AN ANALYSIS OF THE MARGINAL COST OF WRITING AUTOMOBILE INSURANCE

by

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ABSTRACT

The Royal Commission on Automobile Insurance of British Columbia was established in 1966 to enquire, among other things, into the cost of providing automobile insurance by insurers to the public. This thesis is concerned with evaluating the cost of writing automobile insurance in Canada, and how this cost affects the rate making policies of the Canadian Underwriters' Association, and finally, as to the influence of the cost factor in establishing a centralized agency.

In establishing a gross premium, the insurer must cover expected losses arising out of claims and cover administrative costs. Detailed accounts are kept of claims incurred by line of insurance. However, for the expense portion only direct claims expenses are allocated by line of insurance; no accounts by line of insurance are kept for the rest of the administrative expenses.

Expense accounts are submitted annually to the Superintendent of Insurance, but are not broken down by line of insurance. By using multiple regression analysis on cross sectional data for one calendar year, one can estimate the marginal costs of writing different lines of insurance. The hypothesis will be that expenses can be expressed as a linear function of premiums written by line of insurance. In addition, it will be possible to determine whether any economies of scale are present in writing automobile insurance. The results of the statistical study indicated that the marginal cost of writing automobile insurance was between 28 and 30 percent of the gross premium, which is lower than the 33 percent expense factor currently used by the Canadian Underwriters' Association. In addition no economies of scale were found in writing automobile insurance in Canada.

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CHAPTER I

INTRODUCTION

Objectives of Study

In the recent past the automobile insurance industry has come under close scrutiny by the public at large, organizations and governmental agencies. Automobile insurance rates have increased at such a pace that it was inevitable that the industry would be called to task. For example, for British Columbia territory 1, Vancouver rating district, private passenger automobile third party liability rates were increased 29 per cent on January 1st 1965, an additional 5 per cent on July 1st, 1965, and an additional 11 per cent on January 1st, 1966.¹ This is equivalent to a fifty per cent increase in rates in one year.

In the spring of 1966 a Royal Commission on Automobile Insurance was established to inquire, among other things, into:²

"... the cost to insurers, to persons who pay insurance premiums and to the public generally of providing present forms of automobile insurance determined on the

¹Canadian Underwriters' Association Brief (presented to the Royal Commission on Automobile Insurance, June 1966, hereinafter C.U.A. Brief), p. 18.

²Transcript, Royal Commission on Automobile Insurance of British Columbia (hereinarter Transcript R.C.A.I.), Volume 1, pp. 6-7. basis of past and current experience and whether the cost is in proper relationship to the effective protection obtained,...

the justification for recent variations in automobile insurance premium rates,

whether the public of this Province will be better served by the continuation of present procedures for the recovery of damages arising out of motor-vehicle accidents and by the preservation of present forms of insurance coverage or by some variation or variations thereof,...

whether such a variation or a plan for compensation or such a combination, if recommended, should be administered privately or by or through a governmental department or a governmental agency or a combination thereof,...."

This thesis is concerned with evaluating the "cost to insurers" of writing automobile insurance in Canada, and how this cost affects the rate-making policies of the insurers, and finally, as to the influence of the cost factor in establishing a centralized agency.

In establishing a rate or gross premium³ the insuring company must cover expected losses arising out of claims and cover administrative expenses required to write automobile insurance. No statistics are kept by lines of insurance as to what proportion of overhead costs pertain to automobile insurance. This study will thus attempt to evaluate the validity of the 33 percent expense factor currently being used by the Canadian Underwriters' Association Statistical Agency. The procedure used in this study will also

Gross premium is that amount that the insured pays, for a specified amount of coverage.

enable us to distinguish among economies and diseconomies or no economies of scale in the writing of automobile insurance in Canada. The results will indicate whether any reduction in administrative expenses would occur if automobile insurance business were centralized.

Method of Analysis

The procedure that will be followed requires the use of multiple regression analysis. The hypothesis will be that expenses can be expressed as a linear function of lines of insurance. Through statistical criteria it will be possible to determine the marginal costs of writing a particular line of insurance for each expense category included in the study. The results will be analyzed statistically to determine whether they are significantly different from zero and the confidence that can be placed in their predictive value for determining the expense factor loading of the gross premium.

Sources of Data and Constraints

The main source of data is contained in the Annual Reports of the Federal Superintendent of Insurance.⁴ The

⁴<u>Report of the Superintendent of Insurance for Canada</u>, Annual Statements - Fire and Casualty Insurance, Queens' Printer, Ottawa 1965, Volumes I and II (hereinafter Blue Books).

automobile insurance companies report annually on a standard reporting form to each of the Provincial Superintendents and to the Federal Superintendent their automobile experience? The information collected is based upon the calendar year's experience for 1964, and for the purposes of this study consists of net premiums written, net premiums earned and net claims incurred.⁶ Premiums written consists of all of the insurance a company wrote in Canada during the calendar year. Premiums earned consists of that portion of the premium that if written on July 1st, fifty percent of the premium is earned in the year in which it was written. The unearned portion, the other fifty per cent of the premium, is applied to the following calendar year's earned premium. ⁷ Net claims incurred includes the losses arising out of claims and bodily injury, property damage, and collission claim expenses that arise out of a particular claim and can be traced to a particular line of insurance.

⁵Transcript R.C.A.I., Volume 1, p. 254. See also Canadian and British Insurance Companies Act. 1932, C.46, 569,70.

^O"Net" means after deduction of all reinsurance for Canadian companies but only registered or licensed reinsurance for British and foreign companies.

⁷This should not be confused with the "earned premiums" rigures used to calculate rates. On the latter subject see the <u>Report of the Royal Commission on Automobile In-</u> <u>surance</u>, Nova Scotia, 1957, Volume I, pp. 35-6. (Nova Scotia R.C.A.I. hereafter).

In addition to the above, the Blue Book also contains the underwriting account for each insurance company which lists the total expenses incurred and a breakdown of general expenses.

The Superintendent of Insurance, or a duly qualified staff member, must visit each company to check the annual statements submitted at least every three years.⁸ Thus it may be concluded that the data to be used will be uniform and valid.

Organization of the Study

Chapter I presents the objectives and method of the study including sources of data, constraints and organization of the study.

Chapter II will serve as an introduction to the history of the expense factor loading, the components of the expense factor, and the effect of the trend factor on the expense factor as it influences rate making by the statistical agency.

Chapter III will present a description of the model in its original form, and the subsequent refinements to provide meaningful results.

⁸Canadian and British Insurance Companies Act. 1932, C.46, S.72, 73, 74.

Chapters IV and V include the results of the study and implications as to the effects of these results on present practice in the industry. Chapter IV is a detailed analysis of the individual expense items included in the study which are then compared with the current expense ratio of 33 percent. Chapter V includes an analysis of the question of economies of scale and a comparison between Canadian expense factors and American expense factors.

Chapter VI will present the summary and conclusions based on the results of Chapters IV and V including recommendations based upon the statistical results.

CHAPTER II

THE EXPENSE FACTOR:

HISTORY, COMPOSITION, AND EFFECT ON RATES

Introduction

The Canadian Underwriters' Association Statistical Agency produces statistics on behalf of the Superintendents of Insurance of each Province (except Saskatchewan). The information to be provided upon which the statistics are based is a statutory requirement of each province for all companies. These statistics are gathered according to the "Automobile Statistical Plan" as laid down by the Superintendents of Insurance. The "Green Book" is the practical result culminating in a comprehensive rating plan for the many categories of risk.¹ The insurance industry is then able to use these results to establish their own rates if they feel that their experience warrants a different rate, or accept the rates as published. Since underwriting judgment is involved in setting rates, the Canadian Underwriters' Association's influence on rating practices in inevitable.

In April of 1964, the Insurance Bureau of Canada was

¹C.U.A. Brief p. 2.

formed.² Its members consist of independent companies, companies that are members of the Independent Insurance Conference, and companies that are members of the Canadian Underwriters' Association. The IBC's main purpose was to obtain the representation of most insurers so that information could be disseminated quickly and common problems of the industry discussed. The usefulness of the IBC appears to lie in general policy considerations of the insurance industry as a whole as opposed to a qualified organization for solving technical rating problems. The latter conclusion is based on the bulletins issued by the IBC contained in their Submission. Even though the assistance of the actuary for the Statistical Agency is available for consultation, it is not known whether all technical matters receive his attention. Specifically on page 109 of the Document Brief it is stated that the last two years of the least square loss-cost projections are weighted 60 per cent for the latest year's experience and 40 per cent for the preceding year's. This weighting applies only to the evaluation as do whether the rates currently in existence would have been adequate had they been in effect during the last two year's experience. Thus it is separate from the trend factor projection, and no weighting is applied to the trend factor

²Submission of the Insurance Bureau of Canada to the Royal Commission on Automobile Insurance, November 1966 (I.B.C. Submission hereinafter) p. 3.

perseat present.³

There is no doubt in the writers opinion, that the I.B.C. serves a useful function in attempting to create an organization that represents all groups, associations and federations of insurance companies in Canada, in order to discuss common problems. But until an independent staff of competent personnel is acquired, their use as a rating body will remain limited, if not harmful, to the industry itself. Although it is possible that the mistake referred to above is an isolated incident, any repetition can only lead to the demoralization of the membership and hence the cooperation of its members, upon which it depends, will be lost.

The Loss Cost Ratio

When an insurance company establishes a premium it is expected that over time the gross premiums collected will cover the expected loss cost, the administrative expenses involved and provide some allowance for profit. The premium may thus be regarded as consisting of two separate factors: actuarial losses plus an expense factor (including profit). The actual division in practice, as utilized in the rate

³The trend factor is used to weight the loss cost factor, but the data used in developing the trend factor itself is not weighted.

making process of the Canadian Underwriters' Association, is slightly different. The actuarially determined losses also include allocated claims expenses which can be traced directly to a particular line of insurance. Such allocated claims expenses may include all adjustment fees and other immediate out-of-pocket expenses such as medical expenses, towing fees and any other costs directly arising out of a particular claim. The remaining portion of the premium consists of all unallocated claim and general overhead expenses and typically include commissions, premium taxes, rent and an allowance for profit.

The development of a gross premium based on expected losses and an allowance for expenses would initially prove difficult if no data existed to determine what proportion of the gross premium should be devoted to expenses. Once set, competitive factors might indicate the true nature of the expense factor. The earliest loss-cost ratio⁴ in Canada was developed on February 1, 1929 by the Canadian Automobile Underwriters' Association (a forerunner of the C.U.A.). The provision was fifty percent for losses and fifty percent for expenses; that is, a loss-cost ratio of 50/50. At about the same time an Ontario Royal Commission

⁴Loss-cost ratio represents the ratio of the actuarial losses and allocated claims expense as a percent of gross premium to the unallocated expense factor as a percent of gross premium.

was established to evaluate the reasonableness of the then present loss-cost ratio.⁵ The resultant findings of the Hodgins Report indicated that the ratio was too heavily loaded with the expense factor and recommended that the expense factor should not exceed forty-five percent of the gross premium.⁶ The industry subsequently adjusted the losscost ratio to 55/45 which was in effect until 1942 when a two percent federal premium tax changed the loss-cost ratio to 53/47.

In 1949 the board (.C.U.A. member) companies reduced the maximum commission on new automobile insurance business from 25 percent to 20 percent. The loss-cost ratio remained at the previous 53/47 level since the five percent reduction in commission was balanced by a five percent increase in the allowance for company expenses.

In 1951, the loss ratio had increased rapidly and premium rates were raised accordingly in 1952. However, the increase in gross premium had also been applied to the expense factor, which the companies felt they might have difficulty in justifying. ⁷ Hence in 1953 the board companies changed the loss-cost ratio to 63/37. The ten

⁵<u>Report on Automobile Insurance Premium Rates</u>, King's Printers (Ontario), 1930.

⁶Restrictive Trade Practices Commission: Concerning The Business of Automobile Insurance in Canada, Ottawa 1960. p. 158.

⁷Transcript R.C.A.I., Volume 27, p. 3147.

percent change resulted in a five percent reduction in the factor for company expenses and a five percent reduction in commissions.

Similar events preceding 1965 led to further adjustments in the loss-cost ratio. Table I below illustrates the relatively constant level of claim frequency, accompanied by an ever increasing average cost per claim. In 1965 the I.B.C. suggested that the commission rate could be reduced since

TABLE I

PERCENT INCREASE IN COUNTRYWIDE LOSS-COST FOR BODILY INJURY AND PROPERTY DAMAGE,

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YEAR	CLAIM FREQUENCY	AVERAGE COST OF CLAIM	AVERAGE LOSS-COST	PERCENT INCREASE
1961	9.6	361	34.7	-
1962	10.1	385	38.9	12.1
1963	10.2	414	42.2	8.4
1964	10.2	444	45.3	7.3
1965	9.6	501	48.1	6.1

Source: Green Books of Statistical Agency, 1965.

the premiums had risen sharply. It also recognized that previous criticisms on this problem had been woiced by the Combines Commission and the Nova Scotia Royal Commission.⁸ In August of 1965 the Automobile Insurance Statistical Committee directed that the expense factor be reduced to 33 percent.⁹ The loss-cost ratio was thus changed to 67/33; achieved by reducing the agents' commission by $2\frac{1}{2}$ percent and company expenses by $1\frac{1}{2}$ percent.

A summary of the adjustments made in the loss-cost ratio lover the past thirty-six years is shown in Table II. The division of the expense factor assumes the C.U.A. rates of commission, the other expense factors actual percent is hypothetical. The C.U.A. Brief shows the 1966 division of the expense factor a little differently than in Table II, and reflects largely the difficulty of the industry in allocating all expenses by line of insurance.¹⁰

> ⁸I.B.C. Submission, Bulletin No. 65-3, pp. 461-46j. ⁹Ibid., p. 88. ¹⁰Op. cit., p. 34.

TABLE II

PRIVATE PASSENGER AUTOMOBILE LOSS-COST RATIO AND

EXPENSE FACTOR BREAKDOWN,

1930 TO 1966.

DIVISION OF EXPENSE FACTOR

PERIOD	LOSS FACTOR	EXPENSE FACTOR	COMMISSIO	UNALLO- N CATED LOSS EXPENSE	- PROFIT	COMPANY EXPENSE
		· · · · · · · · · · · · · · · · · · ·	(percent)			
1930-41	55	45	· _	-	-	-
1942-48	53	47	25.0	6	2.5	13.5
1949-52	53	47	20.0	6	2.5	18.5
1953-65	63	37	15.0	6	2.5	13.5
1966	67	33	12.5	6	2.5	12.0

Source: Restrictive Trade Practices Commission, loc. cit.

The Trend Factor

The rate making procedure of the C.U.A. statistical agency in order to ensure that the industry will receive enough in terms of gross premiums, consists of two steps. The first step consists of the formula guide to determine whether the rates that are now in effect would have been adequate for the losses incurred during the last five years. The percentage differences are calculated, and the last two years percentage change weighted: 60 percent for the most recent year, and 40 percent for the preceding years change.¹¹

The second step involves the setting of a premium level by determining the probable future level of losses. In order to achieve this end, the loss-cost for the previous years is determined by multiplying the average cost per claim by claim frequency. From these figures a trend is established upon which a projection is made as to the future expected loss-costs.

Not until 1951 did the C.U.A. statistical agency introduce the trend factor.¹² Until 1951, the average loss cost per insured vehicle was relatively constant.¹³ Since the average loss-cost figure consists of a combination of frequency of accidents, and average cost per claim, it may be felt that separate trend factors should be developed for each. However, the data available suggested that the frequency factor by itself was not a stable indication and seemed to fluctuate widely. The average cost per claim was, however, more useful in predicting future costs, as

¹¹C.U.A. Brief, pp. 14-15.

¹²Transcript R.C.A.I., Volume 25, p. 2987.

¹³The average loss cost per insured vehicle represents all claims and allocated claim expenses arising out of claims incurred by the policies written in a calendar year divided by the total number of equivalent car years insured (insured vehicles' in text above). Car years insured means that two cars insured for 6 months each constitute one car year.

it reflected the rising costs of repairing automobiles, hospital and medical costs, level of court awards, and cost of adjustment.¹⁴ In response to the rising average losscost per insured vehicle in both 1951 and 1961, the C.U.A. statistical agency decided that some provision had to be made in the rate making calculations to reflect this trend. The concept is equivalent to allowing for inflation in calculating the future worth of an investment.

Initially the statistical agency used the experience of the preceding five years in analyzing the direction and amount of the trend. In 1965 the number of years used to establish the loss-cost trend was reduced to three years because the minimum limits for coverage had been increased by Provincial statutes in the different provinces.¹⁵ Thus it was felt that the series used before would lack continuity in establishing the expected projection of trend. This reduction in the number of years used for establishing the trend factor severely increases the probability of error. in that the degrees of freedom have been decreased from three to one.¹⁶ Thus any estimates based on these results would have a high expected error, and the resulting confi-

¹⁴Transcript R.C.A.I., Volumé 25, pp. 2989-91.

¹⁵Ibid., Volume 27, pp. 3217-18.

¹⁶The total number of observations, less the estimating constants equals the number of degrees of freedom.

dence greatly reduced. It would thus have been better if the existing data used in establishing the trend were adjusted to allow for the effects of increasing the minimum limits. The procedure used to develop the expected loss-cost per insured vehicle follows below.

The actual loss-cost per insured vehicle is plotted as a time series for countrywide experience, and for provincial experience. An example of such a graph is shown in Figure 1 for countrywide loss-costs. The purpose of plotting the chart is to fit a curve to the points that most closely represents a function expressed in mathematical terms. Through first difference analysis, the analyst can establish whether the historical data may best be described by a first, second or third degree curve, or perhaps through a combination of logarithmic manipulation to arrive at an accurate description of the data. However, even after such a mathematical description has been achieved, the equation holds true only for the area described by the historical data. The use of the equation as a forecasting technique rests solely on the continuity of the underlying factors which produced the equation in the first place.

Figure 1 illustrates the result of the C.U.A. actuaries' analysis. The trend line has been fitted by the least squares technique. In addition to the above constraint in using this curve for forecasting is the problem of the length of time







Source : Green Books 1959 - 1965

FIGURE 1

LEAST SQUARES TREND LINE 'OF LOSS-COSTS FOR COUNTRYWIDE EXPERIENCE

over which observations are made. Clearly if the 1950 to 1958 data indicates fluctuations around a loss-cost of \$32, then the trend line will be levelled to a greater extent. There is also the possibility that the data from 1959 to 1964 represents more nearly the mirror image of a Gompertz curve in which case there will be a maximum loss-cost established in the near future. This may not be too wild a conclusion if one sees that there is a growing concern by auto-manufacturers that we have reached the point where there is only replacement production, so that we have reached a maximum density of cars on the road. If we couple this with a declining birth rate, and moderate inflation, the results are not untenable.

