PROBLEMS IN MOTOR INSURANCE — CLAIM RESERVES

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In his comprehensive paper entitled "A General Survey of Problems Involved in Motor Insurance", Dr. Carl Philipson includes remarks with respect to mathematical reserves. The purpose of this paper is to discuss a method of statistical estimation of Third Party Motor Insurance claim reserves. These methods can also be used for Car Damage Insurance, since reserve determination for these rapid settlement property coverages is simpler than for Third Party lines.

Dr. Philipson mentions the two main purposes of claim reserves-balance sheet loss reserves which shall be estimated on the safe side for financial reasons, and those reserves needed for risk statistics. In this paper I shall confine my subject to aggregate loss reserves for financial statements and internal management operating reports.

In this paper, it will be convenient to refer to both European and U.S. terminology for Motor Car and Automobile Insurance. The comparable terms are:

Motor Insurance	*Automobile (U.S.)*
Third Party	Auto Liability-Bodily Injury
	Auto Liability-Property Damage
Car Damage	Auto Physical Damage

Accident Year Statistics

The *accident year* is the important fiscal period underlying not only the statistical estimation methods discussed in this paper but it is also the basic grouping of accidents in the official reserve tests required in the Annual Statements of U.S. companies for casual-

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ty and property lines. An *accident year* embraces the entire population of claims incurred with *accident dates* in a particular calendar year, whether reported to the company in that year or subsequently (i.e., incurred/not reported).

Under the accident year method of establishing claim reserves, there is an automatic grouping or segregation of all like accident year claims through successive calendar years as the total population of reported claims for each accident year moves to ultimate settlement status, i.e., as increasing numbers of reported claims attain settlement or closure status and the balance or number of unpaid or unsettled claims approaches o (in that future year when all claims occurring in a specified accident year have been settled and closed.)

Accident Year Method

The accident year method of establishing aggregate reserves involves procedures for making successive annual (and quarterly for internal management and balance sheet reports) estimations of probable settlement costs of remaining unpaid claims in each accident year grouping of claims received. Specific attention will be devoted to known reported claims in this paper. (While not discussed here, the special category of incurred/ not reported claims can be solved in a similar manner. A study of past lags in claim reporting gives the needed statistical count from which one can proceed by the use of mean values — as for known claims).

The general method is to determine, for each accident year, the estimated total losses incurred, $ L. From this total $L is subtracted the actual total losses paid for each respective accident year giving a balance, which is the claim reserve for unpaid claims. The writer has found through long experience that more satisfactory and adequate results are obtained by such estimation of losses incurred for the entire accident year population of claims and deducting therefrom the actual claims *payments*, than with methods by which unpaid losses on unsettled claims are directly estimated by multiplying unpaid loss averages by the number of unpaid claims. The use of mean values for all claims incurred in an accident year gives more comparability and stability than does the use of the unpaid claims only. However, in later stages of

development the aggregate of individual claim estimates by claims experts do attain increasing reliability.

Accident Year Development Statistics

Exhibit A is a statistical exhibit of basic data for use in determining ultimate average claim costs for specified accident years.

An important basic statistic is the count of *claim notices* received, The whole population of claims — including notices of claims which ultimately may be settled without payment because of triviality, being less than the policy contract deductible, or non-liability. The method of counting the entire number of these random events (claim notices) has distinct advantages, the most important of which is being able to use the earliest possible indication of a claim liability incurred by the insurance company. The definition of the claim notice must be broad enough to permit immediate and accurate identification. It is preferable to use a broad definition in order to be able to use claim notice statistics immediately, rather than to so refine the definition such that first notices of claims cannot be immediately classified.

For example, separate counts of Auto Liability (*B I*) and (*PD*) can be made for most U.S. claim notices but such may not be possible for single line third party liability.

