EXTENDED WARRANTY

1. Introduction.

1.1 These notes express the view of the writer alone and are not necessarily representative of his Employer. For a background to this subject, reference might be made to "Extended Warranty Insurance", a paper presented to the Institute of Actuaries Students' Society on the 15th January, 1985 by J.M. Taylor and to the note prepared for last year's Seminar by S.Christofides.

1.2 These notes approach the problem of projecting claims with data as provided in table 1. While the data provided retains the shape of the original, it has been transformed so that neither frequency nor average cost are representative of actual absolute values.

1.3 In tackling this forecasting problem we could either project the value of claims or make separate forecasts of numbers and their average cost. In table 4 the claims have increased by 19% in the last twelve months compared with an increase in RPI over the same period of only 5%. Superimposed on inflation is an increase in the severity of claims which would be expected as appliances age. However, it is possible that some of the increase in claims frequency expected over the duration of the policy might arise from an increased number of minor claims so that the average cost of claims could fall at some stage. It is therefore proposed that each component of ultimate cost be considered separately and these notes are restricted to numbers of claims.

2. Factors to be considered.

2.1 IBNR.

The number of IBNR claims will depend upon how the Scheme is administered- whether claimants are reimbursed directly or settled by bordereaux with repairers. Ideally, an attempt should be made to estimate the volume of IBNR and adjust the data to allow for it. During the first 12 months of claims, as policies come on cover, IBNR will tend to overstate any increase in claims frequency. Thereafter, trends will emerge more slowly than they actually arise. In table 2, the data has been "transmogrified" to make an arbitrary allowance for IBNR: a three month moving average was taken and the result moved back one month.

2.2 Type of Product .

Since our data does not differentiate between years of exposure, to make use of forecasts of the percentage of claims which fall within each year of insurance, exposure years have been calculated, assuming an even inception of certificates. In table 2 calculations are shown for forecasts which have been made for this appliance. The frequency calculated at each development stage is a forecast of ultimate frequency assuming the percentages used.
For columns A,B and C the percentages are spread evenly within each year of exposure while for columns D,E and F allowance has been made for the increase in frequency month by month.

2.3 Expected Frequency.
Engineers and Consumer magazines have indicated that, allowing for the transformation made to the data, the overall frequency is likely to be 2-2½.

2.4 Seasonality.

Without data for more than one year of certificate issue, could this factor be estimated and allowed for?

3. Analyses Conducted.

3.1 Frequency to Exposure.

The frequencies in columns A,B and C of table 2 are all increasing but, even if one of them was stable, our only conclusion at this stage could be that the increase in frequency implied by the first two percentages was valid. In the case of column B, equal stability would be obtained from using percentages of 20,40,30,10.

The results may be tested for self consistency as follows:-

Column	Latest Est. of Freq.	Est. of Total No. of Claims	% of Total Expected in 1st Exposure Year	No. Expected in 1st Exposure Year	No. Expected in Remainder of 1st Exposure Year * (Increase over 1st 12 Months
A	109.9%	105,504	25%	26,376	15,347 (39%)
B	257.5%	247,200	10%	24,720	13,691 (24%)
C	168.8%	162,048	16%	25,928	14,899 (35%)

* given 11,029 at 12 months.

For columns A and C, the required growth in frequency exceeds that implied by the percentages assumed. It would appear that column B is more nearly self consistent - it also supports our expected frequency.

3.2 Alternative Approach to Exposure.

The frequencies in columns B and C are increasing partly because of the approximation used to calculate exposure: the percentage to be earned in each insurance year was spread evenly over that year despite the continuous increase in frequency implied by the models.
In columns D and E, allowance has been made for this increase month by month and the resultant frequencies calculated. Although the increase in frequency in column E is less than in column C, it is still unacceptably high. Since the frequency in column D is gradually falling, the model in column F has been applied to the data. Is it reasonable to assume that the ultimate frequency will fall between 233% and 297%?.

3.3 Regression.

In table 2A the cumulative and marginal claims frequencies are plotted using the exposure in column A of table 2. If,in time, the marginal frequency settles down it may be possible to fit a model to it and extrapolate. The regression slope fitted to the last six observations of cumulative frequency is:-

$$\text{Frequency} = 68.178 + .002\,059\,6 \times \text{Exposure}.$$

X^2 (3) is .0314 which is acceptable at better than 99.5% probablity. At 96,000 units of exposure, the estimated frequency is 265.9% which again supports our a priori view.

