

SOME FACTORS AFFECTING THE LOSS EXPECTANCY  
OF IOWA COUNTY MUTUALS

by

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## TABLE OF CONTENTS

INTRODUCTION . . . . .	Page 1
REVIEW OF LITERATURE . . . . .	7
THE INVESTIGATION . . . . .	11
Sources of Material . . . . .	11
Factors Influencing Loss Expectancy . . . . .	15
Size of association . . . . .	15
All associations . . . . .	15
Associations with ten year net loss ratios of 1.20-1.69 mills . . . . .	26
Value of ten year net loss ratio . . . . .	36
All associations . . . . .	36
Associations 2.000-4.999 million dollars in size . . . . .	47
RESULTS . . . . .	57
Size of Association . . . . .	57
All associations . . . . .	57
Associations with ten year net loss ratios of 1.20-1.69 mills . . . . .	58
General . . . . .	58
Value of Ten Year Net Loss Ratio . . . . .	66
All associations . . . . .	66
Associations 2.000-4.999 million dollars in size . . . . .	67
General . . . . .	68

DISCUSSION . . . . .	Page 76
SUMMARY AND CONCLUSIONS . . . . .	78
GLOSSARY . . . . .	80
LITERATURE CITED . . . . .	82
ACKNOWLEDGMENTS . . . . .	83
APPENDIX A . . . . .	84
APPENDIX B . . . . .	85
APPENDIX C . . . . .	86
APPENDIX D . . . . .	88

## LIST OF TABLES

TABLE		Page
I	Size Years (all associations) . . . . .	18
II	Average Size of Associations in Each Size Group (all associations) . . . . .	19
III	Distribution of Annual Net Loss Ratios Exceeding 125% of the Ten Yr. Net Loss Ratio for the Previous Year, by Size Group (all associations) . . . . .	20
IV	Number of Times that the Annual Net Loss Ratios Exceeded 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Size Group (all associations) . . . . .	21
V	Percent of Size Years that the Annual Net Loss Ratios Exceeded 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Size Group (all associations) . . . . .	22
VI	Average of Annual Net Loss Ratios Exceeding 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Size Group (all associations) . . . . .	24
VII	Size Years (associations with 10 yr. net loss ratios of 1.20-1.69 mills) . . . . .	28
VIII	Average Size of Associations in Each Size Group (associations with 10 yr. net loss ratios of 1.20-1.69 mills) . . . . .	29
IX	Distribution of Annual Net Loss Ratios Exceeding 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Size Group (associations with 10 yr. net loss ratios of 1.20-1.69 mills) . . . . .	30
X	Number of Times that the Annual Net Loss Ratios Exceeded 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Size Group (associations with 10 yr. net loss ratios of 1.20-1.69 mills) . . . . .	31



## TABLE

Page

XI	Percent of Size Years that the Annual Net Loss Ratios Exceeded 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Size Group (associations with 10 yr. net loss ratios of 1.20-1.69 mills) . . . . .	32
XII	Average of Annual Net Loss Ratios Exceeding 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Size Group (associations with 10 yr. net loss ratios of 1.20-1.69 mills) . . . . .	34
XIII	Ratio Years (all associations). . . . .	39
XIV	Average Value of 10 Yr. Net Loss Ratios in Each Ratio Group (all associations). . . . .	40
XV	Distribution of Annual Net Loss Ratios Exceeding 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Ratio Group (all associations) . . . . .	41
XVI	Number of Times that the Annual Net Loss Ratios Exceeded 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Ratio Group (all associations) . . . . .	42
XVII	Percent of Ratio Years that the Annual Net Loss Ratios Exceeded 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Ratio Group (all associations). . . . .	43
XVIII	Average of Annual Net Loss Ratios Exceeding 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Ratio Group (all associations) . . . . .	45
XIX	Ratio Years (associations 2.-4.999 million dollars in size). . . . .	49
XX	Average Value of 10 Yr. Net Loss Ratios in Each Ratio Group(associations 2.-4.999 million dollars in size). . . . .	50

TABLE	Page
XXI Distribution of Annual Net Loss Ratios Exceeding 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Ratio Group (associations 2.-4.999 million dollars in size) . . . . .	51
XXII Number of Times that the Annual Net Loss Ratios Exceeded 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Ratio Group (associations 2.-4.999 million dollars in size) . . . . .	52
XXIII Percent of Ratio Years that the Annual Net Loss Ratios Exceeded 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Ratio Group (associations 2.-4.999 million dollars in size) . . . . .	53
XXIV Average of Annual Net Loss Ratios Exceeding 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Ratio Group (associations 2.-4.999 million dollars in size). . . . .	55
XXV Values of "X" and "Y" for the Equation $Y=15.7+2357/(X+0.5)$ . . . . .	60
XXVI Values of "X" and "Y" for the Equation $Y=134+250/(X+1.5)$ . . . . .	60
XXVII Values of "X" and "Y" for the Equation $Y=12.5+139/(X+3.48)$ . . . ; . . . . .	63
XXVIII Values of "X" and "Y" for the Equation $Y=134+211/(X+1.05)$ . . . . .	63
XXIX Values of "X" and "Y" for the Equation $Y=2.59+41.2/(X+.302)$ . . . . .	70
XXX Values of "X" and "Y" for the Equation $Y=146.8+35.5/(X+.283)$ . . . . .	70
XXXI Values of "X" and "Y" for the Equation $Y=6+3.08/(X+.1)$ . . . . .	73
XXXII Values of "X" and "Y" for the Equation $Y=137+48.8/(X-.256)$ . . . . .	73

## LIST OF ILLUSTRATIONS

Figure	Page
1. Percent of Size Years That The Annual Net Loss Ratios Exceeded 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Size Group . . .	23
2. Average of Annual Net Loss Ratios Exceeding 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Size Group . . . . .	25
3. Percent of Size Years That The Annual Net Loss Ratios Exceeded 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Size Group (only assns. with 10 yr. net loss ratios of 1.20-1.69 mills) . . . . .	33
4. Average of Annual Net Loss Ratios Exceeding 125% of the 10 Yr. Net Loss Ratio For The Previous Year, By Size Group (only assns. with 10 yr. net loss ratios of 1.20-1.69 mills) . . . . .	35
5. Percent of Ratio Years That The Annual Net Loss Ratios Exceeded 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Ratio Group . . . . .	44
6. Average of Annual Net Loss Ratios Exceeding 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Ratio Group . . . . .	46
7. Percent of Ratio Years That The Annual Net Loss Ratios Exceeded 125% of The 10 Yr. Net Loss Ratio For The Previous Year (only assns. of 2.-4.999 million dollars in size) . . . . .	54
8. Average of Annual Net Loss Ratios Exceeding 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Ratio Group (only assns. of 2.-4.999 million dollars in size) .. . . .	56
9. Percent of Size Years That The Annual Net Loss Ratios Exceeded 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Size Group & The Curve $Y=15.7+2357/(X+50.5)$ . . . . .	61



Figure	Page
10. Average of Annual Net Loss Ratios Exceeding 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Size Group & The Curve $Y=134+250/(X+1.5)$ . . . . .	62
11. Percent of Size Years That The Annual Net Loss Ratios Exceeded 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Size Group (only assns. with 10 yr. net loss ratios of 1.20-1.69) & The Curve $Y=12.5+139/(X+3.48)$ . . . . .	64
12. Average of Annual Net Loss Ratios Exceeding 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Size Group (only assns. with 10 yr. net loss ratios of 1.20-1.69 mills) & The Curve $Y=134+211/(X+1.05)$ . . . . .	65
13. Percent of Ratio Years That The Annual Net Loss Ratios Exceeded 125% of The 10 Yr. Net Ratio For The Previous Year, By Ratio Group, & The Curve $Y=2.59+41.2/(X+.302)$ . . . . .	71
14. Average of Annual Net Loss Ratios Exceeding 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Ratio Group, & The Curve $Y=146.8+35.5/(X-.283)$ . . . . .	72
15. Percent of Ratio Years That The Annual Net Loss Ratios Exceeded 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Ratio Group, (only assns. of 2.-4.999 million dollars in size) & The Curve $Y=6+3.08/(X-.1)$ . . . . .	74
16. Average of Annual Net Loss Ratios Exceeding 125% of The 10 Yr. Net Loss Ratio For The Previous Year, By Ratio Group, (only assns. of 2.-4.999 million dollars in size) and The Curve $Y=137+48.8/(X-.256)$ . . . . .	75

## INTRODUCTION

Since 1930, Project 23, entitled "An Investigation of Farm Building Losses Due to Wind and Fire", has been undertaken by the Agricultural Engineering Department of Iowa State College and sponsored by the Iowa Mutual Tornado Insurance Association of Des Moines, Iowa and the Farmers' Mutual Reinsurance Association of Grinnell, Iowa. The object of the work done on Project 23 has been to determine the underlying causes of losses, in rural localities, resulting from windstorm and fire and to eliminate these causes. The structural aspects of this problem involving rural buildings quite naturally made this investigation one for Agricultural Engineers. Previous investigations have been divided into two categories, losses caused by wind and losses caused by fire. This study was devoted to problems of the Farmers' Mutual Reinsurance Association which is most interested in losses caused by fire.