The actual choice of the final description of the observations by a mathematical formula thus will depend not only on the time period chosen, but also on the continuity of the underlying factors that determine these observations. These factors will include: the density of motor vehicle traffic, increased costs per claim due to rising labour costs, raw materials costs, and other inflationary pressures that are not as readily measured, such as higher court awards and increased claim consciousness. The industry has apparently recognized that at various points in the past, these underlying factors have created conditions so that it was neces-

sary to establish a new trend line in order to predict with greater accuracy the expected loss-costs. In 1961, 1962 and 1963 the trend factor equalled 4.0 percent; in 1964, 3.8 percent and in 1965, 9.0 percent for the countrywide loss-cost.¹⁷ Up to 1964 a one-year projection of trend was utilized, which was increased to a 1.5 year trend projection for 1965 and in 1966 the planned forecast was to cover 2.4 years, equal to a full policy year.¹⁸ In 1966 the C.U.A. developed trend factors for regions at which time the 2.4 year loss cost projection amounted to 22.0 percent for British Columbia.

In the introduction to this thesis the proposition was put forward that the expenses incurred in writing automobile insurance were directly or linearly related to volume of business written. Thus, application of the trend factor to both the loss-cost and the expense factor would appear logical. However, the industry decreased the proportion allowed for expenses, indicating that either expenses had been too large a proportion of the gross premium, or our hypothesis is incorrect. The actual analysis of the data will indicate a possible answer in Chapter IV.

> 17c.U.A. Brief, p. 22. ¹⁸Ibid., p. 23.

The Problem of Allocation

The above review suggests the importance of establishing uniform criteria for developing an accurate expense loading factor. The method that the C.U.A. employs in establishing gross automobile premiums may be stated by the following equation:

$$Pg = \frac{Pp}{1 - e}$$

where:

Pp = loss-cost per vehicle (pure premium)
e = expense factor (in percent)
Pg = gross premium

The two variables that enter into equation one are thus pure premium and the expense factor. Present actuarial techniques utilizing the countrywide data to develop loss experience and hence pure premiums are accepted as 'good practice' at present.¹⁹ The same cannot be said for the expense factor "e" however. Here no data is collected, analyzed and disseminated by the Statistical Agency. Hence the size of the loading factor has been left largely to chance. As

¹⁹With perhaps the exceptions noted under the trend factor (Chapter II 14).

(1)

stated previously, the Hodgins Report found 45 percent adequate in 1930. In 1957 the Nova Scotia Report found that "...a provision in the rates of 37 percent of the premium dollar for expenses and profit is not unreasonable".²⁰ In the latter case an attempt was made to allow for differences in commission rates; however, the results were confined to the study of board companies only, and lacked statistical validity.²¹ It may thus be apparent that little success has been achieved to date in determining an unambiguous expense factor for rate-making purposes.

The expense factor will typically consist of two items. The first consists of direct costs which are those costs that can be directly traced as the cost of writing a particular line of insurance. The second cost consists of indirect or overhead expenses which cannot be directly traced to an individual line of insurance. The former costs, direct costs, may be allocated and easily determined through standard cost accounting procedures. However, when attempting to allocate overhead costs that are not associated with any particular line of insurance, the result may well be arbitrary. This latter type of allocation may be based upon net premiums written or as a percentage of direct costs incurred

> 20 Nova Scotia R.C.A.I., Volume I, p. 51. ²¹Ibid., p. 49.

or any other method. None of these methods has any more theoretical merit than any other. But once a method has been adopted, it is maintained so as to achieve continuity and comparability or expense data.

At the present time, company expenses are collected by the Federal Superintendent of Insurance and published in the "Blue Book". The expenses shown are for the company as a whole, for all the lines of insurance it is engaged in. There has been no attempt to collect direct costs by line of insurance and show separately unallocated costs.

There would be two alternatives for determining the costs applicable to a particular line of insurance. The first has already been described and would require the corporations to keep records or their direct expenses by line Thus we would then obtain the direct portion of insurance. or the expense factor. However, this still leaves us with the unsatisfactory method of allocating fixed costs, somewhat arbitrarily. The method chosen will have a distinct bearing on the resulting expense ratio of any particular line of insurance. The other method involves the varying of the size of a line of business, and observing the relationship with unallocable overhead factors. If this could be done for each item of expense, and every combination of lines of insurance, we would be able to determine what proportion of an indirect expense is related to the volume of business

transacted in a line of insurance.

The second method outlined above is more useful and the technique results in the ability to determine the marginal cost of writing an additional premium dollar for a particular line of insurance. A similar problem of allocating overhead costs has been solved for carrying different kinds of freight by rail in the United States.²² In order for the technique to be successful, the accounting data must be uniformly prescribed and recorded, the number of observations or companies reporting large so the results will have statistical validity. The Federal Superintendent requires the reporting of expenses for all companies on a calendar year basis in standard form, thus the first requirement is met. Since there are over three hundred companies writing insurance in Canada, the second criteria is also fulfilled.

Summary

The expense factor used in setting automobile rates has been traced over a period of time and has been reduced from an initial fifty percent loading to the present thirtythree percent of gross premium. The introduction of a trend factor rate in 1951 has increased the doubt as to the underlying relationships between expenses, and losses and gross premiums. The application of standard cost accounting tech-

²²J.R. Meyer et al, <u>Economics of Competition in Trans</u>-<u>portation Industries</u>, Harvard University Press, Cambridge, Mass., 1964.

niques would not result in any more information as the losscosts developed by the C.U.A. already include allocated claim costs. Unallocated costs would still present an insurmountable problem as to the justifiability of one method as opposed to another. Hence, the problem of the determination of the marginal cost of writing automobile insurance will be the main subject of the following chapters.

CHAPTER III

THE STATISTICAL STUDY: THE MODEL

The preceding chapter served as a brief introduction to the expense factor as it influenced the rate-making pro-It was seen that the actual expense loading factor cedure. "e" used in the rate-making formula, was arbitrary in that no statistical data had been collected to substantiate a specific expense ratio. It was also argued that standard cost accounting techniques would not be of any greater benefit in deciding upon an appropriate allocation of overhead by line of insurance. Similar problems face any multiproduct firm where many joint costs are impossible to allocate.¹ The first successful treatment of the determination of marginal costs was achieved in railroad costing in the United States.² The success of it the technique, used in the United States, depends on the availability of uniformly reported statistics and a large number of companies or observations. In Canada the Superintendent of Insurance requires the collection of such data from all insurance companies doing

1Henderson and Quandt, <u>Microeconomic Theory: A Mathe-</u> matical Approach, McGraw-Hill, New York, 1958, pp. 67-72.

2J.R. Meyer, et al. <u>Competition in the Transportation</u> <u>Industry</u>, Harvard University Press, Cambridge, Mass., 1964. business, and publishes a summary annually in the "Blue Book",³ There are approximately three hundred and four companies writing different combinations of lines of insurance. Thus there exist sufficient companies and uniformly reported data to make the technique feasible.

The Multiple Regression Model

The technique of multiple regression analysis is by no means a new concept. The technique may be applied to time series analysis and used as a forecasting technique, as it is presently employed by the C.U.A. Statistical Agency in projecting loss-costs. Or, the technique may be applied to a large sample of cross sectional data which does not have the inherent problem of trying to predict beyond the observed values, as is necessary for the time series technique. Since uniformly reported data is available for the cross sectional analysis, it will be used to develop a model to determine the marginal costs of writing a particular line of insurance. The data covers the calendar year 1964 and is taken from the "Blue Book".

Multiple regression analysis is an extension of the familiar least squares technique such that there are up to

³<u>Report of the Superintendent of Insurance for Canada</u>, Queen's Printer, Ottawa, 1965, Volume II Annual Statements -Fire and Casualty Insurance.

"n" independent variables entering into the equation. The same conditions apply, however, so that the sum of the difference of the observed and actual dependent observations are zero, and the sum of the difference of the observed and actual values squared is minimized. These conditions insure that the resultant curve fits the observed data in a best possible manner, and may be stated as the best unbiased estimator of the underlying true population.⁴

The relationship between expenses incurred (Yi) and volume of net premiums written (X), for a company writing only one line of insurance, may be described by the following linear equation: 5

 $Y_1 = A_0 + b_1 X_1 \tag{1}$

and is represented in Figure 1. The fixed cost for the i^{th} expense category is given by A_0 , which is incurred regardless of the volume of dollars of premiums written by the company. The above equation is the end result of the regression analysis, so that if a company writes X_1^* dollars

⁵The assumption of linearity is not inherent in the data, and must be proven by the results. If non-linearity results, techniques are available to convert the relation-ship to a linear function.

⁴For a description of multiple regression analysis, see: Croxton & Cowden, <u>Applied General Statistics</u>, Prentice-Hall, New York, 1939; and Ezekiel & Fox, <u>Methods of Cor-</u> <u>relation and Regression Analysis</u>, John Wiley & Sons, Inc., New York, 1963, 3rd edition.
of premiums, the corresponding expenses may be determined by constructing a perpendicular line from X_1^* until it meets the derived line, and then move parallel to the X_1 axis until it intersects the Yi axis at Yi*. In Figure I, if X_1 equals one unit (in dollars), then Y_1 is regarded as the marginal cost of writing each additional dollar of premium. As long as X_1^* is within the observed range of data used in deriving equation (1), then the resultant expense factor prediction will be accurate within the limitations of signifigance and confidence present in the original data.

Figure 2 illustrates the case where an insurance company is engaged in two lines of insurance X_1 and X_2 . The equation that describes this situation is

$$Y_1 = A_0 + b_1 X_1 + b_2 X_2$$
 (2)

and describes a plane in three dimensions. The fixed cost factor involved in writing both lines of insurance is A_0 . The marginal cost of writing an additional dollar of insurance of line X_1 is Y_1 , and the marginal cost of line X_2 is Y_2 . The overall or total expense of category Yi for X_1^* and X_2^* dollars of premiums written is found by constructing perpendiculars in the X_1 and X_2 plane, and projecting a perpendicular from their point of intersection until it cuts the A_0BCD plane. The height of this point E from the X_1 X_2 plane determines the total expense factor Yi*.

EXPENSE RELATIONSHIP OF A SINGLE-LINE COMPANY







If a company is engaged in more than two lines of insurance, a geometric representation of the expense relationship is impossible. The expense plane becomes a hyperplane in "n" dimensions, where n represents the number of lines of insurance a company is engaged in. Thus in order to obtain the needed information of the constant factor A_0 , and the marginal costs of writing additional dollars of insurance, the technique of multiple regression analysis will result in an algebraic representation of the relationship between expenses and volume of insurance written.

Thus regression analysis involves the derivation of an equation by which the dependent variable may be estimated from the independent variables. Closely related to regression analysis is correlation analysis which measures the closeness of the relationship described in the regression equation. For the purpose of this study we have assumed that there exists a linear relationship between the dependent variables and the independent variables. The general equation for determining the amount of expense incurred for a particular company is given by:

 $Y = A_0 + b_1 X_1 + b_2 X_2 + \dots + b_n X_n + e$

where:

Y = the dependent variable representing a particular expense category such as commissions, premium taxes, etc.⁶

⁶See Appendix A, Table I for a complete listing of all expense categories.

- $X_{1,2}$... $n \neq$ the independent variable denoting a line of insurance where there are n such lines.⁷
- A_0 = the constant factor and represents the fixed cost for being engaged in the n lines of insurance.
- b1,2...n = the regression coefficient that determines which portion of the premium dollar goes toward meeting the expenses of the corresponding line of insurance.
- e = the residual error of the estimating equation, and represents the difference between values estimated from the equation and actual observed values.

Thus the above equation states that the particular expense category is equal to a constant term plus proportional amounts for each line of insurance that a company is engaged in. The error term indicates to what extent the equation over- or under- estimates the actual value for the dependent variable.

There are three classifications for the data that may be used to describe the independent variables. These incluae net premiums written, net premiums earned and net claims incurred.⁸ It is intuitively apparent that a certain classification of independent variables is more meaningful for estimating the value of a particular expense category. Hence net premiums written are probably best for estimating the rate of commissions paid for writing a particular line

⁷See Appendix A, Table II for the initial independent variables included in the model.

⁸Figures I and II used the net premiums written classification; however, net premiums earned, on net claims incurred could have been used also for illustrative purposes. of insurance; whereas net claims incurred are a better estimator for allocated claims expenses which vary more directly with the loss costs incurred; and net premiums earned will be more appropriate for expenses which are related to the length of the life of a policy. The final choice as to which set of explanatory variables or class of insurance to be used will usually be made according to the highest R^2 value, the coefficient of determination which is the percent of the original variation in the mean of the dependent variable that has been explained by the independent variables. The coefficient of determination is at the same time a measure of the goodness of fit achieved for the equation under study and is thus an indicator of the reliability of any predictions made using the equation.

The regression coefficients calculated are equivalent to the marginal or incremental cost incurred in writing a particular line of insurance. The actual validity of the regression coefficient can be determined by comparing the estimated value with the size of its standard error of estimate. The sample size and the absolute size of the standard error of estimate will enable us to determine the confidence that we have in the predictive value of the particular regression coefficient. More specifically the computer printout supplies the corresponding F-ratio, which allows one to treat the observations as a normal probability distribu-

tion with a standard deviation and a corresponding measure as the expected confidence limits.

Eliminating Multicollinearity

After all the data had been coded, and the initial printout from the Trip Program⁹ reviewed, it was found that many of the independent variables were highly correlated amongst each other. This results in the inability of the method to distinguish whether a particular variation in expenses was due to a particular independent variables so correlated, or a combination of them. Thus the regression coefficients and the standard error of estimate will not be meaningful. The only way to obtain statistically meaningful results is to aggregate those independent variables that are highly correlated. An arbitrary cutoff figure for the correlation coefficient of 0.65 was used to combine the independent variables. This meant that 55 percent of the multicollinearity in the original work had been reduced. Unfortunately this results in the inability to distinguish between various independent variables, as they have now been aggregated into a new composite variable.¹⁰ The loss is however small, since we could not distinguish between the independent variables by statistical means anyway. Hence the new results

⁹Trip: Triangular Regression Package, U.B.C. Computing Centre.

¹⁰See Appendix A, Table III for the composition and designation of the new independent variables.

will be more statistically meaningful than the initial results.

The Stepwise Regression

A further refinement in the analysis of the data may be achieved through the use of stepwise regression. Ir in a particular equation the independent variables represent a spurious relationship with the dependent variables under consideration, then all the other independent variables which are significant may be affected so that the resulting regression coefficients are less accurate and the R^2 value for the whole equation reduced. In other words we would like to remove those independent variables that do not contribute significantly to the reduction of the original variance observed in the mean of the dependent variable. The technique is such that each independent variable is tested to see whether it contributes significantly to the reduction of the variance of the dependent variable, and if it does, it is entered into the equation. The statistic used for the accept or reject decision is called an F - ratio. Thus if the independent variable has an F - ratio greater than the cut-off ratio, the variable will be entered.¹¹ If however at a later stage the F - ratio drops below the cut-

 11_{An} F - ratio of 4.0 was used at the 5 percent level of significance.

off ratio due to the entry of other variables, it will be dropped from further consideration. The independent variables are brought one at a time into the regression equation, in order of decreasing contribution to the reduction of variance of the dependent variable under consideration. The tests of significance used (F tests) are based on the ratio of the dependent variables variance contributed by the independent variables in question; to the residual variance of the dependent variable after the inclusion of the independent variable.

Summary

The multiple regression model developed above was rirst adjusted for multicollinearity and finally the insignificant variables were removed from the equation to permit more meaningful results to be obtained. In the following chapter the results will be analysed as they apply to the expense factor loading. An analysis of the economies of scale and relative performance of the Canadian insurance industry and the American insurance industry will be treated separately in Chapter V.

CHAPTER IV

STATISTICAL STUDY: THE RESULTS

The analysis of the statistical study that is to follow will indicate the results of the model developed in Chapter III. A comparison between the C.U.A. breakdown of expenses with those of this study will be made after a detailed discussion of the validity of each factor included in the final results. The data is drawn from Tables I to XXXV in Appendix B. The title of each table designates the dependent variable or expense category. Tables I to VII are the result of the stepwise regression and represent the major expense categories that will be used to evaluate the C.U.A. breakdown of the expense factor. Tables VIII to XXXV represent a detailed breakdown of Table V, the regression analysis.¹

It will first prove prudent to determine the validity of the assumption of linearity of the model, such that the marginal cost of writing an additional dollar of insurance premium is constant. Reference to the data indicates that the residual error or standard error of estimate is larger than the constant value for each and every equation derived. If the data could not be represented by a linear equation,

¹As opposed to stepwise regression which eliminates all statistically insignifigant independent variables, hence the blank spaces in Tables I to VII of Appendix B.

then we would have obtained different results. If the data would have been better described by a curvilinear function, then the assumption as to linearity would have resulted in a linear approximation to the curve at its most densely populated area, such that a large negative or positive constant would have resulted. Since there are no large values for the constant the assumption of linearity is correct and will be useful in estimating the marginal costs of writing different lines of insurance. This conclusion is valid for all lines of insurance including automobile insurance.

In the discussion to follow, certain features will be common throughout the analysis of each expense factor. Although regression analysis can be utilized to determine. from given values of the independent variables, an absolute value for the dependent variable, this discussion will mainly be concerned with the marginal costs involved in writing a particular line of insurance. In this manner the problem of trying to attach any specific meaning to the value of the constant can be ignored. In general it represents the cost of being engaged in the business of writing insurance. However since the standard error of estimate is relatively large in all cases with respect to the "a" value, exact numerical conclusions would be hard to justify. The only general statement to be made is that some firms will find themselves with higher fixed costs than others, but that in general no economies of scale exist, as will be developed more fully in Chapter V.

The concept of the different classifications of independent variables into net premiums written, net premiums earned and net claims incurred was introduced in the preceding The choice as to which classification best suits chapter. the independent variable in estimating a corresponding value for the dependent variable will be based largely on the value of the coefficient of determination. The coefficient of determination shows the percent of the total original variance in the mean of the dependent variable that has been explained by the independent variables considered in the general equation. However, at times it will be necessary to forego a higher explanation of total variance in favour of intuitive reasonableness of the results, especially if the coefficients of determination are not significantly different from each other.