3.4 Graphical Extrapolation.

In table 3 is plotted the number of claims reported (transmogrified) against exposed certificates. It serves to illustrate the enormous gap between the current data and the expiry of the final certificate. The graph drawn is one of many possibilities and, at this stage, can realistically only illustrate what a frequency of some 2.5 might infer.

3.5 What more could we do.?

While a very sophisticated model may be fitted to the data, with the extrapolation tail involved, is it likely to provide a more accurate projection than the simple approaches used above? Although the linear regression model fits the more recent data very well it could not be applied to data prior to the 10,000 exposure level and future development may involve a series of other slopes and curves.

4. Application of Results.

4.1 Reserving.

Even if we reserve on a funded basis should account be taken of projection such as that above? The Seminar notes prepared by DEA Sanders last year required at least an accurate forecast of claims in order to apply his approach: what is accurate?

4.2 Rating.

At this stage of claims development, an extended warranty scheme may be marketed and we might be asked our opinion of appropriate rates as a competitor. The following points need to be considered:-

4.2.1 Is our forecast reasonable as a basis for rating?

4.2.2 What rate of inflation should be used to adjust any burning cost obtained for the inception of the proposed Scheme?

4.2.3 As products continue to be updated - for example increased use of teletext and remote controls on televisions and micro chip technology on cookers and washing machines- can this data be applied to products to be sold in the future?

4.2.4 Are we offering identical cover? Will our interpretation of cover be the same as the current Insurer?

4.2.5 Is the Public becoming increasingly claims conscious and less likely to forget about the existence of cover?

4.2.6 Investment Income.

4.2.7 Expenses.

4.2.8 Safety Margin.

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Table 1

EXTENDED WARRANTY – FOR SINGLE APPLIANCE IN RESPECT OF 96,000 CERTIFICATES ISSUED IN ONE YEAR. COVER FOR FOUR YEARS FOLLOWING EXPIRY OF MANUFACTURER'S GUARANTEE

MONTHS SINCE INCEPTION OF COVER	VALUE OF CLAIMS PAID	NUMBER
1	100	2
2	412	8
3	6934	121
4	15306	261
5	39103	690
6	73486	1252
7	118837	1983
8	178621	2923
9	247787	3996
10	334540	5414
11	434997	6998
12	569874	9184
13	699593	11070
14	850113	13374
15	1 037436	16132
16	1 233 149	18901
17	1 441 558	21800
18	1 690 104	25208

Table 2

Number of Claims	Trans-Morified (See 2.4)	A Straight-line Exposure	A Straight-line % Frequency	B 10% 20% 30% 40% Exposure	B 10% 20% 30% 40% % Frequency	C 16% 20% 30% 34% Exposure	C 16% 20% 30% 34% % Frequency	D 10% 20% 30% 40% Graduated Exposure	D 10% 20% 30% 40% Graduated % Frequency	E 18% 20% 30% 34% Graduated Exposure	E 18% 20% 30% 34% Graduated % Frequency	F 12% 24% 30% 3 Graduated Exposure	F 12% 24% 30% 3 Graduated % Frequency
2	44	83	53.0	33	133.3	53	83.0	20	220%	40	110%	27	163%
9	130	333	39.0	133	97.7	213	61.0	80	163%	170	76%	107	121%
121	357	750	47.6	300	119.0	480	74.4	180	198%	400	89%	240	149%
261	734	1333	55.1	533	137.7	853	86.0	320	229%	730	101%	440	167%
690	1308	2083	62.8	833	157.0	1333	98.1	500	262%	1160	113%	720	182%
1252	2053	3000	68.4	1200	171.0	1920	106.9	720	285%	1670	121%	1080	190%
1983	2967	4083	72.7	1633	181.7	2613	113.5	980	303%	2320	128%	1520	195%
2923	4111	5333	77.1	2133	192.7	3413	120.5	1307	315%	3060	134%	2040	202%
3996	5469	6750	81.0	2700	202.6	4320	126.6	1734	315%	3920	140%	2640	207%
5414	7199	8333	86.4	3333	216.0	5333	135.0	2267	318%	4900	147%	3320	217%
6998	9084	10083	90.1	4033	225.2	6453	140.8	2907	312%	6000	151%	4100	222%
9184	11029	12000	91.9	4800	229.8	7680	143.6	3654	302%	7222	153%	5000	221%
11070	13525	14000	96.6	6633	240.1	8973	150.7	4487	301%	8520	159%	5993	226%
13374	16136	16000	100.9	6533	247.0	10293	156.8	5387	300%	9850	164%	7053	229%
16132	18944	18000	105.2	7500	252.6	11640	162.7	6354	298%	11200	169%	8200	231%
18901	21970	20000	109.9	8533	257.5	13013	168.8	7394	297%	12570	175%	9440	233%
21800		22000		9633		14413							
25208		24000		10800		15840							