A quick review of the statistics in Exhibit A reveals that behavior patterns of an individual accident year are quite consistent with prior accident years at comparable dates of aging or development. This consistency in the aggregate flow of claims from first reporting to final settlement for similar claim settlement periods is one of the reasons why the method discussed in this paper can be valuable to an individual insurance company. The use of individual company patterns to measure the rate of development, is recommended because of the wide variations in individual insurance company practices of recording and counting claims reported, speed of settlement, distribution of business, seasonal traffic patterns, differences in geographic areas as well as differences in general claims management practices.

Exhibit B is a comparable arrangement of data for similar settlement periods. These statistics can be used to estimate ultimate mean settlement values for all claims in a given accident year.

AUTO LIABILITY (B.I.)

Exhibit A

Accident Year Development Statistics

Accident Year	Date 12-31	1 Number of Claim Notices Reported	2 Number of Claim Notices Open	3 Number of Claim Notices Closed	4 Mean Loss Closed	5 Mean Loss Reported	6	7	8
1957	1957	17,337	5,722	11,615	$ 231	$ 638			
	1958	18,732	1,681	17,051	447	695			
	1959	18,811	666	18,145	558	676			
	1960	18,833	305	18,528	621	670			
1958	1958	18,672	6,083	12,589	234	599			
	1959	20,064	1,710	18,354	437	669			
	1960	20,128	716	19,412	554	668			
1959	1959	20,162	6,449	13,713	242	597			
	1960	21,756	1,833	19,923	456	683			
1960	1960	21,123	6,891	14,142	254	619			

Exhibit B

Comparable Accident Year Developments

Accident Year	Development	1 % Closed	2 Mean Closed	3 Loss Reported	4 Ultimate Mean Loss	5 Index 4-2	6 Incurred Loss $ 1000	7 Paid Losses $ 1000	8 Loss Reserve $ 1000
1957	1 year	67.0	$ 231	$ 638	$ 670	2.90			
1958	1 year	67.4	234	599	677	2.89			
1959	1 year	68.0	242	597	695	2.87			
1960	1 year	67.0	254	619	* 729	←2.87	15,400	3,592	11,808
1957	2 years	91.0	447	695	670	1.50			
1958	2 years	91.5	437	669	677	1.55			
1959	2 years	91.6	456	683	* 695	←1.52	15,120	9,085	6,035
1957	3 years	96.5	558	676	670	1.20			
1958	3 years	96.4	554	668	* 677	←1.22	13,627	10,754	2,873
1957	4 years	98.4	621	670	* 670	←1.08	12,618	11,506	1,112

Explanations:

1. $L in Column 6 = No. Notices (Column 1, Exhibit *A*) *X* Ultimate Mean Loss (Column 4, Exhibit *B*)
2. Index marked ← is determined first based upon previous index history and review of any external factors affecting current loss trends.
3. Ultimate Mean Loss for latest development of each accident year (marked *) is product of Index and Mean Loss Closed (column 2).

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The basic method is to apply to the full claim count by accident year the ultimate mean value of single claim notices separately for auto liability (*BI*), auto liability (*PD*), auto physical damage, etc. Only auto liability (*BI*) is illustrated in this paper, since it is by far the most involved of all motor car coverages.

In the statistics shown in Exhibits A and B are included average costs made by claims experts, identified as "reported". Many insurance companies in the United States record individual claim estimates made by claims experts for claims which exceed one year in age and for all serious claims, regardless of age. Where such individual estimates are available, they can be used to supplement projections based upon mean values. In addition, individual claim estimates are often used for risk statistics in special rating plans.

Explanation of Exhibits A and B

Exhibit A contains the basic data for making the estimates of ultimate mean values by accident year in Exhibit *B*.

Exhibit B is an arrangement of statistics from Exhibit *A* by comparable age of development. The actual statistics are based on an actual U.S. company auto liability claim history with minor modifications for clarity of presentation.

An observation of the rate and extent of closings for a particular accident year as compared with past patterns for the average paid cost of settled claims gives a basis for judgment selection of the ultimate mean loss.