The Farmers' Mutual Reinsurance Association was formed to aid the country mutual insurance associations of Iowa in years when heavy losses were suffered. Two types of reinsurance have been available to the county mutuals, specific, in which a specified part of the insurance on a specific item is passed on to the reinsurance association, and blanket, in which all losses above a certain point, and up to a

maximum, experienced by the county mutual, in any one year, would be assumed by the reinsurance association.

The premium rate for specific reinsurance has offered a relatively small problem as compared to that for blanket reinsurance; the latter has not been considered equitable by the larger mutuals. The blanket reinsurance premium for 1946 and prior years, for a specific county mutual, was based on the net risks\* in force January 1 of the reinsurance contract year. This method of calculating a premium rate does not allow a mutual a lower premium rate when its loss ratio\* is lower. The premium rate has varied over the years, but the average has been about twenty cents per \$1,000 of net risks.

For 1947 the premium rate for blanket reinsurance is being based on an idea which is new to usage as far as the Farmers' Mutual Reinsurance Association is concerned. By this method the premium rate is based on, and varies as, the loss budget\* of the mutual purchasing reinsurance. This method of calculating reinsurance premiums for blanket policies is obviously more equitable, as the loss ratio of a county mutual combined with the net risks in force is a much more definite indication of the hazard involved in reinsuring that mutual than the net risks alone. The premium rate for 1947 is \$100 per \$1,000 of loss budget.

The benefits that might be received from the reinsurance

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\* See Glossary



association have varied over the past years. At one time the reinsurance association would pay all losses over 125% and up to 225% of the loss budget. Losses in excess of 225% of the loss budget had to be borne by the county mutual. Thus a county mutual with a loss budget of \$10,000 could recover all losses in excess of \$12,500 and up to \$22,500 that occurred during the reinsurance contract year. More recently the county mutuals could purchase reinsurance for any desired zone above 100% of the loss budget, but most of the reinsurance contracts called for benefits beginning at 125% of the loss budget and extending two mills. In this way a county mutual with a ten year net loss ratio\* of two mills and \$10,000,000 in net risks January 1 could recover all losses in excess of \$25,000 and up to \$45,000 that occurred during the contract year. However, county mutuals with small loss budgets were limited in the amount that could be recovered on a single loss. This prevented small mutuals from accepting large single risks without reinsuring them specifically. Otherwise, the loss of a single large risk might conceivably exceed the loss budget. The 1947 reinsurance contracts make possible the recovery of all losses in excess of 125% of the loss budget and provide the same limitations on single risk size for county mutuals with small loss budgets.

The large county mutuals contend this: the annual net

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\* See Glossary

loss ratio\* of a large county mutual will vary less from the ten year average net loss ratio of that mutual than the annual net loss ratio of a small county mutual will vary from the ten year average net loss ratio of that small mutual; therefore, the larger county mutuals will collect less from the reinsurance association than the small county mutuals will.

By "large" and "small" county mutuals reference is made to the number of risks carried. In general, though, the total net risks carried by an Iowa county mutual are an indication of the number of risks it carries as the size of the average risk varies only slightly, and that variation occurs mainly between mutuals in different sections of the state, where farm building values vary.

The Farmers' Mutual Reinsurance Association feels that it has solved the problem of inequitable reinsurance premium rates to some extent by the introduction of the method it is using for calculating blanket reinsurance premium rates for 1947, but they do not feel that this is the final answer. It is the purpose of this study to determine whether or not the size of the county mutuals should be considered when premium rates for blanket reinsurance are calculated.

The causes of rural fires, the resulting losses, and other pertinent data have been recorded since 1930 for use on Project 23. The past investigations have apparently

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\*See Glossary

resulted, directly or indirectly, in a distinct downward trend in the number of fires in rural localities and the amount of damage done by them each year. However, the total losses, in dollars, paid by the county mutuals have not decreased appreciably because of rising values, including face values of policies, and growth of the mutuals in number of risks carried. The loss ratio for all county mutuals combined has decreased, though. That lowered rate of loss coupled with a more or less uniform rate of assessment through the years has resulted in the building up of a great amount of reserve\* by some of these county mutuals, several to the extent of their being able to pay their expected losses for the next 15 to 25 years without making an assessment to their policyholders during that time. Still, some of the county mutuals do not have sufficient reserve to pay their expected losses for even one year.

It was thought that this study, in its consideration of the financial records of the county mutuals, might also lead to the determination of a logical amount of reserve for a county mutual to have. Too, it was thought that it might be possible for some plan of reinsurance to make a reserve unnecessary for each of the participating mutuals. If, though, a reserve was found desirable, it would be logical to assume that the amount would fall between the two existing extremes.

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\* See Glossary

The terms "mutual" and "association" have been used interchangeably throughout this manuscript as the majority of the Iowa county mutuals actually have in their name the phrase "mutual insurance association".



## REVIEW OF LITERATURE

Defining reinsurance, Valgren (6), p. 1, says:

"The term 'reinsurance' applies to a method of transferring liability for loss from one insurance company to another. It has no reference to the renewal by a given company of insurance that has expired or is about to expire, although this meaning is sometimes erroneously ascribed."

Relative to the history of reinsurance Thompson (3) states, p. 26: "As early as 1755 a writer on insurance mentioned reinsurance" and, p. 28, "Apparently one of the earliest fire reinsurance treaties was arranged in 1866". Valgren (6), p. 5, says: "The possibilities of blanket reinsurance in the farm mutual field began to attract attention about 1918" and, p. 22, "The Iowa company [Farmers' Mutual Reinsurance Association] began writing blanket reinsurance in 1924..."

According to Thompson (3), p. 12,

"The purpose of reinsurance is purely technical. It is a means which insurance uses to reduce, from the point of view of material losses, the perils which it has accepted. When a carriage fitted with a shock absorber passes over a rough street, the road becomes no smoother, but the passengers will feel the jerks less as these are absorbed by the contrivance carried as a special addition to the vehicle. So it is with reinsurance; it does not reduce losses but it makes it easier for insurance to carry the material consequences."

In the same vein, Valgren (6), p. 1, states:

"As most commonly used, reinsurance serves as a means for permitting a given company to

share with one or more other insurance companies the ultimate liability for potential loss on a risk that is deemed too large for it alone to carry."

Thompson (3), p. 25, adds:

"The advantage of reinsurance to the original assured also consists in the fact that the re-assured by obtaining reinsurance thereby helps maintain its solvency and ability to pay losses."

Jones (2), p. 78, referring to the contention that the large county mutuals make concerning their likelihood of collecting from the reinsurance association, states:

"The very basis of insurance lies in the fact that a greater number of uncertainties combined into a whole results in the approximation of a certainty; and that the greater the number of uncertainties combined, the loss will be the variation from the norm [ten year net loss ratio]."

Concerning the system whereby blanket reinsurance premium rates are based on the net risks in force, Valgren (4), p. 94, states:

"An objection to this is found, however, in the fact that the loss rate of companies located in different parts of a state frequently differ materially, not only in individual years but in the average covering a long period of years."

In reference to the plan where the loss rate is used as a basis for calculating blanket reinsurance premiums, virtually that used in 1947 by the Farmers' Mutual Reinsurance Association, Valgren (4), p. 94, says:

"This would give approximate justice as between member companies sharing their larger risks through a reinsurance company even though some of these member companies carried risks involving a higher loss rate than others. It would not, however, give any close approach to



justice as between a large and a small company, both guaranteed the same relative assistance when the loss rate exceeded the average by a given percentage."

In a later publication, (6), p. 7, Valgren states, concerning the plan of blanket reinsurance where losses above a predetermined percentage of the loss budget are assumed by the reinsurance association:

"One of the difficulties of this form of blanket reinsurance, which has not yet been satisfactorily solved, is that of making an equitable distribution of the cost of reinsurance among participating mutuals of varying size. A uniform rate of assessment against the outstanding insurance of the reinsured mutuals obviously implies an equal probability of a given percentage increase in the respective loss rates of these mutuals. This probability varies in some measure, however, with the volume of outstanding insurance and also with the base-period loss rate [ten year net loss ratio] of the member mutuals."

In the foreword of his book Giese (1), pp. 1-2, says:

"It is the intent of this report to show the record and progress of each association over an extended period which may be of more significance than its experience any one particular year. As most of the associations are comparatively small, it is to be expected that their loss experiences will vary widely."

"When one considers that perhaps all of them [the Iowa county mutuals] started on a post-assessment basis and with a definite feeling that the building of a large reserve placed an unnecessary financial burden upon the members, the surprise is to see how much has been accumulated by them."

With respect to reserves or safety funds accumulated by farmers' mutual insurance companies, Valgren (5), pp. 20-21, offers these facts and opinions:

"In connection with the present tendency among the companies to shift from the original post-assessment plan to an advance=assessment plan, increasing emphasis is being placed upon reasonable reserves or safety funds."

