4.67	3.76	3.24	3.10	3.26	3.67	4.34	4.60	4.96	5.86	5.39	4.95	4.00	
J	17308	3.94	3.14	2.65	2.38	2.26	2.27	2.15	2.06	1.86	2.44	2.28	2.50	4.00	
K	16613	4.37	3.45	2.99	2.74	2.52	2.29	2.13	2.11	1.92	2.81	5.88	5.28	4.00	
L	16220	4.77	3.84	3.27	3.05	3.04	3.20	3.37	4.35	5.32	5.53	5.52	4.87	4.00	
M	12502	3.89	2.98	2.49	2.28	2.29	2.18	2.17	1.97	1.59	3.71	6.00	5.00	4.00	
N	11316	4.17	3.29	2.80	2.47	2.15	1.99	2.02	2.20	1.93	1.71	1.07	.50	4.00	
O	10085	4.18	3.25	2.76	2.63	2.53	2.36	2.37	2.63	2.37	3.03	3.66	3.50	4.00	
P	4496	4.79	3.88	3.21	3.06	3.10	3.45	4.08	4.13	4.51	5.85	5.80	5.00	4.00	
Q	4232	4.52	3.57	2.94	2.64	2.38	1.97	1.25	.82	1.18	7.00	6.00	5.00	4.00	
R	2128	4.63	3.75	3.31	3.09	3.04	2.68	3.34	4.74	8.00	7.00	6.00	5.00	4.00	
S	110	3.09	2.20	2.21	1.75	.99	1.50	.50	ERROR	ERROR	ERROR	ERROR	ERROR	4.00	
Average runoff		4.33	3.44	3.03	2.86	2.80	2.93	3.09	3.54	4.08	4.78	4.81	4.56	4.00	
Weighted ave runoff		4.34	3.47	3.11	3.00	3.04	3.22	3.49	3.79	4.14	4.42	4.49	4.44	4.00	
Runoff of aggregate		4.37	3.49	3.14	3.03	3.09	3.29	3.58	3.92	4.32	4.64	4.69	4.55	4.00	

## Claims Run-Off Patterns Interim Report

### Section D

#### Sensitivity analysis

1. Any calculation of discounted non-life claims reserves will at best only produce an estimate of the present value of the claims based on a considerable number of estimates and assumptions.
2. Consequently a range of answers is possible. It is the purpose of this note to consider just some of this potential variation using the patterns derived for the Employers Liability Class by the Working Party. Other areas where this kind of analysis can then be extended are indicated and, if considered useful, could form the basis for continuing this work.
3. All results shown here are based on discounting of gross figures using gross payment patterns. The impact of reinsurance may be a significant further factor but we had no data to estimate this.
4. The discounting process involves three elements. These are :
  - a. Establish the undiscounted reserves suitably subdivided
  - b. Determine the payment patterns associated with these
  - c. Choose suitable rates of interest to apply.
5. Each of these elements introduces sources of potential variability in the calculated result. Only some of this variability will be examined in this section. Some comments are necessary in order to put into context the very limited nature of the work included in this section.
6. Reserves to be discounted .
  - a. Claims estimation is an inexact process particularly for the longer tail classes where discounting will have a more significant impact.
  - b. Current reserving practices assume point estimates with no real view of the likely statistical distribution around these estimates.
  - c. Actuarial loss reserving techniques most often used in practice, such as the chain ladder, produce point estimates only. Where such methods are used for reserve testing or setting a number of methods and assumptions are usually applied resulting in a range of estimates. Where in this range the reserve is set would depend on the degree of prudence required in the resulting reserve.

- d. This approach is not however statistically rigorous. Some of the underlying models, and the fitting process applied, may be suspect in a strict statistical sense, deriving in some instances non-optimal parameters and possibly reserve estimates that are biased down rather than at the desired central value. ( See ICRFS Manual by B.Zehnwirth )
- e. In practice this central estimate and its standard error (variability) is difficult to obtain under rigorous statistical assumptions. Only Zehnwirth's Kalman filter method supposedly does this at present but this has still to gain wide acceptance.
- f. It is reasonable to assume that uncertainty in the figures being discounted will translate to uncertainty in the result. This aspect will not however be pursued further here.