An alternative to judgment selection of ultimate mean loss costs is to plot the development figures and work out formulae for calculating the ultimate mean loss. The formula should reflect the extent of closure at the average settlement cost actually experienced to date.

The incurred losses $L are determined by multiplying the ultimate mean loss determined for each accident year by the respective number of claim notices reported. From this incurred loss figure is deducted the actual paid losses for the accident year to determine the loss reserve. In Exhibit B, such determination of loss reserves is illustrated for four accident years of varying age.

Official Loss Reserve Tests

In U.S.A. the official loss reserve tests for Automobile lines are

a part of the official Annual Statement required by all state insurance departments.

These tests are directly related to loss reserves in the financial balance sheets of U.S. casualty and property insurance companies.

The loss reserves which the companies certify to in their annual statement are subject to subsequent check as to financial adequacy. For automobile insurance lines there are two schedules in U.S. annual statements which check on loss reserves:

Schedule *P* — Part 5 for Incurred Auto Liability (BI) Losses

Schedule O — Part 1 for Auto Liability (PD) and Auto Physical Damage Losses.

ANNUAL STATEMENT FOR THE YEAR 1960 OF THE USA INSURANCE COMPANY

SCHEDULE P — Part 5

Development of Incurred Auto Liability (B.I.) Losses

Exhibit C

Sums of Columns (3) and (12), Schedule P, Part 1 A

Policy years	Years in which losses were incurred	RESERVE DATE					
		Dec. 31, 1955	Dec. 31, 1956	Dec. 31, 1957	Dec. 31, 1958	Dec. 31, 1959	Dec. 31, 1960
1955	1955	8,290,811	8,156,290	8,529,730	8,613,813	8,673,821	8,608,124
1955	1956	× × ×	4,257,160	4,382,867	4,026,459	4,197,022	4,143,810
1956	1956	× × ×	8,510,632	8,985,812	8,462,664	8,209,950	8,026,030
1956	1957	× × ×	× × ×	4,186,075	4,286,063	4,341,045	4,379,129
1957	1957	× × ×	× × ×	9,302,817	9,166,805	8,942,017	8,958,083
1957	1958	× × ×	× × ×	× × ×	5,701,012	5,788,161	5,741,900
1958	1958	× × ×	× × ×	× × ×	10,910,888	10,480,675	10,343,706
1958	1959	× × ×	× × ×	× × ×	× × ×	6,673,869	6,792,109
1959	1959	× × ×	× × ×	× × ×	× × ×	11,714,079	11,658,330
1959	1960	× × ×	× × ×	× × ×	× × ×	× × ×	7,807,664
1960	1960	× × ×	× × ×	× × ×	× × ×	× × ×	12,139,843
* 1955	1957	× × ×	× × ×				
* 1955	1958	× × ×	× × ×	× × ×			
* 1956	1958	× × ×	× × ×	× × ×			
* 1956	1959	× × ×	× × ×	× × ×	× × ×		
* 1957	1959	× × ×	× × ×	× × ×	× × ×		
* 1957	1960	× × ×	× × ×	× × ×	× × ×	× × ×	
* 1958	1960	× × ×	× × ×	× × ×	× × ×	× × ×	

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The Schedule P — Part 5 test involves a split policy year/accident year evaluation of incurred losses (paid plus reserve) at December 31 of the first calendar year (N) period followed by successive annual re-evaluations as of December 31 for years $N + 1$, $N + 2$, . . . , $N + 5$. Even though the Annual Statement does not require an evaluation of incurred cost beyond year $N + 5$, such evaluations are continued for internal Company purposes to $N + x$, the year of final settlement of all claims.