"The building up and maintenance of reasonable reserves or safety funds adds to the stability of farm mutuals and to the desirability of this form of protection from the point of view of the farmer. The presence of such funds in the treasury of a company is the most acceptable evidence to members and prospective members, as well as to mortgagagee interests with which the farm mutual comes in contact, that it is not only willing and able to meet losses that may be incurred but is prepared to meet them promptly."

"Such reserves or safety funds have the further advantage that they tend to give the collective loss burden resting upon the members of the company what may be called a 'time spread' in addition to the spread that results directly from the fact that the group shoulders the loss that may come to any member."

## THE INVESTIGATION

In order to have sufficient data with which to work it was thought desirable to assume that all the county mutuals carried complete blanket reinsurance. Working under this assumption definite figures concerning the frequency of collection and the amount of collection of reinsurance benefits could be calculated by examining the loss experiences of each county mutual. The period of years chosen to be covered by this study was 1921-45, inclusive; it was felt that twenty-five years would provide conclusive results.

### Sources of Material

Two sources were used to obtain financial records of the Iowa County Mutuals. The Loss Records kept by the Farmers' Mutual Reinsurance Association contain the risks and losses, for each year, for each county mutual writing farm fire and lightning insurance. These records begin in 1932 in most cases and in 1933 in the remainder. For simplicity they will be referred to as the "Loss Records". "Statistical Tables Iowa County Mutuals" by Henry Giese contains a record of the risks and losses, for each year, for each county mutual from the year that the mutual began



operation. For simplicity in referring to these tables they will be called "Statistical Tables".

Some of the mutuals write insurance on personal property only, some on plate glass only, and some on town property only. All of these mutuals were eliminated from this study as only farm fire and lightning experiences were to be considered. The insurance on some small town property appeared in the records used, but it would have been practically impossible to eliminate that. Also, some of the county mutuals write windstorm insurance in addition to fire and lightning. In those cases it was necessary to eliminate all losses that concerned windstorm insurance. The "Loss Records" have the windstorm risks and losses eliminated. The "Statistical Tables" do not have these figures eliminated and therefore only the figures found in the "Loss Records" could be used for these mutuals.

As blanket reinsurance involves only the net risks of a county mutual and not those that are specifically reinsured, it was necessary to deduct all risks specifically reinsured from the total risks that the mutual had in force. The "Loss Records" have these specifically reinsured risks deducted and were used for all figures for years subsequent to 1932 or 1933, as the records provided. Risks shown in "Statistical Tables" did not have the specifically reinsured risks deducted, but prior to 1933 the amount of reinsurance

in force was considered negligible, and where no specific reinsurance is in force the net risks and net losses are equal to the total risks and total losses; therefore, it was felt that for the necessary figures prior to 1933 the "Statistical Tables" could be used without introducing too much error into this study.

Appendix A contains a typical "Loss Record". It will be noted that the ten year loss ratios appear only for 1945. The data for these records were gathered in 1946 and at that time the reinsurance association was not interested in calculating the ten year loss ratios for years prior to 1945. A typical page, containing the record of one county mutual from 1901 to 1944, from "Statistical Tables" will be found in Appendix B.

The ten year net loss ratio for each county mutual was calculated for each year contained in the "Loss Record" of that mutual. As many figures as possible were used from the "Loss Record"; supplementary figures were taken from "Statistical Tables" from the column headed "Losses Paid, Dollars per Thousand, Year". The dollars per thousand in this case is the same as the "mills per dollar" or more simply, "mills", when referring to a loss ratio value. For each of the years prior to 1932 or 1933, depending on which year the "Loss Record" began, the ten year net loss ratio did not have to be calculated as that figure appears in "Statistical Tables".

For each county mutual for each year contained in the "Loss Records" a comparison was made between the annual net loss ratio and the ten year net loss ratio for the previous year. This comparison was expressed as a percentage of the ten year net loss ratio for the previous year. The calculation of this percentage was not necessary for years taken from "Statistical Tables" as there is also a column containing that comparison. This comparison was made in this manner as a percentage exceeding 125 would indicate that the mutual would collect reinsurance benefits if reinsurance was in force. Too, the amount of collection would be indicated by this percentage as losses above 125% are those that are assumed by the reinsurance association.

The number of the county mutual, the year, the size of the county mutual in thousands of dollars December 31 of that year, the annual net loss ratio for the year, the ten year net loss ratio for the previous year, and the annual net loss ratio expressed as a percentage of the ten year net loss ratio for the previous year were items that were tabulated for each county mutual. These data were placed on Hollerith cards (see Appendix C) for use in International Business Machines. The use of these cards and these machines greatly simplified the calculations and tabulations that were necessary in this study.



## Factors Influencing Loss Expectancy

It became apparent in early stages of this study that the size of a county mutual and the value of its ten year net loss ratio might have an influence on the loss expectancy of that mutual. This observation was also made by Valgren (6). The first two studies made in this investigation were attempts to find the relationship between the size of a county mutual and its loss expectancy. The two final studies were made in an attempt to determine the relationship between the value of the ten year net loss ratio of a county mutual and the loss expectancy of that mutual.

### Size of association

The consideration of size of an association as a factor influencing the loss expectancy was studied from two viewpoints, one where all associations were considered and the other where only associations with ten year net loss ratios of 1.20-1.69 mills were considered. The latter was an effort to eliminate the value of the ten year net loss ratio as a variable but at the same time cover a wide enough range to have sufficient data with which to work.

All associations. Size Groups were made, based on the amount of net risks in force December 31. Each Size Group covered a range of one million dollars; thus the groups

became \$0-\$999,999, \$1,000,000-\$1,999,999 et cetera to include the largest size county mutual. The size of an association in one year placed the association in the corresponding Size Group. If, in the succeeding year, the association became larger or smaller a sufficient amount it would go into the next higher or lower Size Group as required. The appearance of a specific size, within the range of one Size Group, for one year was called a Size year; thus, the number of times that a specific size appeared became the total Size Years for that Size Group. Table I contains the Size Years in each Size Group. The average size of the associations in each Size Group will be found in Table II. Because of the small number of appearances of sizes above twenty-one million dollars and because later comparisons indicated that all associations above twenty-one million dollars in size could be considered together, the average of all those associations was taken.

For each Size Group, the annual net loss ratios, expressed as a percentage of the ten year net loss ratio for the previous year, were listed numerically in order of increasing size. The distribution of losses in excess of 125% was noted and appears in Table III. In order to determine the frequency with which each Size Group exceeded 125%, the number of times that 125% was exceeded was recorded

and appears in Table IV. Each of the numbers in Table IV represents a certain percent of the Size Years for its respective Size Group. That percentage was calculated and appears in Table V. These percentages were plotted against the average size of the associations in each Size Group; the resulting curve is shown in Figure 1. The average of all the losses above 125% was calculated for each Size Group and recorded in Table VI. These averages were plotted as ordinates and the average size of the associations in each Size Group as abscissas in Figure 2.

Figures 1 and 2 were made for the purpose of visually comparing the loss expectancy of the Iowa county mutuals of different sizes and will be discussed in the "Results".

TABLE I

Size Years  
(all associations)

Size Group (millions of dollars)	Size Years	Size Group (millions of dollars)	Size Years
Less than 1	87	24	4
1	270	25	3
2	302	26	6
3	328	27	1
4	294	28	3
5	247	29	2
6	232	30	3
7	209	31	2
8	181	32	3
9	181	33	5
10	131	34	4
11	122	35	
12	108	36	1
13	80	37	
14	56	38	
15	53	39	1
16	41	40	
17	47	41	
18	27	42	1
19	24	43	
20	16	44	
21	10	45	
22	6	46	1
23	6	47	1

TABLE II

Average Size of Associations in Each Size Group  
(all associations)

Size Group (millions of dollars)	Av. Size (millions of dollars)
Less than 1	0.729
1	1.487
2	2.559
3	3.463
4	4.472
5	5.501
6	6.472
7	7.509
8	8.497
9	9.475
10	10.489
11	11.497
12	12.539
13	13.441
14	14.519
15	15.491
16	16.414
17	17.434
18	18.522
19	19.532
20	20.553
21 & above	28.046

TABLE III

Distribution of Annual Net Loss Ratios Exceeding  
125% of the Ten Yr. Net Loss Ratio for the Previous  
Year, by Size Group (all associations)

Size Group (millions of dollars)	Value of Annual Net Loss Ratio					
	126- 149%	150- 199%	200- 299%	300- 399%	400- 499%	500% & above
	Number of Times					
Less than 1	5	8	6	3	3	1
1	23	24	20	9		3
2	34	23	19	7	3	
3	28	42	17	1	2	
4	35	29	10	3	1	
5	27	27	18	1		
6	30	19	10	1		1
7	16	22	6			
8	20	21	3	1		
9	18	12	7		1	
10	18	9	1			
11	11	10	3			
12	12	8				
13	11	5				
14	8	5	1			
15	9	4	1			
16	0	2				
17	4	3				
18	2	3				
19	4					
20	3					
21 & above	7	2				



TABLE IV

Number of Times that the Annual Net Loss Ratios  
Exceeded 125% of the 10 Yr. Net Loss Ratio for the  
Previous Year, by Size Group (all associations)