The emphasis for the purposes of this study will be to utilize the regression coefficients of the independent variables to determine the marginal cost of writing automobile insurance. Each regression coefficient is accompanied by its standard error, so that we can express the conclusions drawn in the form of confidence limits and at the five and one percent level of significance. The usefulness of this approach hinges on the assumption that marginal cost is the factor to be used in the expense loading of the rate making formula. Since the volume of insurance written is to a large extent by existing insurance companies, then it is

the marginal costs of writing insurance that are significant from the companies' points of view, and all past costs with respect to expenses and investments are sunk costs.

The present difficulty that the industry has in allocating overhead costs, whether these are fixed or variable, when writing primarily fire and automobile insurances, illustrates the usefulness of the marginal cost concept when no economies of scale are present. The industry recognizes that it is relatively more expensive to write fire insurance than it is to write automobile insurance.² It is also suspected that automobile insurance to some extent subsidizes fire insurance by taking on a larger share of overhead, than would have occurred had the company been writing automobile insurance only.³ It is impossible to tell what the marginal cost of writing fire insurance is, as it is aggregated with theft, personal property, plate glass and public liability. However it is estimated that as much as $2\frac{1}{2}$ percent of the automobile expense factor is an overloading from fire insurance.⁵ Thus if there are no significant economies of scale present, the marginal cost factor will allocate over-

²Transcript R.C.A.I., Volume 54, pp. 6391-92.
³Ibid., Volume 56 pp. 6582-83.
⁴Appendix A, Table III.
⁵Loc. Cit., p. 6583.

head expenses equitably among the kinds of insurance that this study is able to distinguish among.

The determination of the marginal cost of writing automobile insurance will be broken down into seven categories as shown by the headings of Tables I to VII, and the limitations of conclusions drawn will be described in the sections that follow.

Net Adjustment Expenses Incurred⁶

Net adjustment expenses incurred are those expenses arising out of collision claims and in general represent the fees paid to claim adjusters. "Net" refers to the amount the company paid out after recovery of any adjustment expenses from the other parties involved. This expense factor is included in the loss portion of the expense factor for rate making purposes by the C.U.A. statistical agency, and thus does not represent part of the 33 percent expense loading presently used.

Turning now to the data, the coefficient of determination is largest (0.8774) for net claims incurred and indicates that the expense factor should be derived from this column. This result is also intuitively appealing since it is expected that claims expenses are directly related to the frequency and size of claims incurred. The regression coefficient of 3.26 percent represents the marginal cost involved in servicing every net dollar of claim incurred. Since the

⁶Source of data: Appendix B, Table I.

standard error of the regression coefficient is small, the resultant F - ratio indicates that this result is significantly different from zero at the one percent level of significance. At the same time the standard error of the regression coefficient indicates that 68 percent of the time a company will have claims expenses for collision claims of 3.26 percent plus or minus 0.19 percent of total claims incurred.

Net Commissions Incurred⁷

Net commissions incurred are the commissions paid to the agents who sell insurance, whether it be as an employee of a single firm or as a licensed agent who does business with more than one firm. The coefficient of determination explained 59.75 percent of the original variation in net commissions incurred with respect to net premiums written. Again this value for the coefficient of determination was larger than for net premiums earned and net claims incurred. This result would be expected as remuneration is typically based on the volume of net premiums written.

The net regression coefficient is 7.58 percent, significant at the one percent level and with a standard error of 0.66 percent. This figure is relatively low in comparison

7Appendix B, Table II.

with the quoted C.U.A. rate of commission of 12.5 percent and needs further explanation.⁸ Board companies write only 31.1 percent of the total business of automobile insurance in the province of British Columbia and about 33 percent of the total business in Canada.⁹ Thus it may be concluded that the C.U.A. rates are not representative of the commissions paid in terms of volume of insurance written.

In order to determine the reason for a lower commission rate than might at first be expected, it is necessary to compare the competitive differences with respect to the marketing of insurance premiums. Members of the Canadian Underwriters' Association, Independent Insurance Conference, and two-thirds of the independent independents operate through the independent agency structure.¹⁰ Licensed agents establish their own offices, and may write and remit automobile insurance premiums to any members of the above. The remuneration received by the agents consists strictly of commissions paid by the companies. The remainder of insurers not included in the above consist of independent independents who are direct writers.¹¹ These companies employ their

⁸Commission rate on private passenger automobile . insurance, C.U.A. Brief p. 34.

⁹Ibid., p. 1-2.

¹⁰See Appendix D, Table I for companies writing under the independent agency structure.

¹¹See Appendix D, Table II for companies who are direct writers.

own agents as employees, and pay them commissions, plus providing office space and related supporting office personnel.

If it could be established what premium volume is written by each of the groupings above, and their respective commission rates, a weighted average may be derived to compare with the 7.58 percent factor obtained from the statistical results. At the same time it would be necessary to determine what percentage of the total automobile insurance written consists of private passenger automobile insurance. The Nova Scotia Report found that 25.7 percent of the total represented private passenger, 28.3 percent of the total was commercial, and the remaining 46 percent falling into fourteen other classifications for Nova Scotia experience in 1955.¹² However for Ontario the private passenger insurance accounted for 45 percent of the total in 1953, 67 percent in 1954. and 72 percent of the total in 1955.¹³ Unfortunately no Canada-wide statistics were available then, or at the present time.

Even though precise data is lacking, it is possible to illustrate the method that could be used in estimating a hypothetical commission rate for total automobile insurance written in order to compare the result with the 7.58

^{±2}Nova Scotia R.C.A.I., Volume I, p. 30, footnote 15.
13Ibid., Volume II, Table XLII, p. 263.

percent factor. The following table shows the weighted average commission rate expected on private passenger automobile insurance written.

TABLE III

CALCULATION OF WEIGHTED AVERAGE

CONTRACTOR DUM

		PERCENT OF TOTAL VOLUME	COMMISSIO PAID (MAX.)	NS WEIGHTED AVERAGE
(1)	Canadian Underwriters Association*	33	12.5	4.1
(11)	Independent Insurance Conference*	23	15	3.5
(111))Independent independents	* 36	14	5.0
(iv)	Independent independents	** 18	6	1.1
* WI ** di	riting through an indepen irect writers	dent agency	structure	<u>13.7</u>

(ii) Transcript, R.C.A.I., Volume 31, p. 3490 and p. 3521.
(iii)derived
(iv) calculated from Appendix D, Table II companies for volume written, commission rate is that of Allstate.

The weighted average commission rate of 13.7 percent represents the expected figure if all automobile insurance written were private passenger only. However as is mentioned above, private passenger business represents only some fraction of the total. Thus if we were to assume that 60 percent of the total was private passenger insurance, then the expected commission rate for this study would be 60 percent of 13.7 plus 40 percent of the weighted average of the remaining types of automobile coverage commissions.

Private passenger automobile insurance carries the highest commission rate in terms of percent, because the average actual dollars per premium is low.¹⁴ For commercial and other classes of automobile insurance, the commissions as a percent of total dollars per premium is lower because of the higher value per premium written. Thus if the actual volume of premiums written is relatively high for classifications other than private passenger, the resulting average commission rate would be expected to be considerably lower than that presently utilized in establishing an expense factor loading for the total industry experience, which is what this study is attempting to do.

Lower commission rates are also paid on premiums written under the assigned risk plan. For private passenger it is 10 percent, whereas for commercial insurance it varies between 5 and $7\frac{1}{2}$ percent lower than normal rates.¹⁵ However,

¹⁴Transcript, R.C.A.I., Volume 18, p. 2178.

¹⁵Transcript, R.C.A.I., Volume 18, pp. 2177-8.

in 1964 the total volume written represented only one half of one percent of all business written, this figure had doubled by 1965.¹⁶ Thus at this time it did not affect the average commission rate expected.

In addition to the foregoing comments, there is one additional reason to accept the 7.58 percent figure as probably a reliable measure of the total commissions incurred. Commission rates obtained in other lines of insurance were within one per cent of those expected in industry.¹⁷ For these reasons it is possible that the 7.58 percent factor is a realistic weighted average commission rate.

Net Profit Commissions Incurred¹⁸

Net profit commissions may be considered a bonus on top of net commissions incurred. Usually a contract exists between an agent and an insurance company so that if an agent remits good risks to the insurer, the insurer rewards the agent by paying him a premium on top of the normal com-

16Ibid., p. 2192.

17Conversation with insurance agent, name witheld on request.

¹⁸Appendix B, Table III. The Independent Insurance Conference calls these 'contingent profit commissions'. The maximum rate being $\frac{1}{2}$ to 1 % of earned premiums. The actual number of agreements of this nature is small and is usually extended by a company who wishes to either increase the market share, or penetrate a market not formerly engaged in. Transcript R.C.A.I., Volume 31, pp. 3492-97. mission paid. The idea is to allow the agent to share in the net profits for having selected good risks. This method of additional remuneration applies only to the board-member companies who use the independent agency system, but does not apply to the independents.¹⁹

The coefficient of determination is largest for the net premiums earned classification which would be expected since this remuneration is based on earned premiums to a large extent. The net regression coefficient for automobile insurance is 0.13 percent, which is significant at the one percent level, and the standard error equals 0.04 percent. This expense should only apply to the board-member companies, and not the various independents.

Taxes Incurred²⁰

The taxes incurred are provincial taxes levied on the premiums written by an insurance company.²¹ This particular category of expenses does not include income taxes, but does include property taxes and other minor miscellaneous tax items that do not fall under the federal taxation authorities.

19Transcript, R.C.A.I., Volume 31, pp. 3492-97.

²⁰Appendix B, Table IV.

²¹Premium taxes equal 2% of net premiums written for automobile insurance.

The coefficient of determination is largest for the net claims incurred at 0.9624; whereas for net premiums written it is a little less at 0.9307. Since the taxes are collected on the basis of net premiums written, and the actual difference between the determination coefficients is small, the net regression coefficient chosen was based on net premiums Thus automobile premium taxes account for 1.97 written. percent of net premiums written with a standard error of 0.07 percent, the regression coefficient being significant at the one percent level. This figure is lower than expected since premium taxes are a minimum of 2.0 percent. However. this year's taxes are based on last year's net premiums writ-The amount of automobile insurance net premiums written ten. increased from 338 to 407 million dollars from 1963 to 1964. This represents a 20 percent increase in dollar volume in one year. Thus by adding 20 percent to the 1.97 percent figure, the taxes incurred equal 2.4 percent of net premiums written for the previous year.²² For the purposes of this study the 2.4 percent figure will be used as it reflects the current expense liability.

²²The 2.4% figure agrees exactly with that quoted in the <u>Report of the Superintendent of Insurance</u> 1964, Volume I, p. xiv.

General Expenses Incurred²³

The general expenses incurred category includes general administrative expenses such as salaries, rent, various fees for different reports, and other items of expense incurred while engaged in the insurance business.

The coefficients of determination are about equal for both net premiums written and net claims incurred, and the choice between the two is essentially arbitrary and will give the same results in either case.²⁴ The choice falls on net premiums written by convention and practical reasons for later comparison. The net regression coefficient equals 15.98 percent with a standard error of only 0.69 percent, and is significant at the one percent level.

Bad Debts²⁵

Bad debts expenses occur through non-payment of premiums. For automobile insurance the regression coefficient was not brought into the final regression and is thus insignificant. The reason for the negligible amount of bad debts appearing in the corporate accounts is that all independent agents submit the total premium written to the particular

²³Appendix B, Table V.

²⁴This result follows if one allows for volume differences between net premiums written and net claims incurred.

²⁵Appendix B, Table VI.

insurance company it wrote the policy for, so that if the account proves uncollectable, the agent suffers the loss, not the company. Bad debts will be incurred however, by companies that write under the direct agency system.

Total Expenses Incurred²⁶

The total expense item is the summation of all the expense categories discussed so far. The \mathbb{R}^2 value is 0.9512 hence the equation has accounted for 95.12 percent of the total variance of the original expense category in terms of net premiums written. The resultant regression coefficient is 27.70 percent of net premiums written, with a standard error of 0.99 percent, which is significant at the one percent level. This figure should not be compared directly with the C.U.A. expense ratio, as the expense factors upon which the respective figures are based are not directly comparable.

Comparison of Statistical Results with

C.U.A. Expense Factor

In order for the comparison between the two sets of data to be valid, it is important to ensure that the items of expense are based on the same classification of insurance. If we ignore the net adjustment expenses incurred category, since it is reflected in the loss portion of the statistical

26 Appendix B, Table VII.

agencies rate making formula, then the results obtained from the study indicate the following marginal costs as based on net premiums written:

Net Commissions Incurred	7.58 %
Net Profit Commissions Incurred	0.09
Taxes Incurred	2.40
General Expenses Incurred	15.98
	26.05

In addition to the total shown above, if we add 2.5 percent as an allowance for profit, then the total expense factor equals 28.55 percent of net premiums written. Another way or calculating the same total expense factor is to recall that total expenses incurred was calculated in Table VII.²⁷ The marginal cost was found to be equal to 27.70 percent or net premiums written. By subtracting the net adjustment expenses incurred²⁸ of 2.12 percent and adding the 2.5 percent allowance for profit, the resultant expense factor equals 28.51 percent.²⁹ The confidence limits of this figure may be obtained by taking the standard errors of both the total expenses and the net adjustment expense which equals 1.15

27Appendix B.

²⁸Based on net premiums written, Table I, Appendix B.
²⁹Includes the tax adjustment from 1.97% to 2.4% of net premiums written.

percent. Thus ninety three percent of the time we expect to find that companies will have expenses that are between 25.78 and 30.38 percent of net premiums written.

The expense factor breakdown as published by the C.U.A. statistical agency is as follows: 3^{0}

Premium and other Taxes	2.4 %
Commission to Agents	12.5
Insurance Association Fees	0.6
Unallocated Claims Adjustment Expense	4.0
Administrative Expense (Including 2.5 % Profit)	13.5
	33.0

In order to compare the statistical results of this study with the above table, insurance association fees, unallocated claims, adjustment expenses and administrative expenses are the equivalent of the general expenses incurred plus the 2.5% allowance for profit. The statistical results can be used to illustrate what the expense factor breakdown would be if the commissions paid were 12.5%. It is only necessary to add 4.92 percent to the net commissions incurred and subtract 4.92 from the general expenses incurred. This result follows from the observation that there is no advantage with respect to total expenses as to whether a company is a direct writer or uses the agency system.³¹ The statistical results

30C.U.A. Brief, p. 34.

31Transcript R.C.A.I., Volume 20, pp. 2326,2329,2377.

thus just show what the total average industry expenses are likely to be for a particular firm with the confidence limits establishing bounds on the predictive value of the results.

Implications of Study for Management Control

The manager of an insurance corporation may well know the general industry average for the expense categories listed and compare his company's results with those of the statistical study. He may be above the allowed expense ratio or below and still not know where the inefficiencies arise. The breakdown of the general expenses incurred however would allow a more detailed comparison of his company to the industry average, and thus concentrate his attention on those areas or expense by line or insurance that appear to be the trouble spots. Thus Tables VIII to XXXV illustrate the measuring rods that the entrepreneur can use in employing the principle or management by exception.³²

As an example in determining management remuneration one can look at the industry average and compare this with the profit position of the particular firm. Thus if claims adjusters are more efficient and operating expenses are down, an increased profit is likely to accrue to the company, and salaries may be increased accordingly.

32_{Appendix B.}

CHAPTER V

ECONOMIES OF SCALE

Economies of Scale in Automobile Insurance

The statistical results of the study can also be utilized to determine whether or not there are significant economies of scale involved in the writing of automobile insurance. If there are significant economies of scale, they would most likely be reflected in the fixed expense portion of the gross premium, and perhaps also in the allocated claims costs. Thus if operations are such that one large entity could administer the insurance volume more efficiently or economically than a large number of smaller entities, a natural monopoly would exist.

In order to determine whether there are economies, diseconomies or no economies of scale, the underlying reasoning behind each possibility will be briefly examined. If the marginal costs of a firm are falling, economic theory tells us that there will be economies of scale present. Since there are usually also some fixed costs involved, average cost will fall as output (that is, volume of premiums written) rises, as long as the fixed costs are not exceedingly large. From the above it is apparent that the total cost curve will rise at a diminishing rate.² And since the linear

¹Economies of scale may occur due to decreasing marginal costs.

²See Figure 4.



TOTAL COSTS FOR A SINGLE-LINE COMPANY WITH MAJOR ECONOMIES OF SCALE

FIGURE 5





equations used in the study represent total cost, we would expect this equation to be tangent to the curve at its highest point, since this is where major economies would result. Extrapolation of the straight line to the Y - axis would then indicate a large "a" value.

If, on the other hand, marginal costs increase as the volume of premiums written is increased, then the total cost curve will rise at an increasing rate.³ The straight line equation produced by the multiple regression study drawn tangent to this curve and extrapolated to the Y-axis would indicate that diseconomies of scale were present through a large negative "a" value.

The third alternative, that there are neither economies nor diseconomies of scale present, assumes that marginal costs are constant throughout the observed range.⁴ Average fixed costs will fall, and if the total fixed costs are not large, no economies of scale would be foundnas reflected by a very low "a" value for the linear equation.⁵

It may be useful to recall briefly what is meant by the standard error of estimate. For a simple regression, it is merely the square root of the sum of the squares of the vertical deviations of Y divided by the number of observations. The standard error of estimate is similar to the relation the standard deviation of a frequency distribution bears

³See Figure 5. ⁴See Figure 6.

Dee Liguie 0.

⁵See Figure 7.

UNIT COSTS OF A SINGLE-LINE COMPANY







to the arithmetic mean. Thus if the deviations are normally distributed, sixty-eight percent of the deviations will lie within a distance of one standard error of estimate from the line. For a multiple regression situation, if the additional independent variables contribute any information about the dependent variable, the standard error of estimate computed from the multiple regression equation will be smaller than that obtained from the simple regression equation.

The statistical results as reflected in Tables I to VII in Appendix B, indicate that there are no economies of scale for the lines of insurance for which statistically significant regression coefficients are listed. The foregoing conclusion is based on the fact that the standard error of estimate for the linear equation is significantly larger than the constant value "a". This same observation held for each operation performed during the stepwise regression. It may at this point be objected that the economies in one line of insurance may be offset by the diseconomies of another, while a third may have constant marginal costs, but a high fixed cost. However, the stepwise regression computer printout shows the same results as in Tables I to VII as each independent variable is brought into the equation.

Thus the standard error of estimate really represents a confidence interval, such that if we draw two parallel

lines one standard error of estimate away from our calculated straight line, we would expect any one firm writing a particular volume of a line of insurance to have a corresponding expense factor as read from the Y - axis sixty eight out of a hundred times.⁶ If we take two standard errors of estimate, we expect that ninety-three times out of one hundred that the departure of this observation from the true value will not be larger than the confidence interval just calculated.