#### 7. Patterns to be used.

- a. A number of payment patterns can be derived from the same base data by using different methods and different tail assumptions. The Working Party derived four patterns for each Company and Table 3 shows the differences in the discounted reserves from these patterns.
- b. The pattern for any one Company will differ from a Market pattern where this can be derived in some way. By taking the aggregate patterns derived by the WP as a proxy for the "Market" pattern we will consider the differences arising from using this pattern rather than the Company's own pattern . It is worth noting, prior to any results, that there may be valid reasons for expecting real differences between a Company and a Market pattern due to differences in the mix of business and types of claim.
- c. A more thorough review of pattern impacts would need to consider how good historically derived patterns are at predicting future payments, especially under varying inflation assumptions, investigate the use of annual patterns and in particular the usual assumption that payments are made on average at mid-year, and consider the impact of varying tail assumptions.
- d. It is worth reiterating that the results derived here are based on data gross of reinsurance. Net patterns may differ from gross patterns especially at the later development periods. The impact of discounting is expected to be relatively less on the net reserves.

8. Choice of discount rates to be used .

- a. The actual choice of rate or rates to be used will have a significant impact on the results. Some testing of this variability will be done here. Any rates used are purely for the purposes of illustration and are in no way supposed to be indicative of rates to be used in practice .
- b. For simplicity the discount rate will be uniform irrespective of term. In view of the sensitivity of the results to the discount rate this source of potential variation warrants further investigation.

9. Choice of method of calculation.

- a. Claims payments, for a cohort of claims, take place more or less continuously rather than discretely . To minimise the potential error in any discounting calculation one could attempt to derive and use such continuous payment patterns.
- b. In practice this is not done as the patterns are usually derived as by-products of a reserving method, which generally uses annual type data, and the potential loss of accuracy may not be deemed significant enough to warrant this level of sophistication.
- c. After estimating the pattern and making assumptions on the distribution of payments within a year it is possible instead of making an exact calculation of the present value of the derived cash flow to use the pattern to calculate the various mean terms and use these instead or indeed use some "quick and dirty" standard formula. With the use of spreadsheets on personal computers there is no difficulty in actually doing any of these calculations.
- d. The figures in the following tables were produced using an exact calculation with annual patterns and a mid-year assumption for payments. It is worth noting that if interest rates are to vary over time it is not easy to see how to use more approximate methods.

10. Description of the method used.

a. Standard Amounts to be discounted.

- ) For simplicity, and due to lack of time, a split of reserves by accident year from a nominal total of 10,000 was derived consistent with the Company specific Basic Chain Ladder pattern. (Section C Table 1).

This was done as follows:

- 1) Assume ultimate losses by accident year increase at a rate of 8% p.a. - a crude approximation.
- 2) Use the payment pattern from the Basic Chain Ladder method to obtain the expected outstanding amounts by accident year.
- 3) Scale these amounts to add up to add up to 10,000.

b. Discounting calculations

- ) For each Company payment pattern calculate the net present value of the cash flows to be generated from this standard mix of reserves. We will also use the aggregate patterns to discount the derived reserves and compare results .
- ) A Spreadsheet was used for these calculations and more specifically the Net Present Value (NPV) function commonly found on these packages.
- ) An simplified example of such a discounting calculation is shown below for illustration purposes.

Example : ( Note figures are rounded in certain instances)

The calculations are done as at the end of the 1986 calendar year and assume no reserves for any year prior to 1981.

Part a: Derivation of nominal accident year reserves

Assumed payment pattern ( BCL patterns used in actual calcs)  
 40        34        12        7        4        2        1

Accident Year Losses ( increasing 8% p.a.)  
 1587   1469    1360    1260    1166    1080    1000

Implied reserves  
 952    382    190        88        35        11

Nominal accident year reserves  
 5741   2303    1148    532       211       65       Tot = 10,000

Part b: Discount calculation table

Calculation at rate of                    5.00%

Acc Year	Ultimate Reserve	Develop Year	Disc * pattern	Disc Factor	Discount Reserve
		0	45		
86	5741	1	32	.9370	5379
85	2303	2	9	.9269	2135
84	1148	3	7	.9402	1080
83	532	4	4	.9497	505
82	211	5	2	.9604	203
81	65	6	1	.9759	64
	10000		100		9364

\* This may be different from the pattern used to derive the split of reserves.