Size Group (millions of dollars)	Number of Times
Less than 1	26
1	79
2	86
3	90
4	78
5	73
6	61
7	44
8	45
9	38
10	28
11	24
12	20
13	16
14	14
15	14
16	2
17	7
18	5
19	4
20	3
21 & above	9

TABLE V

Percent of Size Years that the Annual Net Loss  
 Ratios Exceeded 125% of the 10 Yr. Net Loss Ratio  
 for the Previous Year, by Size Group  
 (all associations)

Size Group (millions of dollars)	Percent of Size Years
Less than 1	29.9
1	29.2
2	28.5
3	27.7
4	26.5
5	29.6
6	26.3
7	21.1
8	24.9
9	21.0
10	21.4
11	19.7
12	18.5
13	20.0
14	25.0
15	26.4
16	4.9
17	14.9
18	18.5
19	16.7
20	18.7
21 & above	14.3

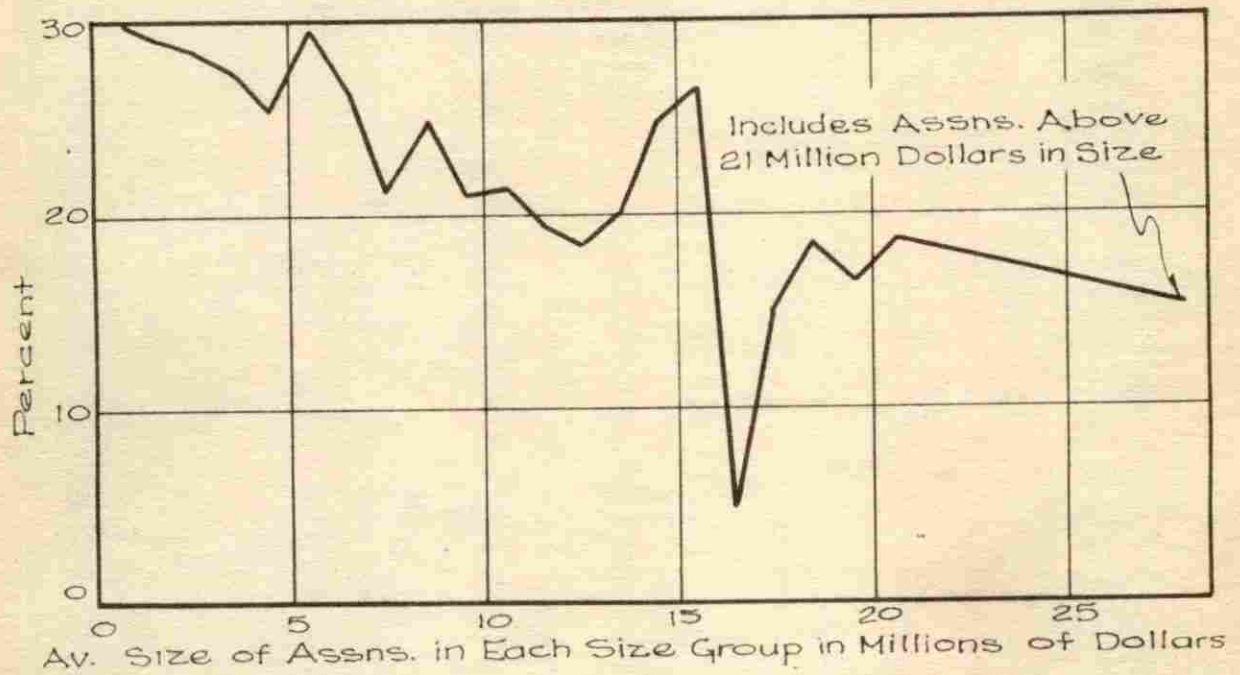


Fig. 1 PERCENT OF SIZE YEARS THAT THE ANNUAL NET LOSS RATIOS EXCEEDED 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY SIZE GROUP

TABLE VI

Average of Annual Net Loss Ratios Exceeding 125%  
of the 10 Yr. Net Loss Ratio for the Previous  
Year, by Size Group (all associations)

Size Group (millions of dollars)	Average of Annual Net Loss Ratios
Less than 1	244
1	218
2	185
3	180
4	171
5	175
6	174
7	163
8	162
9	167
10	149
11	159
12	152
13	148
14	149
15	150
16	175*
17	143
18	146
19	133
20	134
21 & above	142

\* only two losses exceeding 125%



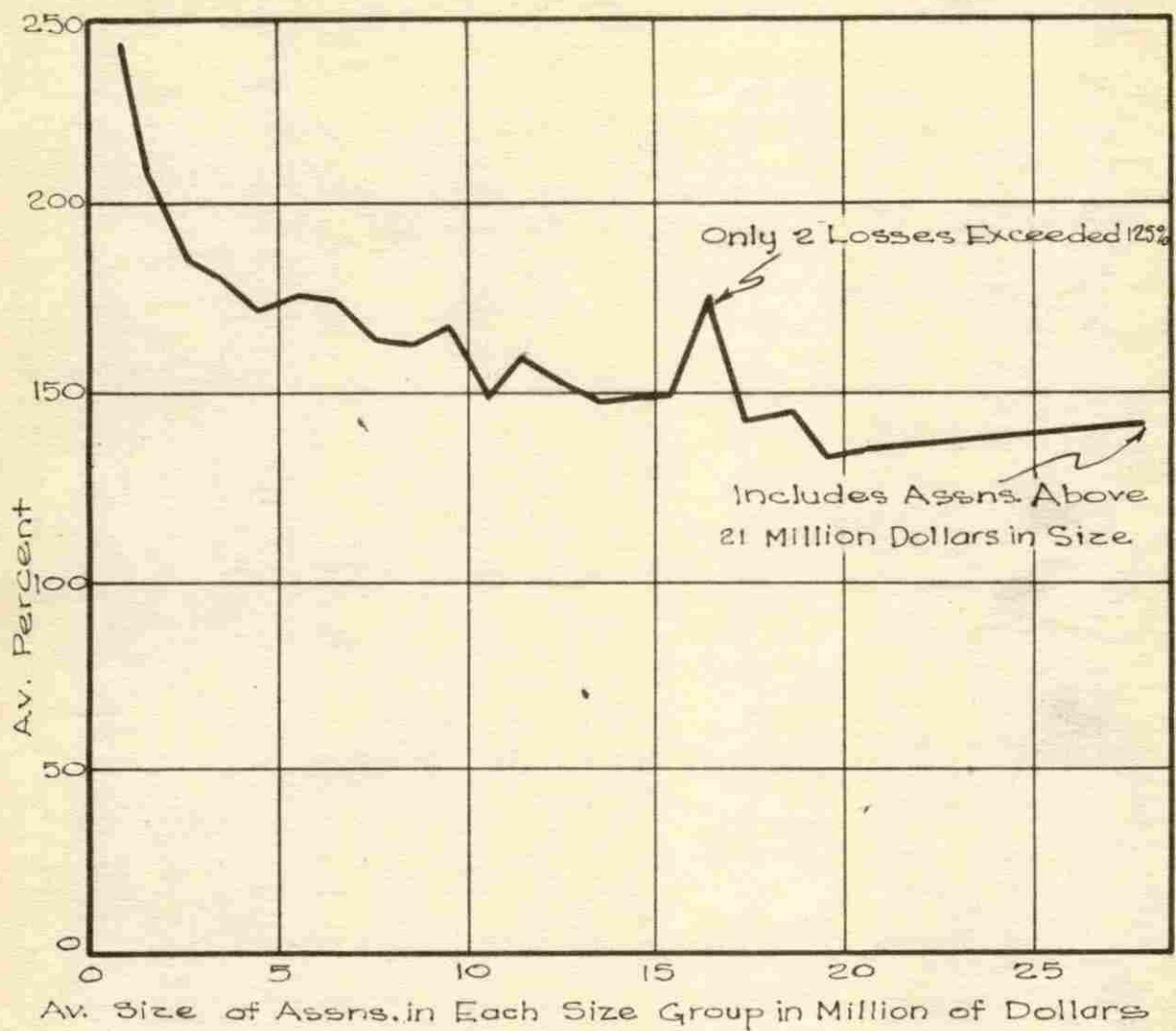


Fig. 2 AVERAGE OF ANNUAL NET LOSS RATIOS EXCEEDING 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY SIZE GROUP

Associations with ten year net loss ratios of 1.20-1.69 mills. The range of values for ten year net loss ratios was found to be from 0.33 to 3.95 mills per dollar when all associations were considered. In more than one-third of the Size Years the value of the ten year net loss ratios was between 1.20 and 1.69 mills. This range was chosen for the second step of this investigation so that as many Size Years as possible could be considered while at the same time the ten year net loss ratio varied such a small amount, as compared to its entire range, that its effect on loss expectancy would be negligible.