Returning briefly to the concept that the standard error of estimate was significantly larger than the "a" values calculated from the particular regression equations, the following statements indicate the lack of any economies or diseconomies of scale. Since our confidence in the absolute value of the constant is determined largely by the relative size of the standard error of estimate; and the standard error of estimate is from four to twenty times greater than the constant for all expense categories, there is therefore no more reason to suspect that there is either a consistent upward or downward bias of the standard error of estimate in expressing confidence limits for "a" at the Y - axis. Hence the only conclusion that appears tenable is that there are no major economies or diseconomies of scale.

⁶This applies to a company writing one line of insurance, however, an extension into n dimensions is possible by the use of algebra.

It is important to realize that the foregoing conclusion shows the long run situation. Thus the equations that describe the relationship between total expenses and premium volume picture a firm on the long run marginal cost curve. It is recognized that a particular firm may at some time not be on the long run marginal cost curve. A new firm entering into the business will incur costs in its early years, that could exceed the industry average. For instance, in order for a firm to break into the market and obtain a large enough share, it may have to offer commission rates far above the industry 'norm'.⁵ Even existing firms may find themselves temporarily incurring costs that are higher This may occur when mechanization of prothan expected. cedures could reduce the overhead expenses now incurred through manual labour. Another area where economies or diseconomies might occur is in 'tie-in' business. Certain lines of insurance are cheaper to underwrite and administrate if combined, so that total costs would be much greater if these lines were written separately. Such a grouping is indicated in this study for certain lines of insurance, but not for automobile.⁶ This grouping appears to have significance for

5Transcript, R.C.A.I., Volume 33, pp. 3846-47.

⁶Recall that some of the initial independent variables included in the study tabulated in Appendix A, Table II, were aggregated in Table III, Appendix A.

those insurance companies who write lines of insurance that are included in the aggregations. The actual benefits derived from writing these aggregated lines of insurance as opposed to writing each line separately is impossible to establish from this study. However a company that writes only automobile insurance does not appear to be at a particular advantage or disadvantage in terms of such tie-in underwriting with other lines of insurance.⁷

The argument has been advanced that the use of automation, specifically computerized operations, would result in significant cost savings.⁸ This result would only occur if computers came in only a few sizes and involved a high capital expenditure. However, the combination of various computer sizes and costs probably allow flexibility in determining whether mechanization would be cheaper at a particular volume of business than manual labour. Rental of machine time on a part-time basis plus pooled arrangements also allow the use of more efficient data processing at all levels of operations regardless of the size of the corporation.⁹

One area which may yield significant economies of scale for a very large firm could result through horizontal integration. Automobile insurers could, for example, esta-

⁸Transcript R.C.A.I., Volume 33 pp. 3852-53. 9Ibid., Volume 48, pp. 5597, 5612.

⁷Even if the industry were unaware of such cost savings by tie-in underwriting, the statistical results would have shown a high correlation coefficient between automobile insurance and any other line of insurance. No such correlation was found.

blish their own repair shops for automobiles.¹⁰ A possible cost saving might occur through the elimination of at least one claims adjuster from either the repair shop or from the company. Other areas for cost savings may arise in terms of further diversification in the future when the volume of business written becomes large enough to support the additional facilities on an economical basis. In this respect it is expected that these horizontal integration movements would appear first in the United States where both volume and market concentration are significantly higher than in Canada.¹¹

The results of this study are based on Canada-wide expense experience and insurance volume. Thus the extent to which economies of scale exist at the provincial level is a matter of argument. It appears that due to the flexibility in the methods employed to market the product that no economies of scale would result in these operations.¹² All data and information is easily transported to a central headquarter established anywhere in the country where normal business concentrates. Market size and concentration may be a limiting factor when writing on a provincial basis, so that the market is only large enough to support the operation of one insurer. If a second insurer entered, both would

¹⁰Ibid., Volume 33, pp. 2850-51

¹¹Ibid., Volume 7, pp. 776-79; Volume 48. pp. 5613.
¹²Ibid., Volume 16, pp. 1983-84; Volume 48, p. 5597;
Volume 56, p. 6587.

incur a higher expense ratio. Thus a case for a regional monopoly regulated by the province to insure appropriate rates may be made. In general, however, if a market is not large, chances of claims will be reduced accordingly and claim expenses relatively low. Thus it is not expected that any economies of scale exist at the provincial level.

Thus, the conclusion that there are no economies of scale follows from the lack of indivisibilities of scale, with no major outlays required to operate an insurance business other than the minimum required to obtain a large enough and diversified experience so that one bad loss will not bankrupt the corporation.¹³ Although some firms will reach a size where mechanization of procedures becomes feasible, this is neither a handicap to small operations nor an advantage to large ones.¹⁴ In the above discussion, it must be remembered that this is the long run situation that the study measures, so that it is possible for any one firm to temporarily have rising or falling marginal costs.

<u>Comparison of American Expense Ratios</u> with the Canadian Statistical

Results

The remainder of this chapter will be devoted to a substantiation of the conclusion based upon Canadian data

13Transcript R.C.A.I. Volume 48, pp. 5594-96. ¹⁴Ibid., p. 5597.
that there are no economies of scale in the operation of automobile insurance. A comparison of the American automobile expense factors with the Canadian counterparts suggests that the American commission rates are double those of Canada, while their general expense factor is significantly lower. The argument has been proposed that the explanation resides in the economies of scale of the American experience. The argument suggests that because the volume written by American companies is so large, economies in automation must be reflected in lower total expense ratios for the very large firms.¹⁵

The following table illustrates the comparison between Canadian expense ratios and American expense ratios.

TABLE IV

COMPARISON OF CANADIAN AND U.S.A.

		U.S.	Stock Con	npanies	
Expense Item Can All	adian Coverage	B.I. Liabili	P.D. tyLiabil:	Other 1ty	Fire, Theft & Compre- hensive
Taxes (W)	.0197	.033	.031	.127	.128
Commissions (W)	.0758	.150	.156	.183	.177
Other Acquisitions(E)	.0013	•049	.051	.048	.051
General Expenses (E) Total	<u>.1998</u> .2966	<u>•059</u> •291	<u>.063</u> .301	<u>•058</u> •316	<u>.061</u> .317
Source of U.S. Data:	1965 Los: Insurance	s and Ex e Depart	pense Ra ment.	tios, Net	w York

EXPENSE RATIOS

¹⁵Ibid., Volume 16, pp. 1983-84.

The above expense ratios should only be used to compare relative magnitudes since the American values are supplied through standard allocation procedures, and may not reflect actual experience if the same statistical procedures outlined in Chapter III were used. The reader should be aware of this shortcoming. However, it is felt that the conclusions will The data contained in the above table shows not be affected. the expense ratios for bodily injury liability; property damage liability; other coverage; and fire, theft, and comprehensive for the U.S. Stock companies, which are roughly comparable to the majority of corporations writing automobile insurance in Canada. The expense items listed include taxes and commission expense ratios as a percent of net premiums written (W) and other acquisitions and general expenses as a percent of net premiums earned (E). The Canadian figures are drawn from Tables II, III, IV and V, where net profit commissions are roughly the equivalent of other acquisitions.¹⁶

Ignoring the different tax effects, it is seen that the four categories of coverage listed in the American ratios can now be compared with the Canadian ratios. Although total expense ratios are roughly similar, the disparity appears in commissions paid to the American agents as compared with the Canadian counterpart. The latter obtaining approximately half of the former in commissions. Even if we allow that

¹⁶Appendix B.

some of the other acquisition costs included in the American experience is probably reflected in the Canadian general expense ratio, still the results show that the general expense ratio for the Canadian corporations is about double that of their American counterpart.

The conclusion reached is that the Canadian companies are less efficient in the administration of automobile insurance in Canada. There is of course the possibility that there are economies of scale involved in writing automobile insurance in the United States because of the tremendous volume written. To test this latter hypothesis, a simple regression study was designed to test the possibility of the inverse relationship between size of automobile insurance premiums earned and the expense ratios incurred. The results are found in Appendix C, Table I to IV.

For each class of insurance, bodily injury liability, property damage liability, collision and fire, theft and comprehensive, net premiums earned was designated the 'dependent variable', reflecting the absolute size of the firm. Within each class the 'independent variable' was in turn: general expenses, other acquisitions, the sum of these two, and the sum of the two plus commissions and brokerage. The results for all of the simple regressions calculated from 125 stock companies based on countrywide experience indicated that there were no major economies or diseconomies of scale present. In every instance the standard error or

estimate was from twenty to one hundred percent larger than the corresponding value for the constant. Further proof that there was little or no relationship between the variables measured is indicated by the F - ratios calculated for each simple regression. None of the "b" values were significantly different from zero at the five percent level of confidence.

A word of caution is necessary with respect to interpretation of the data contained in Tables I to IV of Appendix C. If an absolute interpretation of the simple equation $Y = a + vX_i$ is required, then all the figures of the columns headed by the "standard error" and the "constant" should be multiplied by one thousand, and the figures under the column headed by "regression coefficient" divided by one hundred. These changes do not affect the conclusions reached and were only recorded in this manner to facilitate easier coding for the computer. Recall also that none of the regression coefficients were significant at the five percent level; hence, the equations represented are not of predictive value at a level of confidence high enough to warrant further attention.

Summary

Two separate studies have been used to determine whether any economies of scale are present in writing automobile insurance. Neither the Canadian data nor the American data suggests that any economic advantage would be derived from placing all the automobile insurance business in the hands of a single corporation. This does not mean that certain social benefits would not accrue to society, it only answers the question that if the insurance was placed with a single carrier, no reduction in the total expenditures of both administrative and allocated claims costs would result. Thus barring non-economic terms of reference, the present mix of many independent insurance companies is as expensive as a single large operation.

CHAPTER VI

SUMMARY AND CONCLUSIONS

In chapter II the appropriateness of applying the trend factor to both the loss cost and expense factor in developing new rates was questioned. The successive reductions in the expense factor loading as a percent of gross premiums meant either that expenses did not vary directly with the size of premium or it was already too large and any further increase would be difficult to justify. The reductions were probably as much a result of an intuitive feeling by the rating agency that the expense factor may have been too high, as much as competitive pressures by the independents, even though the latter depended heavily for their rate making procedures on the rating agency of the C.U.A.

The results of Chapters IV and V indicated that the general equation used in estimating the expense loading factor was linear. Thus the marginal costs of writing insurance are constant, and will also represent a constant factor of gross premiums. This result, although obtained from a single year's data, does represent the underlying relationship between the expense factor and gross premiums. Hence the trend factor can be applied to both the loss cost and expense component of gross premium, provided the current expense loading is valid. This is not to say that the expense factor of 28 percent developed from the 1964 data should remain at that level forever. If at any time changes occur in some of the basic cost expense relationships such as increased cost of stationery or unionization of clerical help, these allowances must be made in subsequent rate making decisions as it applies to the expense factor.

Comparison of the expense factor loading used by the C.U.A. statistical agency and that derived from this study using 1964 data illustrates that the decrease in the expense factor from 37 to 33 was in effect justified, and that a further reduction to 30 percent could be achieved. Hence a 70/30loss-cost ratio would not appear to provide undue hardships for companies engaged in automobile insurance. The actual breakdown of the expenses depends to a large extent on the commission remuneration structure employed, which basically represents the different methods of marketing the product. The study indicated what the industry average commission was, and how to adjust the general expense factor to allow for different rates of commission. Knowing what the expense factor is has the added benefit of being able to determine how any one particular firm compares with the rest of the industry.

The conclusions reached in Chapter V indicated that there were no significant economies of scale present in writing any line of insurance, in particular automobile in-

surance. Thus the implication is that no one carrier would be able to achieve a lower overall expense factor because of the structure of technology required. There are no indivisibilities of scale, no large input factors of a scarce nature required. Thus the expense factors can be used as standards to determine whether the firm is on the long run marginal cost curve. Hence management will be able to determine the optimum point of efficiency and scale of manpower inputs as opposed to capital intensity.

In order to racilitate future expense factor loading calculations as a percent of gross premiums, the submission of industry expense and premium data should be on standard punch cards so that they may be used for both the publishing of the data, as is now required for the annual reports, and also allow the calculation of up to date marginal expenses for all lines of insurance, and not just automobile insurance. Once the computer programme has been written, the information that results will be obtainable annually at very little cost.

In addition to the study of the Canadian data presented in this thesis, it would appear fruitful if the American data were subjected to the same type of analysis to determine whether there is any difference in experience or whether it substantiates the data presented here with respect to expense factor loading. A crude comparison was presented in Chapter V; however, a detailed comparison would require further

refinements.

In this study the data utilized covered only the period of the one year 1964 hence the allowance for underlying changes over time with respect to the expense factor in the past may provide additional information to base future rate making decisions on. In this sense the study may be limited in its usefulness to provide predictive information for the future as productivity increases may accure to the industry over time. The extent to which the foregoing comments influence the validity of the conclusions is at this time not felt to be severe as the difference between the statistical results of this study and the present expense factor loading are significantly different from each other as shown by the level of significance and confidence limits presented in Chapter IV.

This thesis has mainly been concerned with evaluating the adequacy of the expense factor used by the C.U.A. in developing automobile insurance premiums. Through analysis or industry-wide data, an industry average expense loading of approximately 28 to 30 percent was found to be adequate to write automobile insurance business. Although such an expense loading would be adequate for the industry in aggregate, it may not reflect accurately the expense experience of individual companies. Thus for some the expense loading would be adequate, while for others they might be wholly inadequate.

These differences could arise out of marketing procedures employed, breadth of market engaged in, and length of time the company had been in the business. In addition to the short-coming of this industry average approach is the continued problem of deciding at which point gradation of expense factors is warrented.¹ At present studies have indicated that a fixed expense percentage as opposed to a fixed dollar amount of premiums written is appropriate for risks up to \$1,000. Since automobile premiums for private passenger business is nowhere near this at present, the percent loading or variation appears appropriate.

It may thus be felt that instead of producing a comprehensive loss-cost formula for developing rates, expenses be determined by each company separately. Thus expected losses could be developed according to the individual company's experience, and the expense factor would be wholly determined by competitive factors existing at any time in the industry. This latter method allows individual corporate judgment to exist, perhaps even at the branch level of large integrated corporations, to meet the current and local conditions existing in the market. The resulting competition would probably increase the efficiency of the industry as a whole, and

¹This comment, and those that follow is developed in the <u>Commonwealth of Virginnia Report of Actvaries by Woodward</u> and Fondiller, Inc., August 1966, pp. 8,10,13,14,16,19,27, 28,51-55; Appendix pp. 3,9,19,20,22-26.

place an added premium on expense reducing innovations. This latter method thus would probably be more equitable to all companies writing automobile insurance since they would not be restricted by a perhaps artificial expense formula.

In conclusion then it may be stated with confidence that if the formula approach to rate making was continued, the loss-cost ratio could be reduced to 70/30 thus decreasing the expense loading factor another three per cent from its 1966 level. It is also felt that no reduction in total expenses incurred could be effected by letting a single carrier or agency operate automobile insurance in Canada. If the automobile insurance business is to be taken over by public administration, the reasons will be other than a reduction in operating expenses.

BIBLIOGRAPHY

BIBLIOGRAPHY

- Canadian Underwriters' Brief, presented to the Royal Commission on Automobile Insurance, June 1966.
- Commonwealth of Virginnia Report of Actuaries, A Report Prepared by Woodward and Fondiller, Inc., August 1966.
- Croxton, F.E., and Cowden D.J. <u>Applied General Statistics</u>. New York: Prentice-Hall, 1939.
- Ezekiel, M., and Fox, K. <u>Methods of Correlation and Regression</u> Analysis. New York: John Wiley & Sons Inc., 1963, 3rd edition.
- Henderson, J.M., and Quandt, R.E., <u>Microeconomic Theory</u>: <u>A Mathematical Approach</u>. New York: McGraw-Hill, 1958.
- Meyer, J.R., Peck M.J., Stenason, J., and Zwick, C. <u>Economics</u> of <u>Competition in the Transportation Industries</u>. Cambridge, Mass.: Harvard University Press, 1964.
- Report of the Royal Commission on Automobile Insurance. Nova Scotia, 1957.
- Report of the Superintendent of Insurance for Canada, Annual Statements - Fire and Casualty Insurance, Ottawa: Queen's Printer, 1965.
- Report on Automobile Insurance Premium Rates, Ontario: King's Printer, 1930.
- Restrictive Trade Practices Commission: Concerning the Business of Automobile Insurance in Canada, Ottawa: Queen's Printer, 1960.
- Richmond, S.B., <u>Statistical Analysis</u>. New York: Ronald Press Co., 1964. 2nd edition.
- Submission of the Insurance Bureau of Canada to the Royal Commission on Automobile Insurance, November 1966.
- Transcript, Royal Commission on Automobile Insurance of British Columbia 1966-67.