The discount factors are the present value of a unit payment according to the remaining pattern. So the last factor is the pv of 1 paid in 6 months time at 5%. The last but one factor is the pv of a total of 1 paid 2/3 rds in six months and 1/3 rd in 18 months and so on. In spreadsheet format the formula will look something as follows:

$$(1.05)^{-.5} * NPV ( 5\% : 7,4,2,1 ) / SUM ( 7,4,2,1 ) = .9402$$

Here the first factor adjusts to mid year payments.

The second factor is the Net Present Value at 5% of the series of payments 7 , 4 , 2 , 1 at the end of 1 , 2 , 3 and 4 years. Finally we divide by the sum of these ultimate payments to normalise them to a total of 1.



## 11. Results

- a. Three tables showing the results by Company now follow . These tables cover only the Employers Liability patterns . The Motor patterns were not available in time for the calculations to be completed for these
- b. Table 1 uses the patterns from the Basic Chain Ladder method and shows the discounted values of the derived 10,000 reserve using the company specific patterns and the aggregate pattern. Percentage differences are also shown. The discount calculations are done for four rates from 4% to 7%.
- c. Table 2 compares the discounted values obtained by using the four patterns derived and shown in Section C and also compares each with the aggregate pattern derived by use of the particular method. The reserves are taken as those derived using the Basic Chain Ladder method. All calculations are at 5% discount rate.
- d. Table 3 considers the results for each company from the four methods as above and compares these with the average value for each company. The results of the two inflation adjusted methods exhibit some bias and this is probably due to differences between the assumed future inflation rate of 8% and the implicit rate in the unadjusted data.

## 12. Final comment.

This section of the Interim Report was completed just prior to the final date for submission to the Institute and has not been discussed by the members of the Working Party. It is circulated for interest and has to be assumed to be in draft and unchecked form.

Comparison of Company Vs Aggregate pattern basis at various rates

Patterns used are the from the Basic Chain Ladder Section C Table 1

Assumed reserves of 10,000 derived from Company BCL patterns

Employers Liability Gross of Reinsurance

Discount values from assumed ultimate reserves of 10,000 at rates shown

Compan	Disc at 4%			Disc at 5%			Disc at 6%			Disc at 7%		
	own	aggr	% +/-	own	aggr	% +/-	own	aggr	% +/-	own	aggr	% +/-
A	8897	8985	-1.0%	8661	8765	-1.2%	8438	8557	-1.4%	8227	8359	-1.6%
B	9100	8964	1.5%	8902	8740	1.9%	8713	8528	2.2%	8533	8326	2.5%
C	9045	8970	.8%	8836	8747	1.0%	8638	8537	1.2%	8449	8336	1.3%
D	9175	8959	2.4%	8991	8734	2.9%	8814	8521	3.4%	8645	8319	3.9%
E	8993	8975	.2%	8774	8754	.2%	8567	8544	.3%	8370	8344	.3%
F	8774	9001	-2.5%	8515	8784	-3.1%	8272	8579	-3.6%	8043	8384	-4.1%
G	8903	8987	-.9%	8667	8768	-1.1%	8445	8560	-1.3%	8234	8363	-1.5%
H	8759	9002	-2.7%	8498	8785	-3.3%	8253	8580	-3.8%	8022	8385	-4.3%
I	8958	8984	-.3%	8733	8764	-.4%	8521	8556	-.4%	8319	8358	-.5%
J	9118	8962	1.7%	8921	8738	2.1%	8734	8526	2.4%	8554	8325	2.8%
K	9036	8969	.7%	8824	8746	.9%	8623	8535	1.0%	8431	8335	1.1%
L	8917	8987	-.8%	8684	8767	-1.0%	8463	8559	-1.1%	8254	8362	-1.3%
M	9134	8962	1.9%	8942	8737	2.3%	8758	8525	2.7%	8582	8323	3.1%
N	9103	8967	1.5%	8903	8744	1.8%	8713	8533	2.1%	8531	8333	2.4%
O	9150	8961	2.1%	8961	8736	2.6%	8780	8524	3.0%	8608	8322	3.4%
P	8908	8987	-.9%	8674	8768	-1.1%	8452	8560	-1.3%	8242	8363	-1.4%
Q	8972	8972	.0%	8745	8750	-.1%	8530	8539	-.1%	8324	8340	-.2%
R	9159	8967	2.1%	8970	8744	2.6%	8788	8532	3.0%	8614	8332	3.4%
S	9105	8971	1.5%	8905	8749	1.8%	8712	8538	2.0%	8527	8339	2.3%