Size Groups were formed as in the foregoing study and the same relationship between size of an association and the annual net loss ratio expresses as a percentage of the ten year net loss ratio for the previous year were calculated and tabulated. Table VII contains the Size Years in each Size Group. The average size of the associations in each Size Group appears in Table VIII. For the same reasons as in the foregoing study all associations above twenty-one million dollars in size were combined. The distribution of the annual net loss ratios that exceeded 125% of the ten year net loss ratio for the previous year appears in Table IX. The number of times that the annual net loss ratios exceeded 125% appears for each Size Group in Table X. These numbers were expressed as a percentage

of the Size Years for each corresponding Size Group and are shown in Table XI. The percentages were also plotted against the average size of the associations in each Size Group in Figure 3. For each Size Group the average of the annual net loss ratios exceeding 125% was calculated and listed in Table XII, and the averages thus obtained were plotted in Figure 4.

A discussion of Figures 3 and 4 will be made later in this manuscript.

TABLE VII

Size Years  
 (associations with 10 yr. net  
 loss ratios of 1.20-1.69 mills)

Size Group (millions of dollars)	Size Years
Less than 1	22
1	54
2	82
3	108
4	128
5	115
6	111
7	85
8	64
9	57
10	59
11	68
12	54
13	41
14	31
15	26
16	22
17	17
18	10
19	13
20	8
21	4
22	2
23	1
24	2
25	2
26	2
27	0
28	2
29	1
30	2
31	0
32	1
33	1
34	2



TABLE VIII

Average Size of Associations in Each Size Group  
 (associations with 10 yr. net loss ratios of  
 1.20-1.69 mills)

Size Group (millions of dollars)	Av. Size (millions of dollars)
Less than 1	.80
1	1.51
2	2.62
3	3.43
4	4.48
5	5.52
6	6.44
7	7.49
8	8.52
9	9.47
10	10.48
11	11.46
12	12.56
13	13.40
14	14.60
15	15.53
16	16.40
17	17.42
18	18.56
19	19.57
20	20.56
21 & above	26.74

TABLE IX

Distribution of Annual Net Loss Ratios Exceeding  
125% of the 10 Yr. Net Loss Ratio for the Previous  
Year, by Size Group (associations with 10 yr. net  
loss ratios of 1.20-1.69 mills)

Size Group (millions of dollars)	Value of Annual Net Loss Ratio					
	126- 149%	150- 199%	200- 299%	300- 399%	400- 499%	500% & above
	Number of Times					
Less than 1	1	5	3	0	0	1
1	7	5	3	5	0	
2	8	12	6	1	1	
3	10	17	6	1		
4	17	16	6	1		
5	5	16	11			
6	17	12	2			
7	6	14	1			
8	7	10	1			
9	5	5	1			
10	7	4	1			
11	8	6	2			
12	5	3	0			
13	7	3	0			
14	6	3	1			
15	5	1				
16	0	1				
17	3	1				
18	1	0				
19	3	0				
20	1	0				
21 & above	2	2				

TABLE X

Number of Times that the Annual Net Loss Ratios Exceeded 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Size Group (associations with 10 yr. net loss ratios of 1.20-1.69 mills)

Size Group (millions of dollars)	Number of Times
Less than 1	10
1	20
2	28
3	34
4	40
5	52
6	31
7	21
8	18
9	11
10	12
11	16
12	8
13	10
14	10
15	6
16	1
17	4
18	1
19	3
20	1
21 & above	4

TABLE XI

Percent of Size Years that the Annual Net Loss Ratios Exceeded 125% of the 10 Yr. Net Loss Ratio for the Previous Year, by Size Group (associations with 10 yr. net loss ratios of 1.20-1.69 mills)

Size Group (millions of dollars)	Percent of Size Years
Less than 1	45.4
1	37.0
2	34.2
3	31.5
4	31.2
5	27.8
6	27.9
7	24.7
8	28.1
9	19.3
10	20.3
11	23.5
12	14.8
13	24.4
14	32.3
15	23.1
16	4.5
17	23.5
18	10.0
19	23.1
20	12.5
21 & above	18.2



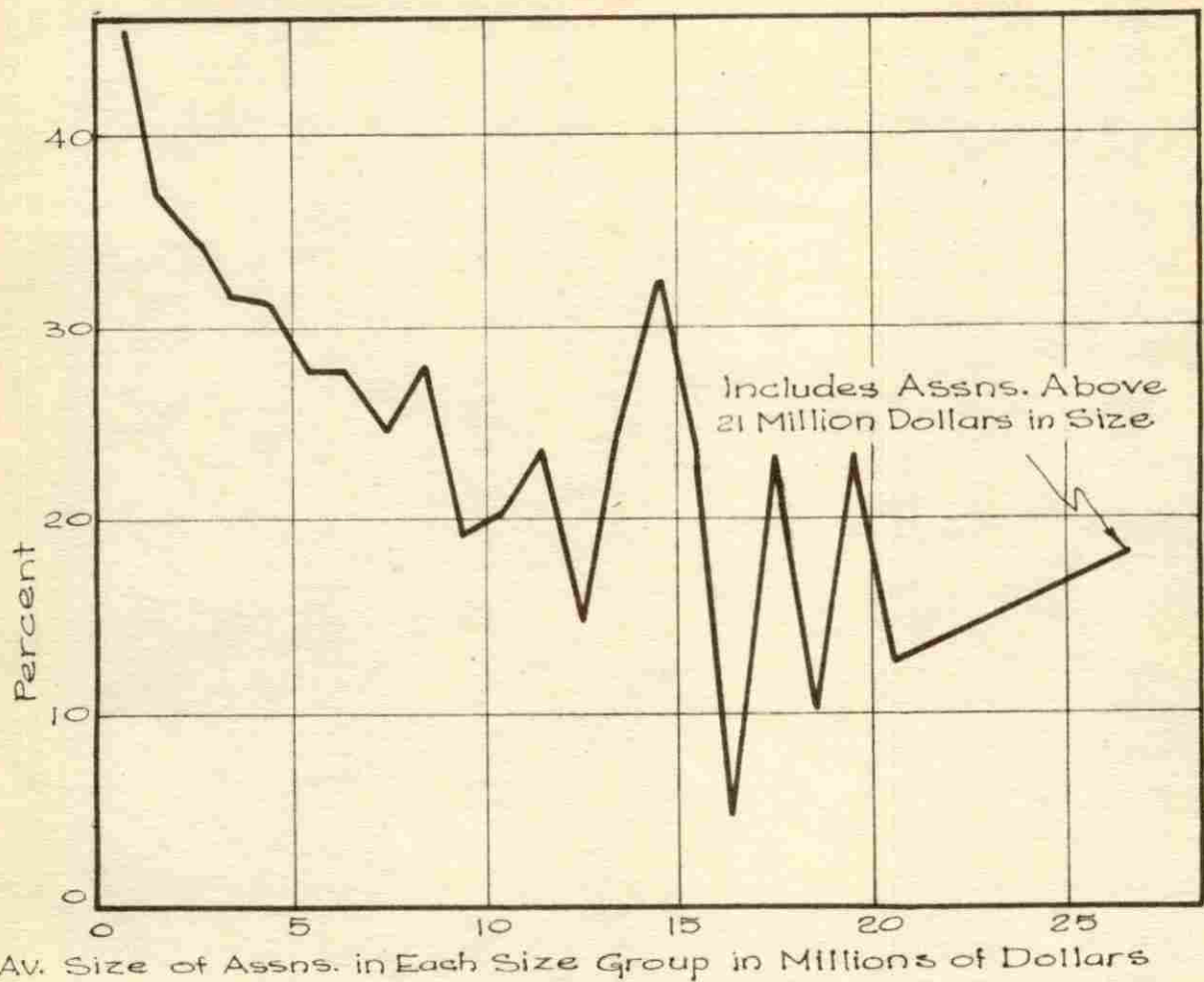


Fig. 3 PERCENT OF SIZE YEARS THAT THE ANNUAL NET LOSS RATIOS EXCEEDED 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY SIZE GROUP (ONLY ASSNS. WITH 10YR. NET LOSS RATIOS OF 1.20-1.69 MILLS)

TABLE XII

Average of Annual Net Loss Ratios Exceeding 125%  
of the 10 Yr. Net Loss Ratio for the Previous  
Year, by Size Group (associations with 10 yr. net  
loss ratios of 1.20-1.69 mills)

Size Group (millions of dollars)	Average of Annual Net Loss Ratios
Less than 1	248
1	206
2	188
3	176
4	171
5	185
6	155
7	169
8	158
9	152
10	154
11	155
12	155
13	148
14	150
15	146
16	193*
17	138
18	153
19	131
20	140
21 & above	141