APPENDIX A

TABLE I

Name	DEPENDENT VARIABLES (- EXPENSE CATEGORIES)
Y ₁	Net adjustment expenses incurred
¥2	Net commissions incurred
^ч з	Net profit commissions incurred
Y ₄	Taxes incurred (other than on income and real estate)
¥5	General expenses incurred
۲ ₆	Bad debts
¥7	Salaries
Y ₈	Agents' allowances
¥9	Contributions to staff pensions and insurance plans
¥ ₁₀	Unemployment and other social insurance contributions
¥ ₁₁	Directors' fees
¥ ₁₂	Auditors' fees
¥ ₁₃	Management remuneration
Y ₁₄	Advertising
¥15	Books and periodicals
۲ ₁₆	Bureau and Association dues
^Y 17 2	$\frac{6}{1}$ Y_1
¥ ₁₈	Charitable donations
¥ ₁₉	Inspections and Surveys
¥ ₂₀	Insurance other than insurance on real estate
¥21	Legal expense
Y ₂₂	Maps and plans
¥ ₂₃	Medical examiners' fees
¥ ₂₄	Mercantile agencies' reports

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Name	DEPENDENT VARIABLES (- EXPENSE CATEGORIES)
¥25	Office furniture and equipment
^Ү 26	Postage, telegrams, telephones and express
¥ ₂₇	Printing and stationery
ч ₂₈	Rents
Y ₂₉	Statistical bureau expenses
ч ₃₀	Trâvelling expenses
¥ ₃₁	Other
¥ <u>32</u>	Expense allowance assumed (+)
^ұ зз	Expense allowance ceded (-)
¥34	Expense allowance to company
¥35	Miscellaneous expense (i.e. those not covered above)

Name	INDEPENDENT VARIABLES (- CLASS OF INSURANCE)
x ₁	Fire
x ₂	Personal Property
x ₃	Real Property
X4	Inland Transportation
x ₅	Theft
x 6	Boiler - boiler
x ₇	Boiler - machinery
x ₈	Plate glass
x ₉	Credit
x ₁₀	Guarantee - fidelity
x ₁₁	Guarantee - surety
X ₁₂	Liability - public liability
X ₁₃	Liability - employers' liability
X14	Personal accident and sickness - Group
x ₁₅	Personal accident and sickness - Individual - cancellable
x ₁₆	Personal accident and sickness - Individual - non-cancellable
x ₁₇	Automobile - liability
x ₁₈	Automobile - other
x ₁₉	Aircraft - liability
x ₂₀	Aircraft - other
x ₂₁	Miscellaneous category = (Total insurance $-\sum_{i=1}^{20} X_i$)

TABLE III

NEW	CLASS	CLASS OF INSURANCE	ORIGINAL INDEPEN- DENT VARIABLES
x ₁	Fire; Pe Plate Gl	rsonal Property; Theft; ass; Public liability.	x ₁ +x ₂ +x ₅ +x ₈ +x ₁₂
x ₂	Boiler -	boiler; Boiler - machine	ry X ₆ +X ₇
x ₃	Real pro	perty	x ₃
X4	Inland T	ransportation	Χų
х ₅	Credit		x ₉
x ₆	Guarante Guarante	e-fidelity; e-surety	x ₁₀ +x ₁₁
х ₇	Employer	s-liability	x ₁₃
х ₈	Personal	Accident/sickness - grou	p X ₁₄
х ₉	Personal individu cancella	Accident/sickness - al Cancellable; Non- ble	x ₁₅ +x ₁₆
x ₁₀	Auto - 1	iability: Auto - other	x ₁₇ +x ₁₈
x ₁₁	Aircraft Aircraft	- liability; - other	x ₁₉ +x ₂₀
x ₁₂	Miscella	neous	X ₂₁

APPENDIX B

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NET ADJUSTMENT EXPENSES INCURR LINE OF INSURANCE	ed regres: NPW	SION COEFFIC	CIENT NCI
Fire; Theft; Personal Property Plate glass; Public liability	; 0.0363** (0.0028)	0.0309** (0.0029)	0.0736 ^{**} (0.0047)
Boiler-boiler; Boiler-machinery			
Real property			
Inland transportation			
Credit		-0.0117** (0.0020)	1.1101** (0.3020)
Guarantee-fidelity Guarantee-surety	0.0378° (0.0153)	0.0384 [•] (0.0172)	0.0807** (0.0301)
Employers'-liability			
Personal Accident/sickness -group	0.0101 ^{••} (0.0032)	0.0110 ^{**} (0.0033)	0.0156** (0.0036)
Personal Accident/sickness Individual-cancellable "-non-cancellable			
Automobile-liability " -other	0.0212** (0.0016)	0.0269** (0.0018)	0.0326** (0.0019)
Aircraft-liability " -other			-0.0937° (0.0456)
Miscellaneous			
R ²	0.7709	0.7455	0.8237
a	13.4407	13.2317	9.0353
SY	52.7151	52.4602	46.4012
• Denotes signifigant at	5% level		
•• Denotes signifigant at	1% level		

TABLE II

NET COMMISSIONS INCURRED	REGRESSION	I COEFFICIEN	T
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theit; Personal Property; Plate glass; Public liability	0.3272•• (0.0120)	0.2761 ^{••} (0.0152)	0•5579•• (0•0254)
Boiler-boiler; Boiler-machinery	0.1695•• (0.0633)		0.4760 ● (0.2298)
Real Property			$3.9804 \bullet$ (1.6488)
Inland transportation		0.2841•• (0.0532)	(
Credit		0.1884 [.] (0.0493)	-3.9432* (1.5861)
Guarantee-fidelity Guarantee-surety	0.2858** (0.0643)	0.3153** (0.0924)	0.5814•• (0.1655)
Employers'-liability		0.1852• (0.0806)	
Personal Accident/sickness -group	0.0647•• (0.0147)	0.0603** (0.0183)	0.0894** (0.0202)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.1745** (0.0133)	0.2063** (0.0247)	0.3116** 0.0257
Automobile-liability -other	0.0758** (0.0066)	0.1057** (0.0094)	0.1464 •• (0.0102)
Aircraft-liability -other		0.4249** (0.1443)	
Miscellaneous		0.1799** (0.0281)	
^B ²	0.8975	0.8224	0.8774
a	5.4487	14.9955	-0.3303
Sy	221.9650	277.4401	243.5902
• Denotes signifigant at	5% level		
• Denotes signifigant at	1% level		
note: figures in brackets repr coefficient	esent stand	ard error o	f regression

TABLE III

NET PROFIT COMMISSIONS INCURRED			
LINE OF INSURANCE	REGRESSION NPW	COEFFICIEN NPE	NCI
Fire; Theft; Personal Property; Plate glass; Public liability	0.0070 ^{••} (0.0007)	0.0085** (0.0006)	0.0116** (0.0012)
Boiler-boiler; Boiler-machinery		-0.0059° (0.0023)	
Real Property			
Inland Transportation			
Credit			
Guarantee-fidelity Guarantee-surety			-0.0179 • (0.0076)
Employers-liability	0.0285• (0.0130)		0.0492** (0.0157)
Personal Accident/sickness -group	0.0016 • (0.0007)	0.0020** (0.0007)	0.0019• (0.0009)
Personal Accident/sickness Individual-cancellable -non-cancellable	·		
Automobile-liability -other	0.0009 [•] (0.0003)	0.0013 ^{••} (0.0004)	0.0025** (0.0005)
Aircraft-liability -other			0.0344 ^{••} (0.0116)
Miscellaneous		0.0010 ^{••} (0.0002)	
R ²	0.5358	0•5896	0.5549
a	0.5115	-0.2821	-0.0274
SY	11.7378	10.9016	11.5332
• Denotes signifigant at	5% level		
• • Denotes signifigant at	1% level		

TAXES INCURRED

LINE OF INSURANCE	REGRESSION NPW	COEFFICIEI NPE	NT NCI
Fire; Theft; Personal Property Plate glass; Public liability	0.0278** (0.0013)	0.0224** (0.0016)	0.0466** (0.0019)
Boiler-boiler; Boiler-machinery	0.0276 ^{••} (0.0071)	0.0184 [•] (0.0072) ⁻	0.0877** (0.0174)
Real Property			
Inland transportation		0.0267** (0.0062)	
Credit		0.0276** (0.0040)	
Guarantee-fidelity Guarantee-surety	0.0357** (0.0072)	0.0326. (0.0092)	0.0638** (0.0126)
Employers-liability		0.0195° (0.0080)	
Personal Accident/sickness -group	0.0224** (0.0017)	0.0207** (0.0018)	0.0286** (0.0015)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0225** (0.0015)	0.0224** (0.0025)	0.0427** (0.0019)
Automobile-liability -other	0.0197** (0.0007)	0.0257** (0.0009)	0.0333** (0.0008)
Aircraft-liability -other			
Miscellaneous		0.0222 ^{••} (0.0021) [*]	0.0796 ^{••} (0.0283)
R ²	0.9307	0.9037	0.9624
a	3.3349	3.6207	1.8013
SY	25.0103	27.8748	18.4554
• Denotes signifigant at	5% level		
• • Denotes signifigant at	1% level		

GENERA	L EXPENSES INCURRED				
LINE O	F INSURANCE	REGRESSIO NPW	N COEFFICIE NPE	NT NCI	
Fire; Plate	Theft; Personal Property; glass; Public liability	0.1180** (0.0139)	0.1031** (0.0169)	0.2323** (0.0228)	
Boiler Boiler	-boiler; -machinery	0.4465** (0.0665)	0.3765** (0.0802)	1.5434** (0.2076)	
Real p	roperty				
Inland	transportation		0.3382** (0.0689)		
Credit			0.1210** (0.0443)		
Guaran Guaran	tee-fidelity tee-surety	0.1405° (0.0676)			
Employ	ers'-liability	0.9868** (0.2608)	0.7316 ^{••} (0.0892)	1.3393** (0.3099)	
Person -group	al Accident/sickness	0.0945** (0.0153)	0.0874** (0.0205)	0.1198°° (0.0190)	
Person Indivi	al Accident/sickness dual-cancellable -non-cancellable	0.2083** (0.0139)	0.2067** (0.0277)	0.3770 ^{••} (0.0241)	
Automo	bile-liability -other	0.1598 ^{••} (0.0069)	0.1998 ^{••} (0.0105)	0.2470°° (0.0094)	
Aircra	ft-liability -other				
Miscel	laneous		0.1526** (0.0236)		
	²	0.8824	0.7865	0.8846	
	8	29.0285	26.8998	20.8148	
	SY	231.8124	311.0489	229.2430	
	• Denotes signifigant at	5% level			
	••Denotes signifigant at	1% level			
note:	note: figures in brackets represent standard error of regression				

coefficient

BAD DEBTS

LINE OF INSURANCE	REGRESSION NPW	N COEFFICIEN NPE	IT NCI
Fire; Theft; Personal Property; Plate glass; Public liability			0.0006 [•] (0.0003)
Boiler-boiler; Boiler-machinery			
Real property			
Inland transportation			
Credit			
Guarantee-fidelity Guarantee-surety	0.0057** (0.0008)	,	
Employers-liability	0.0078 ^{**} (0.0026)	0.2625 ^{••} (0.0299)	0.0146** (0.0041)
Personal Accident/sickness -group			
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0014 ^{••} (0.0002)		0.0023•• (0.0003)
Automobile-liability -other			
Aircraft-liability -other			
Miscellaneous			
R ²	0.3521	0.2037	0.2109
a	0.1387	-1.8049	0.2140
SY	2.7997	113.2628	3.0897
• Denotes signifigant at 5	% level		
••Denotes signifigant at 1	% level		

TOTAL E	XPENSES INCURRED				
LINE OF	INSURANCE		REGRESSIO NPW	N COEFFICIE NPE	NT NCI
Fire; T Plate g	heft; Personal Prope lass; Public liabili	rty; ty	0.5032** (0.0200)	0.4340** (0.0295)	0.9011** (0.0369)
Boiler- Boiler-	boiler; machinery		0.6194** (0.0953)	0.4187** (0.1356)	2.0805** (0.3252)
Real Pr	operty				6.3204** (2.3431)
Inland	transportation			0.6241°° (0.1166)	
Credit				0.2475** (0.0750)	
Guarant Guarant	ee-fidelity ee-surety		0.4926** (0.0969)	0.5543** (0.1728)	0.6612** (0.2368)
Employe	rs'-liability		1.5630 ** (0.3736)	1.2032** (0.1508)	1.9657** (0.4732)
Persona -group	l Accident/sickness		0.1925** (0.0220)	0.1865** (0.0347)	0.2530** (0.0286)
Persona Individ	l Accident/sickness ual-cancellable -non-cancellable		0.4050** (0.0199)	0.4396** (0.0469)	0.7335** (0.0363)
Automob	oile-liability -other		0.2770 ^{••} (0.0099)	0.3590** (0.0179)	0.4596** (0.0142)
Aircraf	't-liability -other				
Miscell	aneous			0.3090** (0.0399)	
B	2		0.9512	0.8698	0.9477
a	ι		55.7181	63.6666	30.2802
S	Y	3	32.1161	525.9969	344.4802
•	Denotes signifigant	t at 5	% level		
٠	•Denotes signifigant	: at 1	% level		

SALA	RIES

LINE OF INSURANCE	REGRESSION	N COEFFICIE	NT
	NPW	NPE	NCI
Fire; Thert; Personal Property;	0.0749 ⁰⁰	0.0838**	0.1505**
Plate glass; Public liability	(0.0124)	(0.0108)	(0.0197)
Boiler-boiler;	0.2925**	0.2945**	1.0233**
Boiler-machinery	(0.0423)	(0.0370)	(0.1412)
Real property	-0.1661	-0.9913	1.2780
	(0.8413)	(0.6686)	(1.0256)
Inland Transportation	0.0328	0.0575	-0.4752 •
	(0.1857)	(0.1619)	(0.1984)
Credit	0.4601	0.3512	1.3543
	(0.2467)	(0.2007)	(0.9749)
Guarantee-fidelity	0.0685	0.0848	-0.0578
Guarantee-surety	(0.0430)	(0.0425)	(0.1038)
Employers-liability	0.7536 ^{••}	0.6216 ^{••}	0.8941**
	(0.1688)	(0.1508)	(0.2083)
Personal Accident/sickness	0.0612**	0.0579 [.]	0.0779**
-group	(0.0097)	(0.0086)	(0.0124)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0958** (0.0088)	0.1007** (0.0079)	0.1718** (0.0157)
Automobile-liability	0∞0840 ^{●●}	0.1023**	0.1321 ^{••}
-other	(0∞0047)	(0.0045)	(0.0063)
Aircraft-liability	-0.0693	-0.0471	0.0117
-other	(0.1287)	(0.1141)	(0.1532)
Miscellaneous	0.0408	0.0576	0.1730
	(0.1277)	(0.1189)	(0.2342)
R ²	0.858	0.891	0.853
a	0.238	-13.409	-4.965
SY	146.943	128.315	149.414
• Denotes signifigant at	5% level		

•• Denotes signifigant at 1% level

AGENTS' ALLOWANCES	DECOECTO		171
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0009	0.0011	0.0001
Plate glass; Public liability	(0.0013)	(0.0013)	(0.0020)
Boiler-boiler;	-0.0004	-0.0004	0.0000
Boiler-machinery	(0.0046)	(0.0046)	(0.0146)
Real property	-0.0528	-0.0520	-0.0449
	(0.0914)	(0.0828)	(0.1060)
Inland Transportation	-0.0167	-0.0178	-0.0110
	(0.0202)	(0.0200)	(0.0205)
Credit	-0.0057	-0.0057	-0.0886
	(0.0268)	(0.0248)	(0.1008)
Guarantee-fidelity	-0.0013	-0.0018	-0.0050
Guarantee-surety	(0.0047)	(0.0053)	(0.0107)
Employers-liability	-0.0250	-0.0286	-0.0217
	(0.0183)	(0.0187)	(0.0215)
Personal Accident/sickness	-0.0001	-0.0004	-0.0011
-group	(0.0011)	(0.0011)	(0.0013)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0087** (0.0010)	0.0091 ^{••} (0.0010)	0.0172* (0.0016)
Automobile-liability	0.0008	0.0011	0.0017 •
-other	0.0005	(0.0006)	(0.0007)
Aircraft-liability	-0.0088	-0.0084	-0.0117
-other	(0.0140)	0.0141	(0.0158)
Miscellaneous	-0.0013	-0.0023	-0.0067
	(0.0139)	(0.0147)	(0.0242)
R ²	0.258	0.266	0.306
a	0.506	0.271	0.423
SY	15.972	15.005	15.444

• Denotes signifigant at 5% level

•• Denotes signifigant at 1% level

CONTRIBUTIONS TO PENSION AND INSURANCE PLANS

LINE OF INSURANCE	REGRESSION	COEFFICIEN	NT
	NPW	NPE	NCI
Fire; Theft; Personal Property;	-0.0019	-0.0021	-0.0033
Plate glass; Public liability	(0.0014)	(0.0014)	(0.0021)
Boiler-boiler;	0.0277**	0.0282**	0.0798**
Boiler-machinery	(0.0049)	(0.0048)	(0.0147)
Real property	-0.0665	-0.0477	-0.1450
	(0.0983)	(0.0865)	(0.1067)
Inland Transportation	-0.0032	-0.0053	0.0142
	(0.0217)	(0.0209)	(0.0206)
Credit	0.0688	0.0568*	0.4195 ^{••}
	(0.0288)	(0.0260)	(0.1014)
Guarantee-fidelity	0.0187**	0.0195**	0.0449**
Guarantee-surety	(0.0050)	(0.0055)	(0.0108 <u>)</u>
Employers'-liability	0.0469*	0.0390	0.1036**
	(0.0197)	(0.0195)	(0.0217)
Personal Accident/sickness	0.0027	0.0024	0.0032
-group	(0.0011)	(0.0011)	(0.0013)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0057° (0.0010)	0.0061• (0.0010)	0.0105° (0.0016)
Automobile-liability	0.0063**	0.0076 ^{••}	0.0088**
-other	(0.0005)	(0.0006)	(0.0007)
Aircraft-liability	-0.0250	-0.0250	-0.0349*
-other	(0.0150)	(0.0148)	(0.0159)
Miscellaneous	0.0521 ⁰⁰	0.0572**	0.0669**
	(0.0149)	(0.0154)	(0.0244)
R ²	0.590	0.617	0.664
a	0.235	-0-369	0.782
SY	17.172	16.596	15.540

• Denotes signifigant at 5% level

• Denotes signifigant at 1% level

TABLE XI

UNEMPLOYMENT AND OTHER SOCIAL INSURANCE CONTRIBUTIONS

REGRESSION	COEFFICIEN	T
NPW	NPE	NCI
0.0006 ^{••}	0.0008**	0.0014**
(0.0001)	(0.0001)	(0.0002)
0.0010 •	0.0010 ^{••}	0.0033**
(0.0004)	(0.0003)	(0.0012)
0.0027	-0.0067	0.0031
(0.0078)	(0.0060)	(0.0086)
-0.0001	-0.0004	-0.0042.
(0.0017)	(0.0015)	(0.0017)
0.0041	0.0030	0.0172
(0.0023)	(0.0018)	(0.0081)
0.0003	0.0004	-0.0007
(0.0004)	(0.0004)	(0.0009)
0.0039•	0.0027	0.0046 •
(0.0016)	(0.0014)	(0.0017)
0.0003**	0.0003**	0.0004**
(0.0001)	(0.0001)	(0.0001)
0.0009**	0.0009**	0.0016**
(0.0001)	(0.0001)	(0.0001)
0.0008**	0.0009**	0.0012**
(0.0000)	(0.0000)	(0.0001)
-0.0015	-0.0016	-0.0018
(0.0012)	(0.0010)	(0.0013)
-0.0007	-0.0006	-0.0004
(0.0012)	(0.0011)	(0.0020)
0.827	0.874	0.853
-0.115	-0.244	-0.187
1.354	1.156	1.248
	REGRESSION NPW 0.0006 ^{••} (0.0001) 0.0010 [•] (0.0004) 0.0027 (0.0078) -0.0001 (0.0017) 0.0041 (0.0017) 0.0003 (0.0003) (0.0003) (0.0003) (0.0003) (0.0003) (0.0003) (0.0001) 0.0009 ^{••} (0.0001) 0.0009 ^{••} (0.0001) 0.0008 (0.0001) 0.0008 (0.0001) 0.0008 (0.00012) -0.0007 (0.0012) 0.827 -0.115 1.354	REGRESSIONCOEFFICIEN NPW $0.0006^{\bullet\bullet}$ $0.0008^{\bullet\bullet}$ (0.0001) (0.0001) $0.0010^{\bullet\bullet}$ $(0.0001)^{\bullet\bullet}$ (0.0004) (0.0003) 0.0027 -0.0067 (0.0078) (0.0060) -0.0001 -0.0004 (0.0017) (0.0015) 0.0041 0.0030 (0.0023) (0.0018) 0.0030 (0.004) $(0.003)^{\bullet\bullet}$ $(0.0027)^{\bullet\bullet}$ $(0.003)^{\bullet\bullet}$ $(0.0027)^{\bullet\bullet}$ $(0.003)^{\bullet\bullet}$ $(0.0027)^{\bullet\bullet}$ $(0.003)^{\bullet\bullet}$ $(0.0027)^{\bullet\bullet}$ $(0.003)^{\bullet\bullet}$ $(0.0027)^{\bullet\bullet}$ $(0.003)^{\bullet\bullet}$ $(0.0027)^{\bullet\bullet}$ $(0.003)^{\bullet\bullet}$ $(0.003)^{\bullet\bullet}$ $(0.003)^{\bullet\bullet}$ $(0.0003)^{\bullet\bullet}$ (0.0001) $(0.0003)^{\bullet\bullet}$ (0.0001) $(0.0003)^{\bullet\bullet}$ (0.0001) $(0.0009)^{\bullet\bullet}$ (0.0001) $(0.0009)^{\bullet\bullet}$ (0.0000) $(0.0000)^{\bullet\bullet}$ (0.0012) (0.0016) (0.0012) (0.0011) 0.827 0.874 -0.115 -0.244 1.354 1.156