For these Companies and under the assumptions used for these calculations use of an Aggregate pattern may impact the calculated discount reserves by up to +/- 3% at 5% disc rate. A change of 1% in discount rate impacts discount reserve value by approximately 2.5 % at these rates of discount and for this class at the gross of reinsurance level.

Comparison of Company Patterns and Aggregate pattern for the four methods

Patterns used as shown in Section C Tables 1 , 4 , 7 , 10

Assumed reserves of 10,000 derived from Company B C L patterns

Employers Liability Gross of Reinsurance

Discount values from assumed ultimate reserves of 10,000 at rate of 5%

Compan	B C L			I A C L			Av Clm Method			Co Incrd Method		
	own	aggr	% +/-	own	aggr	% +/-	own	aggr	% +/-	own	aggr	% +/-
A	8661	8765	-1.2%	8694	8794	-1.1%	8697	8799	-1.2%	8653	8735	-.9%
B	8902	8740	1.9%	8935	8772	1.9%	8932	8777	1.8%	8774	8707	.8%
C	8836	8747	1.0%	8858	8779	.9%	8910	8784	1.4%	8871	8716	1.8%
D	8991	8734	2.9%	9020	8768	2.9%	8987	8773	2.4%	8926	8701	2.6%
E	8774	8754	.2%	8798	8784	.2%	8879	8789	1.0%	8824	8722	1.2%
F	8515	8784	-3.1%	8551	8812	-3.0%	8633	8816	-2.1%	8538	8756	-2.5%
G	8667	8768	-1.1%	8697	8797	-1.1%	8696	8802	-1.2%	8706	8738	-.4%
H	8498	8785	-3.3%	8534	8812	-3.2%	8537	8816	-3.2%	8580	8757	-2.0%
I	8733	8764	-.4%	8751	8795	-.5%	8756	8799	-.5%	8690	8733	-.5%
J	8921	8738	2.1%	8945	8771	2.0%	8955	8776	2.0%	8851	8706	1.7%
K	8824	8746	.9%	8853	8778	.9%	8840	8782	.7%	8773	8715	.7%
L	8684	8767	-1.0%	8709	8797	-1.0%	8745	8802	-.6%	8698	8737	-.4%
M	8942	8737	2.3%	8977	8770	2.4%	9030	8775	2.9%	8905	8704	2.3%
N	8903	8744	1.8%	8928	8777	1.7%	8878	8782	1.1%	8810	8712	1.1%
O	8961	8736	2.6%	8989	8770	2.5%	8967	8775	2.2%	8799	8703	1.1%
P	8674	8768	-1.1%	8689	8797	-1.2%	8704	8802	-1.1%	8692	8737	-.5%
Q	8745	8750	-.1%	8726	8780	-.6%	8537	8784	-2.8%	8816	8719	1.1%
R	8970	8744	2.6%	8967	8778	2.2%	8985	8783	2.3%	8701	8711	-.1%
S	8905	8749	1.8%	8951	8782	1.9%	9086	8787	3.4%	9189	8716	5.4%