\*only one loss exceeding 125%

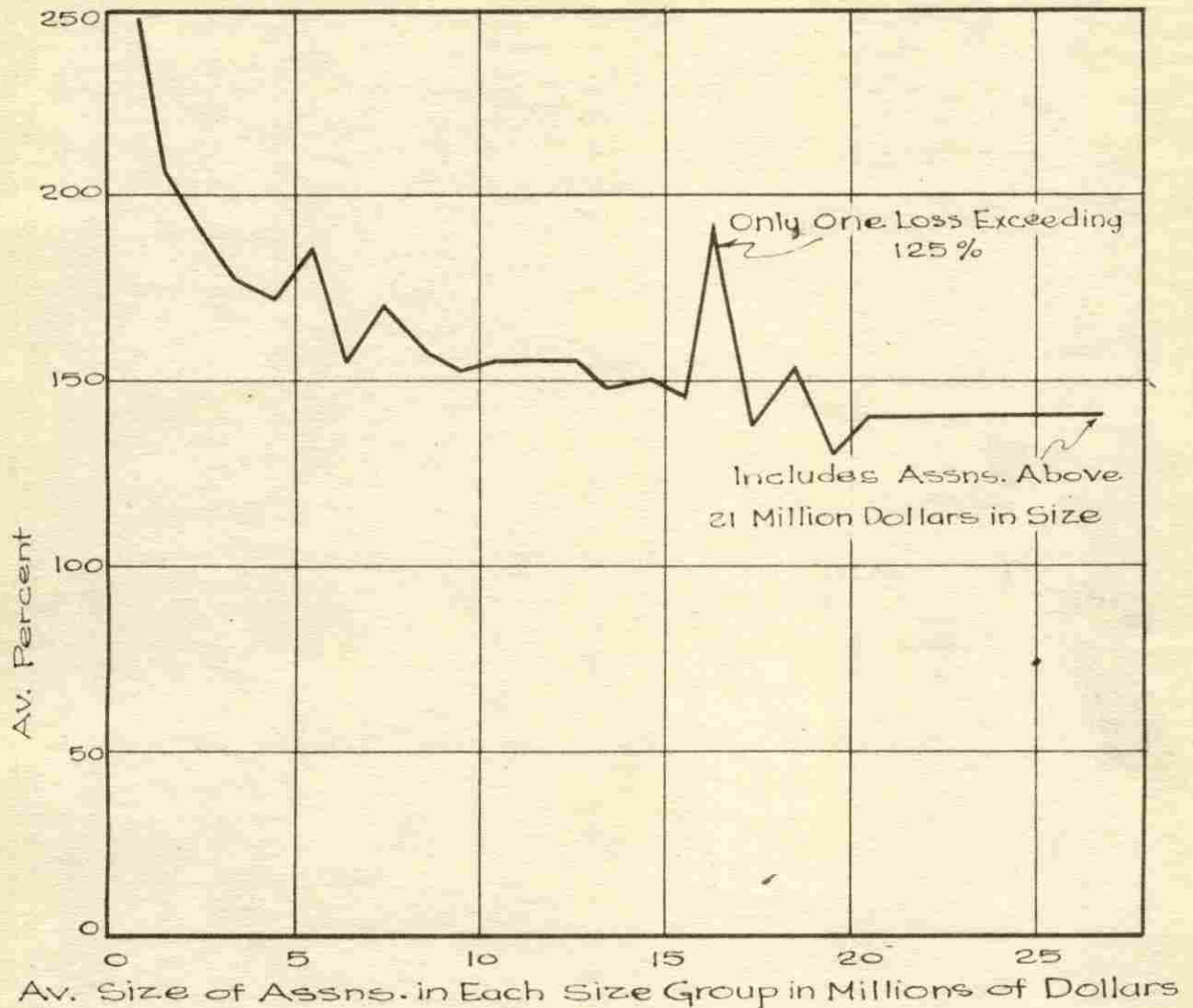


Fig. 4 AVERAGE OF ANNUAL NET LOSS RATIOS EXCEEDING 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY SIZE GROUP (ONLY ASSNS. WITH 10YR. NET LOSS RATIOS OF 1.20-1.69 MILLS)

Value of ten year net loss ratio

If each of two county mutuals, one with a ten year net loss ratio of one mill and the other with a ten year net loss ratio of two mills, had an annual net loss ratio one mill greater than the ten year net loss ratio for the previous year, the mutual with the smaller ten year net loss ratio would show a greater percentage increase and would collect more from the reinsurance association. In order to determine the effect of the value of the ten year net loss ratio on the loss expectancy of a county mutual two separate studies were made, one where all associations were considered and the other where only the associations of \$2,000,000-\$4,999,999 in size were considered. The latter was an effort to eliminate the size of a mutual as a factor influencing the loss expectancy and at the same time cover a wide enough range to have sufficient data with which to work.

All associations. Ratio Groups were made, based on the ten year net loss ratios of the mutuals. Each Ratio Group covered a range of one-tenth of a mill; thus the groups became 0.00-0.09 mills, 0.10-0.19 mills, 0.20-0.29 mills et cetera to include the largest ten year net loss ratio found in the data covered by this study. The value of the ten year net loss ratio of an association placed it in the corresponding Ratio Group. If in the succeeding year



the ten year net loss ratio became larger or smaller a sufficient amount the mutual would be placed in a higher or lower Ratio Group, as required. The appearance of a specific ten year net loss ratio, within the range of one Ratio Group, for one year was called a Ratio Year; thus the total number of times that a specific value for the ten year net loss ratio appeared became the total Ratio Years for the Ratio Group. Table XIII shows the Ratio Years for each Ratio Group. The average size of the ten year net loss ratios in each Ratio Group was calculated and appears in Table XIV. Because later comparisons showed that all Ratio Years from the Ratio Groups 2.60-2.69 and above could be considered together and because only few Ratio Years were found in those Ratio Groups all of these Ratio Groups were considered as one.

For each Ratio Group, the annual net loss ratios, expressed as a percentage of the ten year net loss ratio for the previous year, were listed in numerical order of increasing size. The distribution of the annual net losses that exceeded 125% was noted and appears in Table XV. In order to determine the frequency with which each Ratio Group exceeded 125%, the number of times that that figure was exceeded by each Ratio Group was recorded and is shown in Table XVI. Each of the numbers in Table XVI represents a percentage of the Ratio Years for the corresponding Ratio

Group. That percentage was calculated and placed in Table XVII. As only one and two Ratio Years, respectively, were found for the Ratio Groups 0.30-0.39 and 0.40-0.49 mills the experiences involving those Ratio Years were eliminated at this point as being insufficient to obtain reliable results. No Ratio Years were found in the still lower Ratio Groups. The percentages from Table XVII were plotted against the average value of the ten year net loss ratios in the respective Ratio Groups; the resulting curve is shown in Figure 5. The averages of all the losses above 125%, in the corresponding Ratio Groups, are shown in Table XVIII and are plotted in Figure 6 as ordinates where the average values of the ten year net loss ratios in each Ratio Group are the abscissas. As in Figure 5, the average values were not plotted in Figure 6 for losses exceeding 125% for the Ratio Groups 0.30-0.39 and 0.40-0.49 mills.

The implications of Figures 5 and 6 will be discussed in the "Results" of this investigation.

TABLE XIII

Ratio Years  
(all associations)

Ratio Group (mills)	Ratio Years
0.30-0.39	1
0.40-0.49	2
0.50-0.59	9
0.60-0.69	24
0.70-0.79	37
0.80-0.89	50
0.90-0.99	60
1.00-1.09	170
1.10-1.19	197
1.20-1.29	244
1.30-1.39	255
1.40-1.49	255
1.50-1.59	203
1.60-1.69	240
1.70-1.79	211
1.80-1.89	184
1.90-1.99	179
2.00-2.09	140
2.10-2.19	118
2.20-2.29	113
2.30-2.39	98
2.40-2.49	82
2.50-2.59	66
2.60-2.69	43
2.70-2.79	41
2.80-2.89	21
2.90-2.99	9
3.00-3.09	11
3.10-3.19	6
3.20-3.29	10
3.30-3.39	1
3.40-3.49	5
3.50-3.59	2
3.60-3.69	1
3.70-3.79	4
3.80-3.89	5
3.90-3.99	2

TABLE XIV

Average Value of 10 Yr. Net Loss Ratios in Each  
Ratio Group (all associations)

Ratio Group (mills)	Average Value
0.30-0.39	0.33
0.40-0.49	0.45
0.50-0.59	0.54
0.60-0.69	0.64
0.70-0.79	0.75
0.80-0.89	0.85
0.90-0.99	0.95
1.00-1.09	1.05
1.10-1.19	1.15
1.20-1.29	1.24
1.30-1.39	1.35
1.40-1.49	1.44
1.50-1.59	1.55
1.60-1.69	1.64
1.70-1.79	1.74
1.80-1.89	1.85
1.90-1.99	1.94
2.00-2.09	2.05
2.10-2.19	2.14
2.20-2.29	2.24
2.30-2.39	2.34
2.40-2.49	2.45
2.50-2.59	2.54
2.60-3.99	2.92



TABLE XV

Distribution of Annual Net Loss Ratios Exceeding  
125% of the 10 Yr. Net Loss Ratio for the  
Previous Year, by Ratio Group (all associations)