• Denotes signifigant at 5% level

• Denotes signifigant at 1% level

DIRECTORS' FEES			
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0008 ^{••}	0.0008**	0.0010*
Plate glass; Public liability	(0.0002)	(0.0002)	(0.0004)
Boiler-boiler	0.0007	0.0007	0.0025
Boiler-machinery	(0.0008)	(0.0008)	(0.0027)
Real property	0.0008	-0.0137	0.0110
	(0.0169)	(0.0150)	(0.0198)
Inland Transportation	-0.0108**	-0.0099**	-0.0130**
	(0.0037)	(0.0036)	(0.0038)
Credit	0.0018	0.0009	0.0124
	(0.0049)	(0.0045)	(0.0189)
Guarantee-fidelity	0.0007	0.0012	-0.0016
Guarantee-surety	(0.0009)	(0.0010)	(0.0020)
Employers-liability	-0.0009	-0.0010	0.0016
	(0.0034)	(0.0034)	(0.0040)
Personal Accident/sickness	-0.0005°	-0.0005**	-0.0006*
-group	(0.0002)	(0.0002)	(0.0002)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0001 (0.0002)	0.0001 (0.0002)	0.0002 (0.0003)
Automobile-liability	0.0007**	0.0008 ⁰⁰	0.0012**
-0ther	(0.0001)	(0.0001)	(0.0001)
Aircraft-liability	-0.0035	-0.0033	-0.0021
-other	(0.0026)	(0.0026)	(0.0030)
Miscellaneous	-0.0050	-0.0050	-0.0091°
	(0.0026)	(0.0027)	(0.0045)
B ²	0.373	0.400	0.396
a	0.521	0.425	0.468
SY	2.943	2.878	2.889
• Denotes signifigant at	5% level		

••Denotes signifigant at 1% level

AUDITORS FEES	REGRESSION	COEFFICIENT	
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0006 ^{••}	0.0007**	0.0007**
Plate glass; Public liability	(0.0002)	(0.0002)	(0.0003)
Boiler-boiler	0.0007	0.0007	0.0033
Boiler-machinery	(0.0006)	(0.0006)	(0.0018)
Real property	0.0145	0.0151	0.0457**
	(0.0112)	(0.0102)	(0.0131)
Inland transportation	-0.0031	-0.0029	-0.0059°
	(0.0025)	(0.0025)	(0.0025)
Credit	0.0008	0.0003	0.0058
	(0.0033)	(0.0031)	(0.0125)
Guarantee-fidelity	-0.0011	-0.0009	-0.0045**
Guarantee-surety	(0.0006)	(0.0006)	(0.0013)
Employers - liability	-0.0009	-0.0019	0.0009
	(0.0023)	(0.0023)	(0.0027)
Personal Accident/sickness	-0.0001	-0.0001	-0.0000
-group	(0.0001)	(0.0001)	(0.0002)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0001 (0.0001)	0.0001 (0.0001)	0.0002 (0.0002)
Automobile-liability	0.0006**	0.0007**	0.0010**
-other	(0.0001)	(0.0001)	(0.0001)
Aircraft-liability	-0.0009	-0.0016	-0.0015
-other	(0.0017)	(0.0017)	(0.0020)
Miscellaneous	-0.0042*	-0.0051**	-0.0026
	(0.0017)	(0.0018)	(0.0030)
R ²	0.514	0.514	0.536
a	0.297	0.203	0.249
Sy	1.961	1.961	1,915

• Denotes signifigant at 5% level

••Denotes signifigant at 1% level

MANAGEMENT REMUNERATION	REGRESSION COEFFICIENT		
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0043	0.0021	0.0198
Plate glass; Public liability	(0.0084)	(0.0084)	(0.0128)
Boiler-boiler	-0.0032	-0.0035	-0.0202
Boiler-machinery	(0.0288)	(0.0287)	(0.0920)
Real Property	1.2970 [●]	1.5120 ^{••}	-0.2399
	(0.5736)	(0.5190)	(0.6681)
Inland Transportation	-0.0052	0.0433	0.4503**
	(0.1266)	(0.1257)	(0.1292)
Credit	-0.0490	-0.0501	-0.3636
	(0.1682)	(0.1558)	(0.6351)
Guarantee-fidelity	-0.0229	-0.0248	-0.0714
Guarantee-surety	(0.0293)	(0.0330)	(0.0676)
Employers-liability	-0.0990	-0.0825	-0.0880
	(0.1151)	(0.1171)	(0.1357)
Personal Accident/sickness	-0.0042	-0.0046	-0.0036
-group	(0.0066)	(0.0067)	(0.0081)
Personal Accident/sickness Individual-cancellable -non-cancellable	-0.0012 (0.0060)	-0.0011 (0.0061)	-0.0019 (0.0103)
Automobile-liability	0.0006	0.0012	-0.0012
-other	(0.0032)	(0.0035)	(0.0041)
Aircraft-liability	0.0434	0.0173	-0.1051
-other	(0.0877)	(0.0886)	(0.0998)
Miscellaneous	-0.1826	-0.2153	-0.3696
	(0.0871)	(0.0923)	(0.1526)
<u>n</u> 2	0.035	0.046	0.089
a	18.997	18.204	17.600
Sy	100.173	99.608	97.332
• Denotes signifigant at	5% level		

••Denotes signifigant at 1% level

ADI	/ERT	IS	ING	

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LINE OF INSURANCE	REGRESSION	I COEFFICIEN	NT	
	NPW	NPE	NCI	
Fire; Theft; Personal Property;	-0.0027	-0.0024	-0.0107**	
Plate glass; Public liability	(0.0022)	(0.0022)	(0.0032)	
Boiler-boiler	0.0025	0.0019	0.0198	
Boiler-machinery	(0.0075)	(0.0074)	(0.0230)	
Real property	-0.1491	-0.1303	0.1293	
	(0.1485)	(0.1341)	(0.1672)	
Inland Transportation	-0.0108	-0.0213	-0.0090	
	(0.0328)	(0.0325)	(0.0323)	
Credit	0.0414	0.0290	0.2703	
	(0.0435)	(0.0402)	(0.1589)	
Guarantee-fidelity	-0.0065	-0.0104	-0.0184	
Guarantee-surety	(0.0076)	(0.0085)	(0.0169)	
Employers'-liability	-0.0761°	-0.0877**	-0.0456	
	(0.0298)	(0.0302)	(0.0340)	
Personal Accident/sickness	-0.0036 •	-0.0040 [•]	-0.0056**	
-group	(0.0017)	(0.0017)	(0.0020)	
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0222** (0.0016)	0.0231 ^{••} (0.0016)	0.0428 ^{••} (0.0026)	
Automobile-liability	0.0119 ^{••}	0.0136 ^{••}	0.0169 ^{••}	
-other	(0.0008)	(0.0009)	(0.0010)	
Aircraft-liability	0.0057	0.0125	0.0251	
-other	(0.0227)	(0.0229)	(0.0250)	
Miscellaneous	0.0046	-0.0039	-0.0099	
	(0.0225)	(0.0239)	(0.0382)	
B ²	.628	0.634	0.672	
a	-3.156	-3.792	-2.825	
Sy	25.934	25.734	24.357	
• Denotes signifigant at 5% level				

•• Denotes signifigant at 1% level

BECRESSION COFFETCIENT			
NPW	NPE	NCI	
0.0002 ^{••}	0.0002**	0.0003**	
(0.0001)	(0.0000)	(0.0001)	
0.0001	0.0001	0.0003	
(0.0002)	(0.0002)	(0.0005)	
0.0003	0.0016	0.0004	
(0.0035)	(0.0029)	(0.0038)	
-0.0008	-0.0008	-0.0018*	
(0.0008)	(0.0007)	(0.0007)	
0.0010	0.0007	0.0055	
(0.0010)	(0.0009)	(0.0036)	
-0.0001	-0.0001	-0.0001	
(0.0002)	(0.0002)	(0.0004)	
0.0012	0.0005	0.0010	
(0.0007)	(0.0006)	(0.0008)	
0.0001°	0.0001	0.0001 •	
(0.0000)	(0.0000)	(0.0000)	
0.0003°°	0.0003**	0.0005**	
(0.0000)	(0.0000)	(0.0001)	
0.0002 ^{••}	0.0002**	0.0003**	
(0.0000)	(0.0000)	(0.0000)	
0.0002	0.0004	0.0009	
(0.0005)	(0.0005)	(0.0006)	
-0.0000	-0.0003	-0.0001	
(0.0005)	(0.0005)	(0.0009)	
0,568	0.650	0.640	
-0.038	-0.088	-0.062	
0.612	0.551	0.559	
	REGRESSION NPW 0.0002 (0.0001) 0.0001 (0.0002) 0.0003 (0.0035) -0.0008 (0.0008) 0.0010 (0.00010) -0.0001 (0.0001 (0.0001 (0.0001 (0.0001 (0.0001 (0.0001 (0.0001 (0.0002) 0.0002 (0.0002) 0.0002 (0.0005) 0.568 -0.038 0.612	REGRESSION NPE COEFFICIEN NPE 0.0002** 0.0002** (0.0001) 0.0001 (0.0002) (0.0002) 0.0001 0.0001 (0.0002) (0.0002) 0.0003 0.0016 (0.00035) (0.0029) -0.0008 -0.0008 (0.0010) 0.0007 0.0010 0.0007 0.0011 0.0007 0.0012 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0003** 0.0003** 0.0002** 0.0002** 0.0002** 0.0002** 0.0002** 0.0004 0.0002** 0.0004 0.0002** 0.0004 0.0005 -0.003 0.0005 -0.0035 0.0005 -0.0035 0.568 0.650 -0.038 -0.088 0.612 0.551	

• Denotes signifigant at 5% level

•• Denotes signifigant at 1% level

note: figures in brackets represent standard error of regression coefficient

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BUREAU AND ASSOCIATION DUES	REGRESSION	COEFFICIENT	
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0094 ⁰⁰	0.0107**	0.0197**
Plate glass; Public liability	(0.0015)	0.0015	(0.0023)
Boiler-boiler	0.0071	0.0064	0.1275
Boiler-machinery	(0.0051)	(0.0050)	(0.0162)
Real property	0.2466 •	0.1766	0.6254**
	(0.1014)	(0.0905)	(0.1178)
Inland transportation	0.0487°	0.0572**	-0.0153
	(0.0224)	(0.0219)	(0.0228)
Credit	0.0003	-0.0012	0.0021
	(0.0297)	(0.0272)	(0.1119)
Guarantee-fidelity	0.0067	0.0094	0.0187
Guarantee-surety	(0.0052)	(0.0057)	(0.0119)
Employers'-liability	0.1101 ^{••}	0.0985**	0.1172**
	(0.0203)	(0.0204)	(0.0239)
Personal Accident/sickness	0.0001	-0.0001	0.0005
-group	(0.0012)	(0.0012)	(0.0014)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0009 (0.0011)	0.0010 (0.0011)	0.0017 (0.0018)
Automobile-liability	0.0002	0.0004	0.0008
-other	(0.0006)	(0.0006)	(0.0007)
Aircraft-liability	-0.0011	-0.0150	0.0136
-other	(0.0155)	(0.0154)	(0.0176)
Miscellaneous	0.0340 [•]	0.0386 [•]	0.1088 ^{••}
	(0.0154)	(0.0161)	(0.0269)
B ²	0.655	0.668	0.676
a	0.198	-0.521	-0.351
SY	17.705	17.363	17.158
• Denotes signifigant at 5% level			

• Denotes signifigant at 1% level
CHARITABLE DONATIONS	DECORCE		7(7)
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0001	0.0001	0.0002
Plate glass; Public liability	(0.0001)	(0.0001)	(0.0002)
Boiler-boiler;	0.0003	0.0003	0.0012
Boiler-machinery	(0.0004)	(0.0004)	(0.0014)
Real property	0.0015	-0.0043	-0.0061
	(0.0081)	(0.0074)	(0.0099)
Inland transportation	-0.0039 [•]	-0.0036•	-0.0042•
	(0.0018)	(0.0018)	(0.0019)
Credit	0.0019	0.0015	0.0014
	(0.0024)	(0.0022)	(0.0094)
Guarantee-fidelity	0.0008	0.0010	-0.0018
Guarantee-surety	(0.0004)	(0.000 <u>5)</u>	(0.0010)
Employers'-liability	-0.0004	-0.0002	0.0012
	(0.0016)	(0.0017)	(0.0020)
Personal Accident/sickness	-0.0000	-0.0000	-0.0000
-group	(0.0001)	(0.0001)	(0.0001)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0002 [•] (0.0001)	0.0002° (0.0001)	0.0003 (0.0002)
Automobile-liability	0.0005°°	0.0005°°	0.0007**
-other	(0.0000)	(0.0000)	(0.0001)
Aircraft-liability	-0.0010	-0.0009	-0.0014
-other	(0.0012)	(0.0013)	(0.0015)
Miscellaneous	-0.0011	-0.0009	-0.0023
	(0.0012)	(0.0013)	(0.0023)
B ²	0.453	0.454	0.427
a	-0.091	-0.114	-0.053
sy	1.412	1.411	1.445

•• Denotes signifigant at 1% level

INSPECTION AND SURVEYS	DECDEGGION		r m
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0028 ⁰⁰	0.0026**	0.0027•
Plate glass; Public liability	(0.0007)	(0.0007)	(0.0012)
Boiler-boiler;	-0.0005	-0.0007	0.0022
Boiler-machinery	(0.0025)	(0.0025)	(0.0082)
Real property	-0.0891	-0.0787	-0.0522
	(0.0490)	(0.0447)	(0.0598)
Inland transportation	-0.0209	-0.0162	-0.0023
	(0.0108)	(0.0108)	(0.0116)
Credit	-0.0041	-0.0036	-0.0279
	(0.0144)	(0.0134)	(0.0568)
Guarantee-fidelity	0.0037	0.0046	0.0005
Guarantee-surety	(0.0025)	(0.0028)	(0.0061)
Employers'-liability	-0.0068	-0.0062	-0.0025
	(0.0098)	(0.0101)	(0.0121)
Personal Accident/sickness	-0.0000	-0.0000	-0.0001
-group	(0.0006)	(0.0006)	(0.0007)
Personal Accident/sickness Individual-cancellable -non-cancellable	-0.0002 (0.0005)	-0.0002 (0.0005)	-0.0002 (0.0009)
Automobile-liability	-0.0004	-0.0003	-0.0000
-other	(0.0003)	(0.000 <u>3)</u>	(0.0004)
Aircraft-liability	-0.0029	0.0016	0.0105
-other	(0.0075)	(0.0076)	<u>(</u> 0.0089)
Miscellaneous	-0.0058	-0.0061	-0.0135
	(0.0074)	(0.0080)	(0.0137)
R ²	0.083	0.077	0.050
æ	1.519	1.419	1.437
SY	8.560	8.587	8.712

••Denotes signifigant at 1% level

INSURANCE OTHER THAN INSURANCE ON REAL ESTATE

LINE OF INSURANCE	REGRESSION	COEFFICIEN	T
	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0001	0.0001	0.0005 [•]
Plate glass; Public liability	(0.0001)	(0.0001)	(0.0002)
Boiler-boiler	0.0029 ^{••}	0.0029**	0.0098**
Boiler-machinery	(0.0004)	(0.0004)	(0.0014)
Real property	0.0218 ^{••}	0.0102	-0.0152
	(0.0081)	(0.0074)	(0.0098)
Inland transportation	0.0027	0.0025	-0.0006
	(0.0018)	(0.0018)	(0.0019)
Credit	0.0019	0.0015	0.0068
	(0.0024)	(0.0022)	(0.0093)
Guarantee-fidelity	0.0006	0.0008	-0.0036 ^{••}
Guarantee-surety	(0.0004)	(0.0005)	(0.0020)
Employers-liability	-0.0034°	-0.0030	-0.0007
	(0.0016)	(0.0017)	(0.0020)
Personal Accident/sickness	0.0004 ^{••}	0.0004 ^{••}	0.0005**
-group	(0.0001)	(0.0001)	(0.0001)
Personal Accident/sickness Individual-cancellable -non-cancellable	-0.0000 (0.0001)	÷0.0000 (0.0001)	-0.0001 (0.0002)
Automobile-liability	0.0003**	0.0003 ^{••}	0.0004 ^{••}
-other	(0.0000)	(0.0000 <u>)</u>	(0.0001)
Aircraft-liability	0.0006	0.0002	0.0001
-other	(0.0012)	(0.0013)	(0.0015)
Miscellaneous	0.0004	0.0005	0.0044
	(0.0012)	(0.0013)	(0.0022)
E ²	0.417	0.418	0.405
a	-0.002	-0.023	0.042
SY	1.418	1.417	1,432
• Denotes signifigant at	5% level		