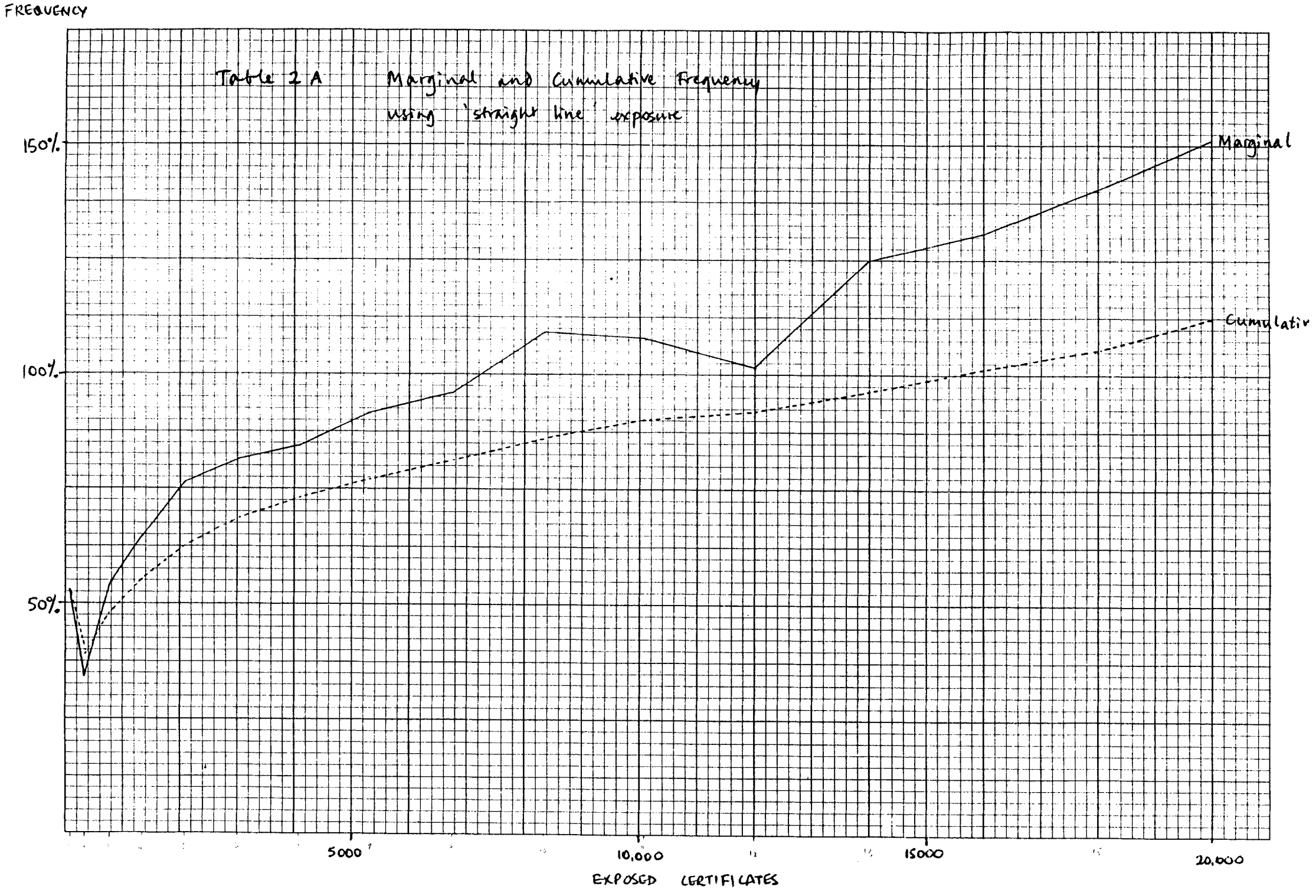
FREQUENCY
Table 2 A Marginal and Cumulative Frequency
using 'straight line' exposure
150%
100%
50%
Marginal
Cumulativ
5000
10,000
15000
20,000
EXPOSED CERTIFICATES