## Section D :

## Sensitivity analysis

## Table 3

Comparison of the four derived Company Patterns

Patterns used as shown in Section C Tables 1 , 4 , 7 , 10

Assumed reserves of 10,000 derived from Company B C L patterns

Employers Liability Gross of Reinsurance

Discount values from assumed ultimate reserves of 10,000 at rate of 5%

Company	BCL	IACL	Aver Claim	Co Incrd	Average	Range	Percent Diff from Av Value			
							BCL	IACL	Av	Cl Co Incr
A	8661	8694	8697	8653	8676	44	-.2%	.2%	.2%	-.3%
B	8902	8935	8932	8774	8886	161	.2%	.6%	.5%	-1.3%
C	8836	8858	8910	8871	8869	74	-.4%	-.1%	.5%	.0%
D	8991	9020	8987	8926	8981	94	.1%	.4%	.1%	-.6%
E	8774	8798	8879	8824	8819	105	-.5%	-.2%	.7%	.1%
F	8515	8551	8633	8538	8559	118	-.5%	-.1%	.9%	-.3%
G	8667	8697	8696	8706	8692	39	-.3%	.1%	.1%	.2%
H	8498	8534	8537	8580	8537	83	-.5%	.0%	.0%	.5%
I	8733	8751	8756	8690	8733	66	.0%	.2%	.3%	-.5%
J	8921	8945	8955	8851	8918	104	.0%	.3%	.4%	-.7%
K	8824	8853	8840	8773	8822	80	.0%	.3%	.2%	-.6%
L	8684	8709	8745	8698	8709	61	-.3%	.0%	.4%	-.1%
M	8942	8977	9030	8905	8964	124	-.2%	.2%	.7%	-.7%
N	8903	8928	8878	8810	8880	118	.3%	.5%	.0%	-.8%
O	8961	8989	8967	8799	8929	189	.4%	.7%	.4%	-1.5%
P	8674	8689	8704	8692	8690	30	-.2%	.0%	.2%	.0%
Q	8745	8726	8537	8816	8706	279	.4%	.2%	-1.9%	1.3%
R	8970	8967	8985	8701	8906	284	.7%	.7%	.9%	-2.3%
S	8905	8951	9086	9189	9033	284	-1.4%	-.9%	.6%	1.7%

## Interim report from Working Party on Claims run-off patterns

presented to GISG Convention October 1988

### E Chairman's comments

E1 First an apology. Owing to pressure of work we were unable to produce Section B in time for distribution prior to this Convention. We appreciate that this makes it very difficult for readers to comment on the detailed calculations underlying our analyses.

E2 Section C does not contain tables 5 or 8, which would contain standard deviations for the two inflation adjusted methods. The tails of the run-off patterns show negative proportions paid in four cases in Tables 1, 4 and 7. In three cases these are artefacts arising out of the 3 year averaging process used.

E3 A major purpose of this note is to stimulate comment, both on the approach adopted by the Working Party and on the results presented in our interim report. There are a number of points on which we wish to solicit the views of the Convention. For instance is GISG content with our self-imposed terms of reference? We wanted also to indicate our current intentions on the work to be carried out over the next year.

E4 The Working Party do not intend to analyse data other than from DTI run-off statistics in our next report (see A5).

E5 Nor do we intend to analyse net (whole class) data (see A4.2). Of course gross run-off data should not be used to discount net claims without further investigation. The net run-off would be quicker than the gross run-off if the large claims, protected by reinsurance, tended to be settled more slowly than the generality of claims. Timing differences between claim payments and reinsurance recoveries normally also reduce the effective run-off on a net account.

E6 We do not intend to analyse 3 year accounts (A7) in our next report.

E7 Nor do we intend to analyse the run-off of numbers of settlements (A8).

E8 1987 data are now available. We intend to add them to our database and show 13 year instead of 12 year run-off patterns.

E9 As indicated in A11, we intend to use private motor data for 1980 and earlier years of occurrence to enable comp and non-comp run-offs to be extended to (in principle) 13 years.

E10 In A13.1 we noted that we had observed some inconsistencies in the data. We intend to investigate these, to see to what extent they might distort the run-off patterns produced. It might be necessary to exclude a few companies' data from the aggregate data.