Ratio Group (mills)	Value of Annual Net Loss Ratio					
	126- 149%	150- 199%	200- 299%	300- 399%	400- 499%	500% & above
	Number of Times					
0.30-0.39					1	
0.40-0.49			1			
0.50-0.59	2	1	1			1
0.60-0.69	2	2	4	1	1	
0.70-0.79	9	5	2	1		2
0.80-0.89	5	5	7	3		
0.90-0.99	5	6	2	2	4	
1.00-1.09	11	19	11	1	1	1
1.10-1.19	23	21	14	3		
1.20-1.29	19	35	11	3	1	1
1.30-1.39	27	27	9	1		
1.40-1.49	28	22	13			
1.50-1.59	28	21	7	3		
1.60-1.69	30	32	4	1		
1.70-1.79	20	18	3	2		
1.80-1.89	27	14	5	1	1	
1.90-1.99	17	8	7	1		
2.00-2.09	12	8	4			
2.10-2.19	12	8	4	1		
2.20-2.29	11	7	2			
2.30-2.39	11	6	5		1	
2.40-2.49	7	6	3	1		
2.50-2.59	11	1	0			
2.60-3.99	9	6	2	1		

TABLE XVI

Number of Times that the Annual Net Loss Ratios  
Exceeded 125% of the 10 Yr. Net Loss Ratio for  
the Previous Year, by Ratio Group  
(all associations)

Ratio Group (mills)	Number of Times
0.30-0.39	1
0.40-0.49	1
0.50-0.59	5
0.60-0.69	10
0.70-0.79	19
0.80-0.89	20
0.90-0.99	19
1.00-1.09	44
1.10-1.19	61
1.20-1.29	70
1.30-1.39	64
1.40-1.49	63
1.50-1.59	59
1.60-1.69	67
1.70-1.79	43
1.80-1.89	48
1.90-1.99	33
2.00-2.09	24
2.10-2.19	25
2.20-2.29	20
2.30-2.39	23
2.40-2.49	17
2.50-2.59	12
2.60-3.99	18

TABLE XVII

Percent of Ratio Years that the Annual Net Loss  
 Ratios Exceeded 125% of the 10 Yr. Net Loss  
 Ratio for the Previous Year, by Ratio Group  
 (all associations)

Ratio Group (mills)	Percent of Rat. Years
0.30-0.39	100.0
0.40-0.49	50.0
0.50-0.59	55.6
0.60-0.69	41.6
0.70-0.79	51.3
0.80-0.89	40.0
0.90-0.99	31.7
1.00-1.09	25.9
1.10-1.19	31.0
1.20-1.29	28.7
1.30-1.39	25.1
1.40-1.49	24.7
1.50-1.59	29.0
1.60-1.69	27.9
1.70-1.79	20.4
1.80-1.89	26.1
1.90-1.99	18.4
2.00-2.09	17.1
2.10-2.19	21.2
2.20-2.29	17.7
2.30-2.39	23.5
2.40-2.49	20.8
2.50-2.59	18.2
2.60-3.99	12.8

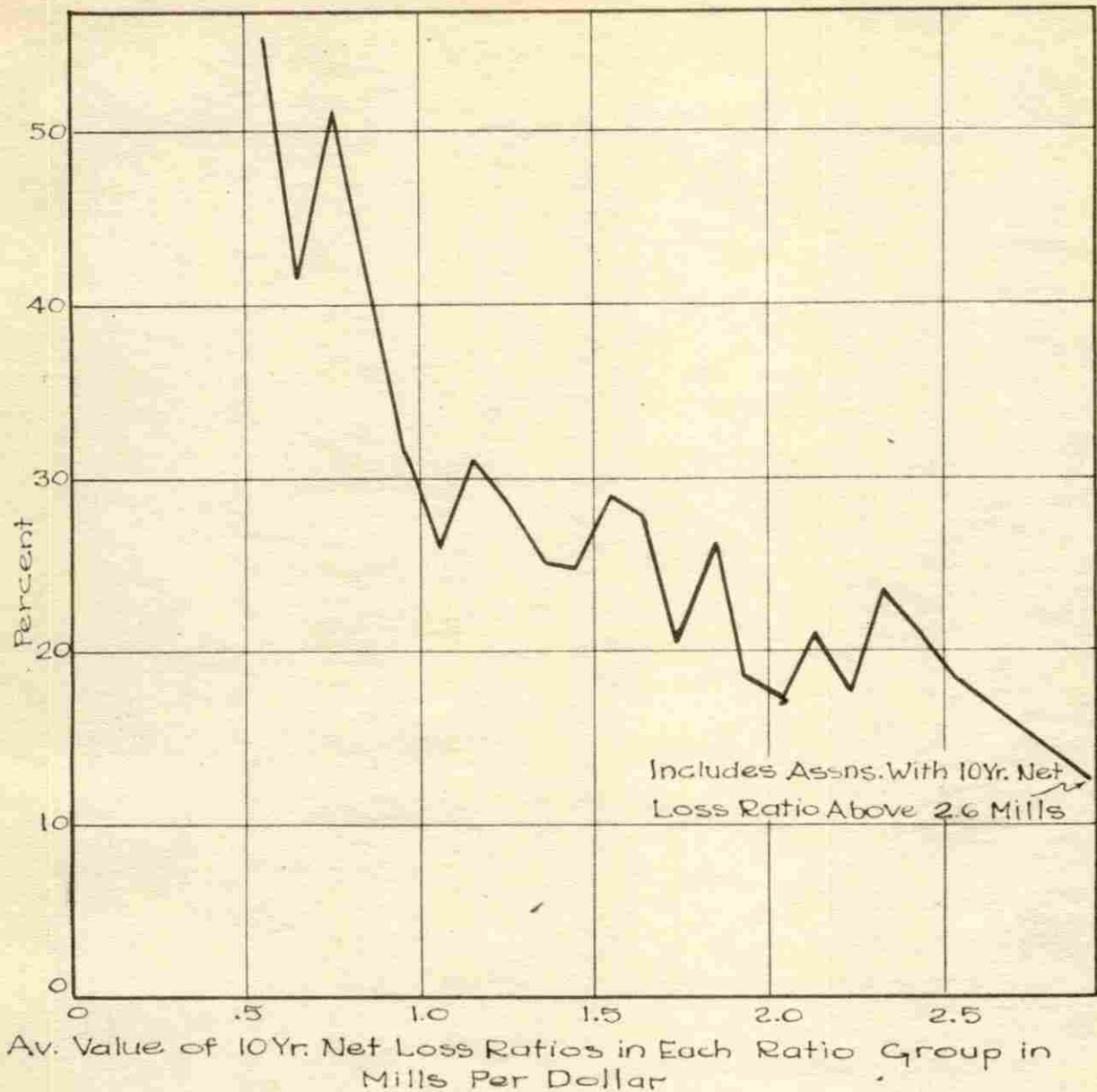


Fig. 5 PERCENT OF RATIO YEARS THAT THE ANNUAL NET LOSS RATIOS EXCEEDED 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY RATIO GROUP

TABLE XVIII

Average of Annual Net Loss Ratios Exceeding 125%  
of the 10 Yr. Net Loss Ratio for the Previous  
Year, by Ratio Group (all associations)

Ratio Group (mills)	Av. of Ann. N.L.R.
0.30-0.39	470*
0.40-0.49	247*
0.50-0.59	245
0.60-0.69	233
0.70-0.79	231
0.80-0.89	207
0.90-0.99	242
1.00-1.09	197
1.10-1.19	180
1.20-1.29	189
1.30-1.39	165
1.40-1.49	165
1.50-1.59	170
1.60-1.69	162
1.70-1.79	168
1.80-1.89	164
1.90-1.99	171
2.00-2.09	165
2.10-2.19	172
2.20-2.29	156
2.30-2.39	181
2.40-2.49	162
2.50-2.59	145
2.60-3.99	172