TABLE 3 EXTENDED WARRANTY

NUMBER OF CLAIMS BY EXPOSED CERTIFICATES

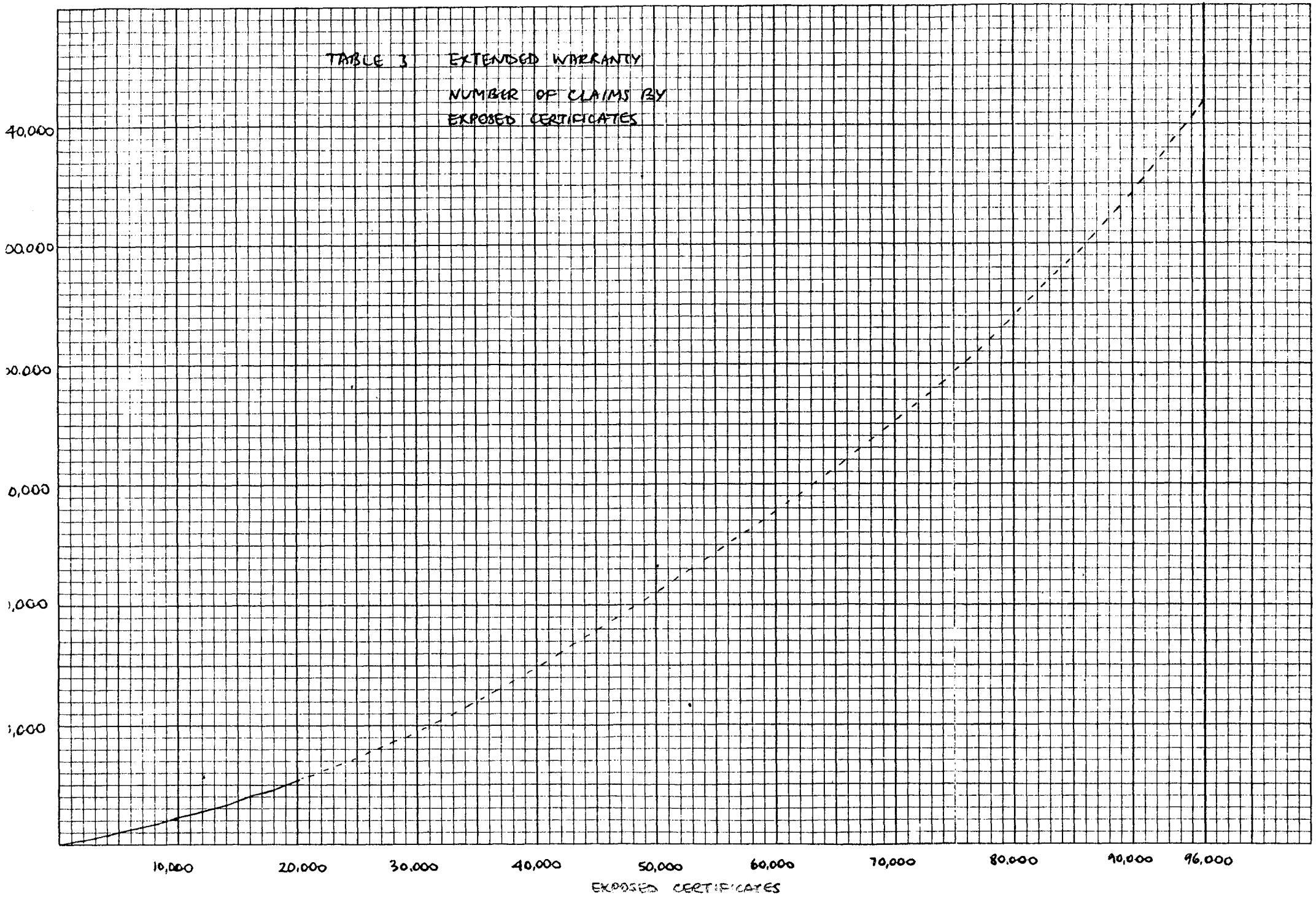

Table 4

Month	Marginal acpc*		12 months claims drift	
1	50.00			
2	52.00			
3	57.72	58.69		
4	59.80			
5	55.47			
6	61.18			
7	62.04			
8	63.60			
9	64.46			
10	61.18			
11	63.42			
12	61.70			
13	68.78		38%	
14	65.33		26%	
15	67.92	69.91	18%	19%
16	70.68		18%	
17	71.89		30%	
18	72.93		19%	

* Average cost of claims settled in the month