E11 The Working Party intend to consider under what circumstances, at least for the risk groups investigated, it might be appropriate to use a standard run-off table for discounting outstanding claims reserves, and how such a table might be used.

E12 We intend to investigate whether there are any obvious systematic differences between companies of different sizes (measured by size of risk group or overall size of company). It would be desirable to analyse rather more companies and (resources permitting) we intend to do this.

E13 We are also considering whether to analyse one additional risk group (we could not at this stage contemplate analysing 2 or more additional groups). Resources devoted to this could not be used to analyse more companies' data. In case we need to choose one or the other, would GISG prefer us to analyse more companies or another risk group? Which additional risk group would be of greatest interest? We are considering whether Property Fire might not be a suitable candidate. Although the Property Class is short-tailed and therefore not a Class where discounting of reserves is considered worthwhile, interest earnings on claims reserves may still make a significant contribution to profits. Other candidates include Commercial Motor (and/or Fleets) and Public Liability.

E14 In A15 we said that we intended to identify companies in our final report. We see no reason not to do so, since the data we are analysing is publicly available, provided we are careful to confine our comments on individual companies to factual matters arising out of our analysis.

E15 Different methods of analysing the data naturally give somewhat different run-off patterns. Does GISG consider it necessary to use all 4 of the methods presented? If not which of the methods do they consider redundant? Alternatively, for which other methods would they like to see results presented. (Originally we considered more than 16 methods, but it would not have been practical to use so many.)

E16 It is obviously appropriate to present some measure of the variability of the run-off patterns, both between years within a company and between companies. The standard deviation is the obvious candidate but in view, inter alia, of the relationships between the payments in different years, it is not obvious to us how to use standard deviations to test whether the run-off of an individual company is significantly different from the norm, nor indeed is it clear what is the best measure of variability. Any views on these points would be welcome.

E17 One obvious point: in considering whether the observed run-off for a company differs significantly from the norm, it is not sufficient simply to consider the various standard deviations. For example if the number of claims settled is small then clearly one should expect great variability even if it is not apparent from the data on payments

E18 In A18.4 we state that we believed the precise assumption about the mean term of the tail of the distribution would not have a great effect. We have now performed some calculations to investigate this. Using the run-off pattern derived from the aggregate data for the Employers Liability risk group by the basic chain ladder method, the claims reserves actually held at the end of 1986 for the years of occurrence 1975-86 have been discounted at various rates of interest with different assumptions about the length of the tail. Similar calculations were done for company H, which showed the largest tail. (Note: actual reserves were used unlike in Section D, which, for reasons of convenience and to avoid distortions from varying growth rates between companies, used invented reserves consistent with the run-off patterns.) The results were:

Tail length	AGGREGATE				COMPANY H			
	1 yr	4 yrs	7 yrs	10 yrs	1 yr	4 yrs	7 yrs	10 yrs
3% discount		.913				.885		
5% discount	.873	.864	.855	.848	.844	.823	.806	.790
7% discount		.820				.771		

E19 The ratios above are the ratios of the discounted to undiscounted reserves. It is assumed that all payments (except for tail) are made at 30 June, and that all the payments in the tail are made at the end of year 12, 15, 18 or 21 as appropriate. The results show that, for the aggregate, adding 3 years to the assumed length of tail has less effect than an increase of 0.4% in the discount rate. Even for company H, 3 years on the tail is equivalent to only 2/3% on the discount rate.

E20 Further consideration will need to be given to the extent to which appropriate mean terms for the tail may be derived from the data.

E21 We would welcome any further comments which it is not possible to make during the Convention, or which occur to GISG members after the Convention. These may be sent to the Chairman at Government Actuary's Department, 22 Kingsway, WC2B 6LE.

PHH  


P H Hinton  
 October 1988

#### Membership of Working Party

Mark Allen  
 Martyn Bennett  
 Bob Chadwick  
 Stavros Christofides

Terry Clarke  
 Peter Hinton (chairman)  
 Andrew Thomson