••Denotes signifigant at 1% level

DECDERGIÓN		, m
NPW	NPE	NCI
0.0002 [•]	0.0002 ^{••}	0.0003**
(0.0001)	(0.0001)	(0.0001)
0.0002	0.0003	0.0003
(0.0003)	(0.0003)	(0.0009)
-0.0080	-0.0069	-0.0044
(0.0050)	(0.0046)	(0.0064)
-0.0030 ^{••}	-0.0023°	-0.0032 •
(0.0011)	(0.0011)	(0.0012)
0.0129 ^{••}	0.0120 ^{••}	0.0343**
(0.0015)	(0.0014)	(0.0061)
0.0004	0.0005	0.0014 [•]
(0.0003)	(0.0003)	(0.0007)
0.0000	-0.0004	-0.0009
(0.0010)	(0.0010)	(0.0013)
-0.0000	-0.0000	-0.0000
(0.0001)	(0.0001)	(0.0001)
0.0002 ^{••}	0.0002**	0.0004 ⁰
(0.0001)	(0.0001)	(0.0001)
0.0000	0.0001 [•]	0.0001
(0.0000)	(0.0000)	(0.0000)
-0.0012	-0.0011	-0.0012
(0.0008)	(0.0008)	(0.0010)
0.0025**	0.0009	-0.0005
(0.00C8)	(0.0008)	(0.0015)
0.336	0.329	0.231
0.157	0.138	0.173
0.873	0.877	0.939
	REGRESSION NPW 0.0002 (0.0001) 0.0002 (0.0003) -0.0080 (0.0050) -0.0030 (0.0011) 0.0129 (0.0015) 0.0004 (0.0015) 0.0004 (0.0003) 0.0000 (0.0001) -0.0000 (0.0001) 0.0002 (0.0001) 0.0000 (0.0001) 0.0000 (0.0001) 0.0000 (0.0000 (0.0001) 0.0000 (0.0001) 0.0000 (0.0000 (0.0000) 0.0000 (0.0001) 0.0000 (0.0000 (0.0000) 0.0000 (0.0000) 0.0000 (0.0000) 0.0000 (0.0000) 0.0000 (0.0000) 0.0000 (0.0000) (0.00000) (0.0000) (0.0000) (0.0000) (0.0000) (0.0000) (0.	REGRESSION NFWCOEFFICIEN NPE 0.0002° (0.0001) 0.0002° (0.0003) 0.0002 (0.0003) 0.0003 (0.0003) -0.0030° (0.0011) -0.0023° (0.0011) -0.0030° (0.0011) -0.0023° (0.0011) 0.0129° (0.0015) 0.0120° (0.0014) 0.0129° (0.0015) 0.0120° (0.0014) 0.0004 (0.0015) 0.0025° (0.0003) 0.0004 (0.0001) -0.0004 (0.0001) 0.0002° (0.0001) 0.0001° (0.0001) 0.0002° (0.0003) 0.0002° (0.0003) 0.0025° (0.0008) 0.0009 (0.0008) 0.336 0.329 0.329 0.157 0.138 0.873 0.873 0.877

• Denotes signifigant at 1% level

MAPS AND PLANS			700
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0001	0.0001 [•]	0.0002 ^{••}
Plate glass; Public liability	(0.0000)	(0.0000)	(0.0001)
Boiler-boiler	-0.0001	-0.0001	-0.0000
Boiler-machinery	(0.0001)	(0.0001)	(0.0004)
Real property	-0.0022	-0.0011	-0.0035
	(0.0026)	(0.0024)	(0.0032)
Inland transportation	0.0028 ⁰⁰	0.0018 ⁰⁰	0.0016 [•]
	(0.0006)	(0.0006)	(0.0006)
Credit	-0.0001	-0.0001	-0.0005
	(0.0008)	(0.0007)	(0.0030)
Guarantee-fidelity	-0.0002	-0.0002	-0.0005
Guarantee-surety	(0.0001)	(0.0002)	(0.0003)
Employers'-liability	0.0003	0.0001	0.0006
	(0.0005)	(0.0005)	(0.0006)
Personal Accident/sickness	-0.0000	-0.0000	-0.0000
-group	(0.0000)	(0.0000)	(0.0000)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Automobile-liability	-0.0000	-0.0000	-0.0000
-other	(0.0000)	(0.0000)	(0.0000)
Aircraft-liability	-0.0003	-0.0004	-0.0001
-other	(0.0004)	(0.0004)	(0.0005)
Miscellaneous	-0.0006	-0.0006	0.0000
	(0.0004)	(0.0004)	(0.0007)
B ²	0.162	0.118	0.120
a	0.014	0.004	-0.010
SY	0.448	0.460	0.459

• Denotes signifigant at 1% level

TABLE XXIII

MEDICAL EXAMINERS' FEES			
TIME OF THEMPANDE	REGRESSION	COEFFICIEN	IT NGT
LINE OF INSURANCE	<u>N</u> PW	NPL	NCT
Fire: Thert: Personal Property;	0.0000	0.0001	0.0002
Plate glass; Public liability	(0.0001)	(0.0001)	(0.0001)
Deditor hetion	0.0001	0.0001	0 0006
Boiler-poller Boiler-machinery	(0.0001)	(0.0002)	(0.0009)
Dolfor wooningl	(010002)	100002/	(0.000))
Real property	0.0106	0.0047	0.0006
	(0.0049)	(0.0045)	(0.0065)
Inland transportation	0-0007	0.0002	-0,0005
	(0.0011)	(0.0011)	(0.0013)
Credit	0.0005	0.0004	0.0044
	(0.0014)	(0.0013)	(0.0062)
Guarantee-fidelity	-0.0001	-0.0002	-0.0008
Guarantee-surety	(0.0003)	(0.0003)	(0.0007)
The same of the best des	0.0004	0.0000	0.000
Employers'-liability	(0.0001)	-0.0000	0.0004
	(0.0010)	(0.0010)	(0.001)
Personal Accident/sickness	0.0001°	0.0001	0.0002
-group	(0.0001)	(0.0001)	(0.0001)
Personal Accident/sickness			
Individual-cancellable	$0.0017^{\bullet\bullet}$	0.0017**	0.0029**
-non-cancellable	(0.0001)	(0.0001)	(0.0001)
		· ·	
Automobile-liability	0.0000	0.0000	0.0000
-other	(0,0000)	(0.0000)	$(0 \cdot 0000)$
Aircraft-liability	-0.0009	-0.0015	-0.0014
-other	(0.0008)	(0.0008)	(0.0010)
Migoolijomooya	0.0000	0 0011	0 0025
MISCEITANEOUS	(0.0007)	(0.0008)	(0.0025)
	(0.0007)	(0.0000)	
R ²	0.819	0.820	0.780
	-0.051	-0.062	0.005
a		-0.002	-0.025
SY	0.858	0.856	0.946
· Donoton of mining out of Mai	1070]		

• Denotes signifigant at 5% level

•• Denotes signifigant at 1% level

MERCANTILE AGENCIES' REPORTS	REGRESSION	COEFFETCIEN	ለጥ
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	-0.0006	-0.0004	0.0021
Plate glass; Public liability	(0.0011)	(0.0009)	(0.0016)
Boiler-boiler	-0.0010	-0.0009	-0.0013
Boiler-machinery	(0.0036)	(0.0032)	(0.0112)
Real property	0.0655	0.0210	0.0154
	(0.0719)	(0.0571)	(0.0816)
Inland transportation	0.0074	0.0037	-0.0283
	(0.0159)	(0.0138)	(0.0158)
Credit	0.0388	0.0291	0.1899*
	(0.0211)	(0.0171)	(0.0776)
Guarantee-fidelity	0.0045	0≋0044	0.0106
Guarantee-surety	(0.0037)	(0₊0036)	(0.0083)
Employers -liability	0.0552**	0.0466**	0.0638**
	(0.0144)	(0.0129)	(0.0166)
Personal Accident/sickness	-0.0000	-0.0004	0.0002
-group	(0.0008)	(0.0007)	(0.0010)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0031°° (0.0008)	0.0033** (0.0007)	0.0050°° (0.0013)
Automobile-liability	0.0058**	0.0073**	0.0083**
-other	(0.0004)	(0.0004)	(0.0005)
Aircraft-liability	-0.0080	-0.0098	-0.0165
-other	(0.0110)	(0.0087)	(0.0122)
Miscellaneous	0.0187	0.0225°	0.0328
	(0.0109)	(0.0102)	(0.0186)
B ²	0.641	0.727	0.678
a .	0.945	0.147	0.787
SY	12.564	10.954	11.891
• Denotes signifigant at	5% level		

note: figures in brackets represent standard error of regression coefficient

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OFFICE FURNITURE AND EQUIPMENT	REGRESSION	COEFFICIENT		
LINE OF INSURANCE	NPW	NPE	NCI	
Fire; Theft; Personal Property;	0.0015	0.0021	0.0062	
Plate glass; Public liability	(0.0011)	(0.0011)	(0.0018)	
Boiler-boiler	0.0028	0.0027	0.0082	
Boiler-machinery	(0.0039)	(0.0037)	(0.0128)	
Real property	0.0244	-0.0388	0.1056	
	(0.0768)	(0.0665)	(0.0933)	
Inland transportation	0.0034	0.0007	-0.0438 [•]	
	(0.0169)	(0.0161)	(0.0181)	
Credit	-0.0116	-0.0143	-0.1928	
	(0.0225)	(0.0199)	(0.0887)	
Guarantee-fidelity	0.0165**	0.0190 [.]	0.0217°	
Guarantee-surety	(0.0039)	(0.0042)	(0.0094)	
Employers'-liability	0.0294	0.0206	0.0090	
	(0.0154)	(0.0150)	(0.0190)	
Personal accident/sickness	0.0035**	0.0033**	0.0042**	
-group	(0.0009)	(0.0009)	(0.0011)	
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0104 ** (0.0008)	0.0108°° (0.0008)	0.0192 ^{●●} (0.0014)	
Automobile-liability	0.0060**	0.0071 (0.0004)	0.0088	
-other	(0.0004)		(0.0006)	
Aircraft-liability	-0.0024	-0.0039	-0.0086	
-other	(0.0117)	(0.0113)	(0.0139)	
Miscellaneous	0.0021	0.0030	0.0043	
	(0.0117)	(0.0118)	(0.0213)	
B ²	0.741	0.765	0.733	
a	-0.934	-1.594	-1.005	
SY	13.411	12.755	13.598	
• Denotes signifigant at 5% level				

POSTAGE	DECDEGATON		m
LINE OF INSURANCE	NPW	NPE	NCI.
Fire; Theft; Personal Property;	0.0016	0.0020	0.0050 [*]
Plate glass; Public liability	(0.0013)	(0.0011 <u>)</u>	(0.0020)
Boiler-boiler;	0.0102 [•]	0.0101 ^{••}	0.0378
Boiler-machinery	(0.0043)	(0.0038)	(0.0145)
Real property	-0.0405	-0.0889	0.0487
	(0.0857)	(0.0687)	(0.1053)
Inland transportation	0.0169	0.0105	-0.0255
	(0.0189)	(0.0166)	(0.0204)
Credit	0.0554	0.0427 [•]	0.2835
	(0.0251)	(0.0206)	(0.0101)
Guarantee-fidelity	0.0105 [•]	0.0107 [•]	0.0077
Guarantee-surety	(0.0044)	(0.0044)	(0.0107)
Employers'-liability	0.0234	0.0124	0.0304
	(0.0172)	(0.0155)	(0.0214)
Personal Accident/sickness	0.0022	0.0019*	0.0035**
-group	(0.0010)	(0.0009)	(0.0013)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0099 ⁰⁰ (0.0009)	0.0103** (0.0008)	0.0163 ^{••} (0.0016)
Automobile-liability	0.0090 ^{••}	0.0109 ^{••}	0.0128**
-other	(0.0005)	(0.0005)	(0.0007)
Aircraft-liability	-0.0013	0.0029	0.0051
-other	(0.0131)	0.0117	(0.0157)
Miscellaneous	0.0051	0.0070	0.0068
	(0.0130)	(0.0122)	(0.0241)
R ²	0.779	0.829	0.768
a	0.703	-0.406	0.543
SY	14.976	13.189	15.347
	al al		

•• Denotes signifigant at 1% level

note: figures in brackets represent standard error of regression coefficient

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PRINTING AND STATIONERY	PECRESSION	τ η	
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0036 ^{••}	0.0038**	0.0064**
Plate glass; Public liability	(0.0013)	(0.0012)	(0.0020)
Boiler-boiler	0.0138**	0.0139 ^{••}	0.0436**
Boiler-machinery	(0.0043)	(0.0040)	(0.0143)
Real property	-0.0186	-0.0463	0.1189
	(0.0856)	(0.0717)	(0.1037)
Inland transportation	-0.0046	-0.0005	-0.0092
	(0.0189)	(0.0174)	(0.0200)
Credit	0.0162	0.0072	0.0376
	(0.0251)	(0.0215)	(0.0985)
Guarantee-fidelity	0.0113 [•]	0.0128 ^{••}	0.0252 •
Guarantee-surety	(0.0044)	(0.0046)	(0.0105)
Employers'-liability	0.0320	0.0209	0.0407
	(0.0172)	(0.0162)	(0.0211)
Personal Accident/sickness	0.0049 ^{••}	0.0045**	0.0060**
-group	(0.0010)	(0.0009)	(0.0013)
Personal Accident/sickness Individual-cancellable -noncancellable	0.0165** (0.0009)	0.0172 ^{••} (0.0008)	0.0306 •• (0.0016)
Automobile-liability	0.0092**	0.0110 ^{••}	0.0135**
-other	(0.0005)	(0.0122)	(0.0006)
Aircraft-liability	-0.0144	-0.0138	-0.0135
-other	(0.0133)	(0.0122)	(0.0155)
Miscellaneous	0.0179	0.0163	0.0252
	(0.0130)	(0.0128)	(0.0237)
R ²	0.844	0.868	0.841
a	1.006	-0.022	1.152
SY	14.947	13.759	15.101

• • Denotes signifigant at 1% level

note: figures in brackets represent standard error of regression coefficient

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DENTS

LINE OF INSURANCE	REGRESSION NPW	I COEFFICIEN NPE	NCI
Fire; Theft; Personal Property;	0.0097 ⁰⁰	0.0106**	0.0182**
Plate glass; Public liability	(0.0019)	(0.0017)	(0.0030)
Boiler-boiler	0.0192**	0.0189**	0.0620**
Boiler-machinery	(0.0065)	(0.0060)	(0.0215)
Real property	-0.0787	-0.1689	0.1581
	(0.1290)	(0.1080)	(0.1560)
Inland transportation	0.0108	0.0139	-0.0599
	(0.0185)	(0.0261)	(0.0302)
Credit	0.0663	0.0503	0.3049 [•]
	(0.0378)	(0.0324)	(0.1483)
Guarantee-fidelity	0.0223 ^{••}	0.0246**	0.0683**
Guarantee-surety	(0.0066)	(0.0069)	(0.0158)
Employers'-liability	0.0845**	0.0623 [•]	0.0936 ^{••}
	(0.0259)	(0.0244)	(0.0317)
Personal Accident/sickness	0.0090 ^{••}	0.0086 ⁰⁰	0.0120 ^{••}
-group	(0.0015)	(0.0014)	(0.0019)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0157 ⁰⁰ (0.0004)	0.0165** (0.0013)	0.0278 ^{••} (0.0024)
Automobile-liability	0.0116	0.0141 ^{••}	0.0174**
-other	(0.0007)	(0.0007)	(0.0010)
Aircraft-liability	0.0022	0.0106	0.0251
-other	(0.0197)	(0.0184)	(0.0233)
Miscellaneous	0.0321	0.0391 [•]	0.0702
	(0.0196)	(0.0192)	(0.0356)
\mathbb{R}^2	0.831	0.857	0.828
a	-1.702	-3.377	-1.666
SY	22,525	20.719	22.725

• Denotes signifigant at 5% level

• • Denotes signifigant at 1% level

STATISTICAL BUREAU EXPENSES	DECREGATON	I COPRETATEN	T
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0020 ⁰⁰	0.0022**	0.0035**
Plate glass; Public liability	(0.0006)	(0.0006)	(0.0010)
Boiler-boiler	0.0001	-0.0001	0.0020
Boiler-machinery	(0.0022)	(0.0022)	(0.0069)
Real property	0.0270	0.0199	0.0927
	(0.0441)	(0.0398)	(0.0502)
Inland Transportation	-0.0109	-0.0106	÷0.0241 [•]
	(0.0097)	(0.0096)	(0.0097)
Credit	0.0243	0.0204	0.2210 ^{**}
	(0.0129)	(0.0119)	(0.0477)
Guarantee-fidelity	-0.0016	-0.0020	-0.0032
Guarantee-surety	(0.0023)	(0.0025)	(0.0051)
Employers'-liability	-0.0043	-0.0052	0.0010
	(0.0088)	(0.0090)	(0.0102)
Personal Accident/sickness	-0.0007	-0.0008	-0.0008
-group	(0.0005)	(0.0005)	(0.0006)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0001 (0.0005)	0.0001 (0.0005)	0.0002 (0.0008)
Automobile-liability	0.0004	0.0005	0.0006
-other	(0.0002)	(0.0003)	(0.0003)
Aircraft-liability	-0.0003	-0.0004	0.0081
-other	(0.0067)	(0.0068)	(0.0075)
Miscellaneous	-0.0074	-0.0090	-0.0173
	(0.0067)	(0.0071)	(0.0115)
R ²	0.136	0.150	0.220
a	0.940	0.718	0.605
SY	7.694	7.630	7.307
• Denotes signifigant at	5% level		

note: figures in brackets represent standard error of regression coefficient

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TRAVELLING EXPENSES	DECDEGETON	COFETTATE	
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0051 ^{••}	0.0056 ^{••}	0.0129**
Plate glass; Public liability	(0.0016)	(0.0015)	(0.0025)
Boiler-boiler	0.0606**	0.0612**	0.2095**
Boiler-machinery	(0.0055)	(0.0050)	(0.0177)
Real property	0.0272	-0.0308	-0.0311
	(0.1088)	(0.0903)	(0.1287)
Inland transportation	0.0157	0.0196	-0.0195
	(0.0240)	(0.0219)	(0.0249)
Credit	0.0585	0.0462	0.2603*
	(0.0319)	(0.0271)	(0.1223)
Guarantee-fidelity	0.0045	0.0058	-0.0489**
Guarantee-surety	(0.0056)	(0.0057)	(0.0130)
Employers [•] -liability	0.0713°°	0.0611 ^{••}	0.1080**
	(0.0218)	(0.0204)	(0.0261)
Personal Accident/sickness	0.0057**	0.0051**	0.0068**
-group	(0.0013)	(0.0012)	(0.0016)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0129 ^{••} (0.0011)	0.0136°° (0.0011)	0.0227** (0.0020) ⁻
Automobile-liability	0.0060**	0.0078**	0.0097**
-other	(0.0006)	(0.0006)	(0.0008)
Aircraft-liability	-0.0190	-0.0099	-0.0168
-other	0.0166	(0.0154)	(0.0192)
Miscellaneous	0.0048	0.0003	0.0067
	(0.0165)	(0.0161)	(0.0294)
R ²	0.745	0.788	0.752
a	2.815	1.469	2.283
SY	18.994	17.326	18,744