Exhibit C illustrates this Auto Liability (BI) development of incurred losses at successive year-ends. It gives an historical record of adequacy of valuations of claims for split policy year/accident year groups of accidents. In this Exhibit *C* are illustrated all of the policy year/accident year developments reportable in the 1960 Annual Statement. For example, follow 1958 policy year/1958 accident year (marked with an arrow): At December 31 of the first calendar year (1958) these accidents were evaluated at $ 10,910,888 (paid plus reserves). During calendar Year 1959, more claims were closed and those still not settled were re-evaluated and revised reserves established to produce a December 31, 1959 development (paid plus reserves) of $ 10,480,675. Another calendar year of claims settlement activity and re-evaluation of unsettled claims produced a December 31, 1960 development of $ 10,343,706. Thus, the first year valuation of $ 10,910,888 has proved redundant by $ 567,182 or about 5.2%.

In a like manner, other policy year/accident year groups of accident can be reviewed and their development history noted. These data illustrate both favorable and unfavorable developments. In this Schedule P reserve test, each *accident* year is divided into two parts or policy (effective) years. Summation of these parts gives total accident year results. Both company management and insurance regulatory departments can observe the company's loss reserving history for financial balance sheet purposes.

Schedule O — Part 1 provides a loss reserve test in the annual statement for year N of the development for all accident years N-1, N-2, N-3 . . . . back to and including the oldest unsettled claims.

Exhibit D illustrates this Schedule O test for Auto Liability (PD)

Exhibit D

ANNUAL STATEMENT FOR THE YEAR 1960 OF THE USA INSURANCE COMPANY

Schedule O—Part 1

Losses Other Than Bodily Injury Liability and Workmen's Compensation Claims

	(2) Losses paid during the year less salvage and reinsurance received thereon during the year. ** On losses incurred prior to January 1 of current year.	(6) Losses unpaid Dec. 31 of current year, viz.: ** On losses unpaid Dec. 31 of previous year, less reinsurance thereon.	(9) Total losses incurred to Dec. 31 of current year on losses incurred in prior years (Cols. 2 + 6).	(10) Estimated liability on unpaid losses Dec. 31 of previous year, per Column (8), Schedule O, previous year.	(11) Increase or Decrease in such estimated liability (indicate decrease by minus sign) difference between (Col. 9 and 10).
20. Auto liability (P.D.)	$ 3,593,246	$ 1,827,199	$ 5,420,445	$ 5,764,132	$ —343,687
21. Auto physical damage	2,415,381	251,530	2,666,911	2,915,296	—248,385

and Auto Physical Damage. The three significant reserve test columns are the last three (marked by arrows). In this 1960 annual statement test for Auto Liability (PD), column (10) from last year's (1959) statement reported unpaid (including incurred/not reported) claims reserved at $ 5,764,132. In this 1960 statement, a year later, that same group of claims (1959 and prior) has now developed to $ 5,420,445 (paid in 1960 plus reserves for such claims still unsettled) indicating (in column (11) a favorable development, i.e., redundancy) of $ 343,687 or about 6%.

You will note a principal difference between these two reserve tests. The Schedule P test provides successive annual evaluations of incurred losses. The Schedule O test is a combined test of all accident years of the loss reserves prior to the year of the annual statement.

** Including all losses reported in the current year where the loss was incurred prior thereto.

These two exhibits for testing casualty and fire company reserves for automobile insurance lines in the U.S. are important measures of the most difficult item to determine in the financial statement — Reserve for Losses.

General Comments

Mean values to reflect ultimate average losses for an accident year are subject to disturbances which require attention and judgment. External factors, such as inflation, court congestion, etc., can change an individual company's evaluation mean values. Major internal company changes can also distort logical use of averages developed in the past. The introduction of or change in the amount of a deductible can distort past averages as usable for current purposes. No claim bonus plans can change the normal unbiased or random nature of claims reported. Dr. Philipson refers in his paper to the effect of "hunger for bonus" in distorting normal claims practices, particularly by policyholders in relinquishing benefits from minor claim reportings of less financial gain than keeping of position in the bonus scale.

Another item requiring judgment attention is the relationship between claim frequency and average mean loss values. A sudden increase in claim notice frequency usually involves the receipt of an abnormal number of below-average claims but tend to decrease the mean values determined from past experience. Therefore, a sudden increase in claim notice frequency may render the prior pattern inconsistent without modification.