•• Denotes signifigant at 1% level

note: figures in brackets represent standard error of regression coefficient

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OTHER	DECDEGATON		m
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	-0.000 <i>5</i>	0.0004	0.0022
Plate glass; Public liability	(0.0020)	(0.0009)	(0.0015)
Boiler-boiler	0.0078 [•]	0.0080*	0.0312 ^{••}
Boiler-machinery	(0.0033)	(0.0031)	(0.0106)
Real property	-0.0716	-0.1045	-0.0379
	(0.0654)	(0.0554)	(0.0767)
Inland transportation	0.0355 [•]	0.0308 [•]	-0.0059°
	(0.0144)	(0.0134)	(0.0148)
Credit	0.0299	0.0222	0.2263 ^{••}
	(0.0192)	(0.0166)	(0.0729)
Guarantee-fidelity	0.0040	0:0038	-0.0048
Guarantee-surety	(0.0033)	(0.0035)	(0.0078)
Employers-liability	-0.0049	-0.0158	-0.0117
	(0.0131)	(0.0125)	(0.0156)
Personal Accident/sickness	-0.0008	-0.0009	-0.0006
-group	(0.0008)	(0.0007)	(0.0009)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0081 ^{**} (0.0007)	0.0084 ^{**} (0.0007)	0.0138 ^{••} (0.0012)
Automobile-liability	0.0060 ⁰⁰	0.0070 ^{**}	0.0083**
-other	(0.0004)	(0.0004)	(0.0005)
Aircraft-liability	-0.0081	-0.0096	-0.0179
-other	(0.0100)	(0.0095)	(0.0115)
Miscellaneous	-0.0152	-0.0197	-0.0417 [•]
	(0.0099)	(0.0099)	(0.0175)
R ²	0.686	0.727	0.699
a	0.448	-0.308	0.039
SY	11.417	10.638	11.179
• Denotes signifigant at	5% level		

EXPENSE ALLOWANCE ASSUMED (+)	DFCDFSSTA		777
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0019	0.0011	0.0010
Plate glass; Public liability	(0.0032)	(0.0032)	(0.0051)
Boiler-boiler	-0.0005	-0.0003	-0.0042
Boiler-machinery	(0.0110)	(0.0110)	(0.0362)
Real property	-0.1093	-0.0450	0.0440
	(0.2189)	(0.1995)	(0.2633)
Inland transportation	-0.0225	-0.0169	-0.0129
	(0.0483)	(0.0483)	(0.0509)
Credit	-0.0010	-0.0008	0.0092
	(0.0642)	(0.0599)	(0.2502)
Guarantee-fidelity	0.0020	0.0035	0.0089
Guarantee-surety	(0.0112)	(0.0127)	(0.0266)
Employers'-liability	-0.0026	-0.0090	-0.0249
	(0.0439)	(0.0450)	(0.0535)
Personal Accident/sickness	0.0153 ^{••}	0.0152 ^{••}	0.0187**
-group	(0.0025)	(0.0026)	(0.0032)
Personal Accident/sickness Individual-cancellable -non-cancellable	-0.0054 [•] (0.0023)	-0.0053° (0.0024)	-0.0079 (0.0040)
Automobile-liability	-0.0011	-0.0010	-0.0008
-other	(0.0012)	(0.0013)	(0.0016)
Aircraft-liability	-0.0087	-0.0038	-0.0031
-other	(0.0335)	(0.0341)	(0.0393)
Miscellaneous	0.0012	0.0014	-0.0096
	(0.0332)	(0.0355)	(0.0601)
R ²	0.113	0.110	0.107
a	2.141	2.155	1.896
SY	38.234	38.286	38.353

••Denotes signifigant at 1% level

EXPENSE ALLOWANCE CEDED (-)	BECRESSION	CORFFICIEN	1 T
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	0.0005	0.0006	0.0010
Plate glass; Public liability	(0.0015)	(0.0015)	(0.0024)
Boiler-boiler	0.0006	0.0006	0.0017
Boiler-machinery	(0.0052)	(0.0052)	(0.0171)
Real property	0.0115	-0.0004	0.0089
	(0.1038)	(0.0945)	(0.1244)
Inland transportation	-0.0006	-0.0007	-0.0014
	(0.0229)	(0.0229)	(0.0241)
Credit	0.0034	0.0031	0.0104
	(0.0304)	(0.0283)	(0.1183)
Guarantee-fidelity	0.0002	0.0003	-0.0006
Guarantee-surety	(0.0053)	(0.0060)	(0.0126)
Employers'-liability	-0.0027	-0.0032	-0.0019
	(0.0208)	(0.0213)	(0.0253)
Personal Accident/sickness	0.0000	0.0001	0.0001
-group	(0.0012)	(0.0012)	(0.0015)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0002 (0.0011)	0.0002 (0.0011)	0.0003 (0.0019)
Automobile-liability	0.0000	0.0000	0.0000
-other	(0.0006 <u>)</u>	(0.0006)	(0.0008)
Aircraft-liability	0.0014	0.0008	0.0006
-other	(0.0159)	(0.0161)	(0.0186)
Miscellaneous	0.0006	0.0004	0.0017
	(0.0158)	(0.0168)	(0.0284)
R ²	0.002	0.002	0.002
a	-1.689	-1.717	-1.703
sy	18.130	18.129	18.129
• Denotes signifigant at 5	5% level		

note: figures in brackets represent standard error of regression coefficient

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EXPENSE ALLOWANCE TO COMPANY	DECORGETO		an a
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	-0.0004	-0.0003	-0.0000
Plate glass; Public liability	(0.0002)	(0.0002)	(0.0003)
Boiler-boiler	0.0002	0.0001	-0.0003
Boiler-machinery	(0.0007)	(0.0007)	(0.0025)
Real property	0.0708 ⁰⁰	0.0550**	0.0128
	(0.0145)	(0.0133)	(0.0180)
Inland transportation	0.0014	0.0016	-0.0001
	(0.0032)	(0.0032)	(0.0035)
Credit	0.0000	-0.0002	-0.0000
	(0.0042)	(0.0040)	(0.0172)
Guarantee-fidelity	-0.0002	-0.0002	0.0002
Guarantee-surety	(0.0007)	(0.0008)	(0.0018)
Employers-liability	-0.0015	-0.0009	-0.0006
	(0.0029)	(0.0030)	(0.0037)
Personal Accident/sickness	-0.0001	-0.0000	-0.0000
-group	(0.0002)	(0.0002)	(0.0002)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0000 (0.0002)	0.0000 (0.0002)	-0.0000 (0.0003)
Automobile-liability	0.0000	0.0000	-0.0000
-other	(0.0001)	(0.0001)	(0.0001)
Aircraft-liability	0.0018	0.0000	-0.0006
-other	(0.0022)	(0.0023)	(0.0027)
Miscellaneous	-0.0028	-0.0028	-0.0014
	(0.0022)	(0.0024)	(0.0041)
R ²	0.078	0.057	0.003
a	0.083	0.124	0.196
SY	2.529	2.557	2.629

• Denotes signifigant at 1% level

note: figures in brackets represent standard error of regression coefficient

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MISCELLANEOUS EXPENSE			a m
LINE OF INSURANCE	NPW	NPE	NCI
Fire; Theft; Personal Property;	-0.0013	-0.0012	-0.0013
Plate glass; Public liability	(0.0008)	(0.0008)	(0.0014)
Boiler-boiler	0.0047	0.0045	0.0157
Boiler-machinery	(0.0029)	0.0029	(0.0100)
Real property	0.0312	0.0275	-0.0047
	(0.0575)	(0.0518)	(0.0728)
Inland transportation	0.0047	0.0042	0.0031
	(0.0127)	(0.0125)	(0.0141)
Credit	-0.1307**	-0.1242**	-0.3384**
	(0.0169)	(0.0155)	(0.0692)
Guarantee-fidelity	-0.007	-0.0013	-0.0061
Guarantee-surety	(0.0029)	(0.0033)	(0.0074)
Employers'-liability	-0.0053	-0.0090	-0.0063
	(0.0115)	(0.0117)	(0.0148)
Personal Accident/sickness	-0.0003	-0.0005	-0.0005
-group	(0.0007)	(0.0007)	(0.0009)
Personal Accident/sickness Individual-cancellable -non-cancellable	0.0000 (0.0006)	0.0001 (0.0006)	0.0001 (0.0011)
Automobile-liability	0.0008 [•]	0.0012**	0.0013**
-other	0.0003	(0.0003)	(0.0005)
Aircraft-liability	0.0086	0.0070	0.0026
-other	(0.0088)	(0.0088)	(0.0109)
Miscellaneous	0.0033	-0.0031	-0.0035
	(0.0087)	(0.0092)	(0.0166)
R ²	0.188	0.207	0.096
a	0.942	0.686	0.580
Sy	10.048	9.932	10.602
• Denotes signifigant at	5% level		
••Denotes signifigant at	1% level		

APPENDIX C

NET PREMIUMS EARNED FOR AUTO BODILY INJURY LIABILITY

INDEPENDENT VARIABLE	STANDARD ERROR	CONSTANT	REGRESSION COEFFICIENT
GENERAL EXPENSES (G.E.)	39159.74	18989.76	-38.5676 (40.7769)
(O.A.)	39287.99	16815.57	-15.6358 (64.4612)
G.E. + O.A.	39212.54	18635.67	-20.4010 (27.6499)
G.E. + O.A. + COMMISSION AND BROKER- AGE	38815.24	30562.58	-47.3096 (26.6636)

TABLE II

NET PREMIUMS EARN	ED FOR AUT	O PROPERTY	DAMAGE LIABILITY
INDEPENDENT VARIABLE	STANDARD ERROR	CONSTANT	REGRESSION COEFFICIENT
GENERAL EXPENSES (G.E.)14748.87	7390.79	-13.3136
OTHER ACQUISITIONS (0.A.)	14785.31	6732.63	(10.14)() - 6.8697 (24.1278)
G.E. + O.A.	14762.74	7304.75	- 7.1869 (10.6964)
G.E. + O.A. + COMMIS- SION AND BROKERAGE	14651.74	11019.22	-14.8553 (9.7982)

TABLE III

INDEPENDENT VARIABLE	STANDARD ERROR	CONSTANT	REGRESSION COEFFICIENT
GENERAL EXPENSES (G.E.)	13739.29	7782.52	-21.5018 (16.5104)
OTHER ACQUISITIONS (0.A.)	13829-55	6434•55	- 6.0895 (24.6962)
G.E. + O.A.	13765.86	7873.72	-13.6653 (12.4156)
G.E. + O.A. + COMMISSION AND BROKERAGE	13686.81	11309.27	-15.6627 (9.5998)

NET PREMIUMS EARNED FOR AUTO COLLISION

TABLE IV

NET PREMIUMS EARNED FOR AUTO THEFT, FIRE AND COMPREHENSIVE

INDEPENDENT VARIABLE	STANDARD ERROR	CONSTANT	REGRESSION COEFFICIENT
GENERAL EXPENSES (G.E.)	7722.02	4185.16	-10.0838 (10.5901)
OTHER ACQUISITIONS (O.A.)	7742.44	3061.24	- 8.2485 (16.7131)
G.E. + O.A.	7742.84	3911.80	- 3.8487 (8.0155)
G.E. + O.A. + COMMISSION AND BROKERAGE	7713.89	4707.69	- 3.7867 (3.4972)
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APPENDIX D

TABLE I

COMPANIES THAT OPERATE THROUGH THE

INDEPENDENT AGENCY SYSTEM

Acadia Insurance Co. Adanac General Insurance Co. Adriatic Insurance Co. Aetna Casualty & Surety Co. Aetna Insurance Co. Albion Insurance Co. of Canada Alliance Assurance Co. Ltd. American Insurance Co. American Mutual Liability Insurance Co. American National Fire Insurance Co. American Road Insurance Co. Anglo-Scottish Insurance Co. Ltd. Atlas Assurance Co. Ltd. Bankers & Traders Insurance Co. Ltd. Beaver Insurance Co. Bee Insurance Co. Boston Insurance Co. British America Assurance Co. British Canadian Insurance Co. British Empire Assurance Co. British Northwestern Insurance Co. Calvert Fire Insurance Co. Canada Accident & Fire Assurance Co. Canada Security Assurance Co. Canadian Commerce Insurance Co. Canadian General Insurance Co. Canadian Home Assurance Co. Canadian Indemnity Co. (Canadian National Insurance Co.) Canadian Mercantile Insurance Co. Canadian Pioneer Insurance Co. Canadian Provincial Insurance Co. Canadian Surety Co. Casualty Co. of Canada (Citadel Insurance Co. of Canada) Century Insurance Co. Ltd. Commerce General Insurance Co. Commercial Union Assurance Co. Ltd. Continental Casualty Co. Continental Insurance Co. Cornhill Insurance Co. Ltd. Dominion Insurance Corporation Dominion of Canada General Insurance Co. Economical Mutual Insurance Co.

Elite Insurance Co. Employers' Liability Assur. Corp. Ltd. Employers Mutual Liability Insurance Co. of Wisconsin English & American Insurance Co. Ltd. Federal Fire Insurance Co. of Canada Federal Insurance Co. Federation Insurance Co. of Canada Fidelity & Casualty Co. of New York Fidelity Insurance Co. of Canada Fidelity-Phenix Insurance Co. Fire Insurance Co. of Canada Fireman's Fund Insurance Co. Firemen's Insurance Co. of Newark First National Insurance Co. of America General Accident Assurance Co. of Canada General Accident Fire & Life Assurance Corporation Ltd. General Insurance Co. of America General Security Insurance Co. of Canada Glens Falls Insurance Co. (Global General Insurance Co.) Globe Indemnity Co. of Canada Gore Mutual Insurance Co. Granite State Insurance Co. Great American Insurance Co. Great Eastern Insurance Co. Guarantee Co. of North America Guardian Assurance Co. Ltd. Guardian Insurance Co. of Canada Guildhall Insurance Co. Ltd. Guildhall Insurance Co. of Canada Halifax Insurance Co. Hardware Mutual Casualty Co. Hartford Accident & Indemnity Co. Hartford Fire Insurance Co. Helvetia Swiss Fire Insurance Co. Home Insurance Co. Hudson Bay Insurance Co. Imperial Guarantee & Accident Insurance Co. of Canada Imperial Insurance Office Insurance Co. of North America Insurance Corporation of Ireland Ltd. Law, Union & Rock Insurance Co. Ltd. Legal & General Assurance Society Ltd. Liverpool & London & Globe Insurance Co. Ltd. London & Edinburgh Insurance Co. Ltd. London & Lancashire Guarantee & Accident Co. of Canada London & Lancashire Insurance Co. Ltd. London & Midland General Insurance Co. London & Scottish Assurance Corp. Ltd. London Assurance

London-Canada Insurance Co. London Guarantee & Accident Co. Ltd. Lumbermens Mutual Casualty Co. Maryland Casualty Co. Merchants Marine Insurance Co. Ltd. Milwaukee Insurance Co. of Milwaukee, Wis. Missiquoi & Rouville Insurance Co. National Employers Mutual General Insurance Assn. Ltd. New Hampshire Insurance Co. New India Assurance Co. Ltd. New Zealand Insurance Co. Ltd. (Non-Marine Underwriters, Member of Lloyds, London, Eng.) Niagara Fire Insurance Co. North British & Mercantile Insurance Co. Ltd. Northern Assurance Co. Ltd. Northwestern Mutual Insurance Co. Norwich Union Fire Insurance Society Ltd. Ocean Accident & Guarantee Corp. Ltd. Old Colony Insurance Co. Old Republic Insurance Co, Olympic Insurance Co. (Pacific Automobile & Fire Insurance Co.) (Pacific Indemnity Co.) Orion Insurance Co. Ltd. Pacific Coast Fire Insurance Co. Pacific Insurance Co. of New York Pearl Assurance Co. Ltd. Perth Mutual Fire Insurance Co. Phoenix Assurance Co. Ltd. (Provident Assurance Co.) Phoenix Insurance Co. Provincial Insurance Co. Ltd. Prudential Assurance Co. Ltd. Quebec Assurance Co. Queensland Insurance Co. Ltd. Railway Passengers Assurance Co. Reliance Insurance Co. of Canada Reliance Insurance Co. of Philadelphia Royal Exchange Assurance Royal Insurance Co. Ltd. St. Paul Fire & Marine Insurance Co. St. Paul Mercury Insurance Co. Safeco Insurance Co. ôf America Saskatchewan Mutual Insurance Co. Scottish Canadian Assurance Corporation Scottish Metropolitan Assurance Co. Ltd. Scottish Union & National Insurance Co. Sea Insurance Co. Ltd. Security National Insurance Co. Service Fire Insurance Co. New York Skandinavia Insurance Co. Ltd. Stanstead & Sherbrooke Insurance Co.

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Storebrand Insurance Co. Ltd. Sun Insurance Office Ltd. Switzerland General Insurance Co. Ltd. Toronto General Insurance Co. Traders General Insurance Co. Transport Indemnity Co. Travelers Indemnity Co. Travelers Insurance Co. Union Assurance Society Ltd. Union Insurance Society of Canton Ltd. United Canada Insurance Co. United States Fidelity & Guarantee Co. United States Fire Insurance Co. Unity Fire & General Insurance Co. Victoria Insurance Co. of Canada Victory Insurance Co. Ltd. Wawanesa Mutual Insurance Co. Wellington Fire Insurance Co. (Western Union Insurance Co.) Western Assurance Co. Westminster Fire Office World Auxiliary Insurance Corp. Ltd. World Marine & General Insurance Co. Yorkshire Insurance Co. Ltd. Zurich Insurance Co.

Source: Insurance Agents' Association of British Columbia.

TABLE II

COMPANIES OPERATING AS DIRECT WRITERS

Allstate Insurance Co. Allstate Insurance Co. of Canada Co-operative Fire & Casualty Co. Emmco Insurance Co. Employers Mutual Casualty Co. (Fruit Growers Mutual Insurance Co.) Federated Mutual Implement & Hardware Insurance Co. Liberty Mutual Fire Insurance Co. Liberty Mutual Insurance Co. Merit Insurance Co. Motors Insurance Co. Motors Insurance Co. State Farm Fire & Casualty Co. State Farm Mutual Automobile Insurance Co.

Source: Insurance Agents' Association of British Columbia.