\* Only one loss exceeding 125%



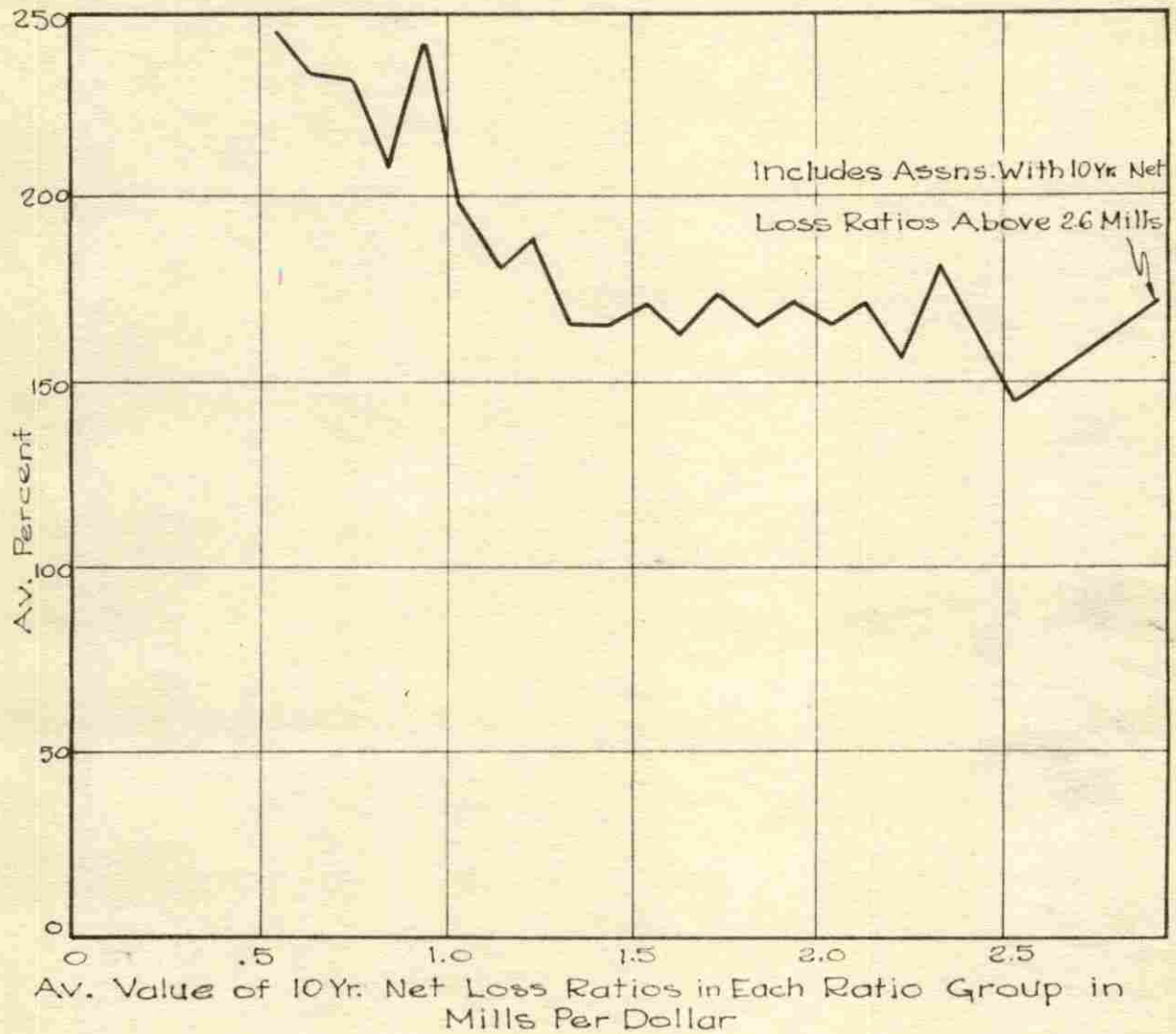


Fig. 6 AVERAGE OF ANNUAL NET LOSS RATIOS EXCEEDING 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY RATIO GROUP

Associations 2.000-4.999 million dollars in size. The range of sizes of the county mutuals was from slightly more than \$300,000 to more than \$47,000,000. The Size Group which contained the greatest number of Size Years was the one covering the range \$3,000,000-\$3,999,999. Taking this Size Group and the one on each side of it, including mutuals from \$2,000,000 to \$4,999,999 in size, slightly less than one-third of the loss experiences were included. By using only these three Size Groups and conducting a study similar to the foregoing one it was possible to determine the exact effect of the value of the ten year net loss ratio on the loss expectancy of a county mutual, with the size of the association having very little possible effect.

Ratio Groups were formed as in the foregoing study and the same relationships between the ten year net loss ratio of an association and the annual net loss ratio expressed as a percentage of the ten year net loss ratio for the previous year were calculated and tabulated. Table XIX contains the Ratio Years for each Ratio Group. The average value of the ten year net loss ratios in each Ratio Group appears in Table XX. As the associations with ten year net loss ratios of 0.99 mills or less were so few they were combined for the purpose of this study. The same was true of associations having ten year net loss ratios of 2.60 mills or more. The distribution of the annual net loss

ratios is shown in Table XXI. The number of times that the annual net loss ratios exceeded 125% of the ten year net loss ratio for the previous year is shown, for each Ratio Group, in Table XXII. These times that the annual net loss ratios exceeded 125% are expressed as a percentage of the Ratio Years, in their respective Ratio Groups, in Table XXIII, and in Figure 7 these percentages are plotted against the average value of the ten year net loss ratios. The average of the annual net loss ratios that exceeded 125% was calculated for each Ratio Group and is listed in Table XXIV. The averages thus obtained were plotted in Figure 8.

The variation of loss expectancy as shown in Figures 7 and 8 will be discussed later.

TABLE XIX

Ratio Years  
(associations 2.-4.999 million dollars in size)

Ratio Group (mills)	Ratio Years
0.30-0.99	68
1.00-1.09	39
1.10-1.19	40
1.20-1.29	60
1.30-1.39	65
1.40-1.49	68
1.50-1.59	57
1.60-1.69	68
1.70-1.79	53
1.80-1.89	46
1.90-1.99	50
2.00-2.09	40
2.10-2.19	47
2.20-2.29	59
2.30-2.39	31
2.40-2.49	41
2.50-2.59	34
2.60-3.49	58
3.50-3.99	0

TABLE XX

Average Value of 10 Yr. Net Loss Ratios in Each Ratio Group (associations 2.-4.99 million dollars in size)

Ratio Group (mills)	Av. Value of 10 Yr. Net Loss Ratio
0.30-0.99	.77
1.00-1.09	1.05
1.10-1.19	1.15
1.20-1.29	1.25
1.30-1.39	1.35
1.40-1.49	1.45
1.50-1.59	1.55
1.60-1.69	1.65
1.70-1.79	1.74
1.80-1.89	1.85
1.90-1.99	1.94
2.00-2.09	2.04
2.10-2.19	2.15
2.20-2.29	2.25
2.30-2.39	2.34
2.40-2.49	2.44
2.50-2.59	2.55
2.60-3.49	2.91
3.50-3.99	----



TABLE XXI

Distribution of Annual Net Loss Ratios Exceeding 125%  
of the 10 Yr. Net Loss Ratio for the Previous Year,  
by Ratio Group, (associations 2.-4.999 million dollars  
in size)

Ratio Group (mills)	Value of Annual Net Loss Ratio					
	126- 149%	150- 199%	200- 299%	300- 399%	400- 499%	500% & above
	Number of Times					
0.30-0.99	12	6	10	4	3	0
1.00-1.09	5	5	5	0	1	
1.10-1.19	1	5	4	2	0	
1.20-1.29	4	10	3	3	1	
1.30-1.39	6	11	4	0	0	
1.40-1.49	6	9	5	0	0	
1.50-1.59	7	5	3	0	0	
1.60-1.69	12	10	3	0	0	
1.70-1.79	3	5	0	1	0	
1.80-1.89	7	8	0		1	
1.90-1.99	5	2	3			
2.00-2.09	5	1	1			
2.10-2.19	5	5	2			
2.20-2.29	6	4	1			
2.30-2.39	3	1	1			
2.40-2.49	2	4	1			
2.50-2.59	5	1	1			
2.60-3.49	9	2				

TABLE XXII

Number of Times that the Annual Net Loss Ratios Exceeded  
 125% of the 10 Yr. Net Loss Ratio for the Previous  
 Year, by Ratio Group (associations 2.-4.999 million  
 dollars in size)

Ratio Group (mills)	Number of Times
0.30-0.99	35
1.00-1.09	16
1.10-1.19	12
1.20-1.29	21
1.30-1.39	21
1.40-1.49	20
1.50-1.59	15
1.60-1.69	25
1.70-1.79	8
1.80-1.89	16
1.90-1.99	10
2.00-2.09	7
2.10-2.19	12
2.20-2.29	11
2.30-2.39	5
2.40-2.49	7
2.50-2.59	7
2.60-3.49	11

TABLE XXIII

Percent of Ratio Years that the Annual Net Loss Ratios  
Exceeded 125% of the 10 Yr. Net Loss Ratio for the  
Previous Year, by Ratio Group (associations 2.-4.999  
million dollars in size)

Ratio Group (mills)	Percent of Ratio Years
0.30-0.99	51.5
1.00-1.09	41.0
1.10-1.19	30.0
1.20-1.29	35.0
1.30-1.39	32.3
1.40-1.49	29.4
1.50-1.59	26.3
1.60-1.69	36.8
1.70-1.79	15.1
1.80-1.89	34.8
1.90-1.99	20.0
2.00-2.09	17.5
2.10-2.19	25.6
2.20-2.29	18.6
2.30-2.39	16.1
2.40-2.49	17.1
2.50-2.59	20.6
2.60-3.49	19.0



Fig. 7 PERCENT OF RATIO YEARS THAT THE ANNUAL NET LOSS RATIOS EXCEEDED 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR (ONLY ASSNS. OF 2.4.999 MILLION DOLLARS IN SIZE.)

TABLE XXIV

Average of Annual Net Loss Ratios Exceeding 125% of the  
10 Yr. Net Loss Ratio for the Previous Year, by Ratio  
Group (associations 2.-4.999 million dollars in size)

Ratio Group (mills)	Average of Annual Net Loss Ratios
0.30-0.99	229
1.00-1.09	189
1.10-1.19	221
1.20-1.29	211
1.30-1.39	170
1.40-1.49	174
1.50-1.59	166
1.60-1.69	164
1.70-1.79	180
1.80-1.89	171
1.90-1.99	179
2.00-2.09	159
2.10-2.19	154
2.20-2.29	157
2.30-2.39	167
2.40-2.49	170
2.50-2.59	150
2.60-3.49	152



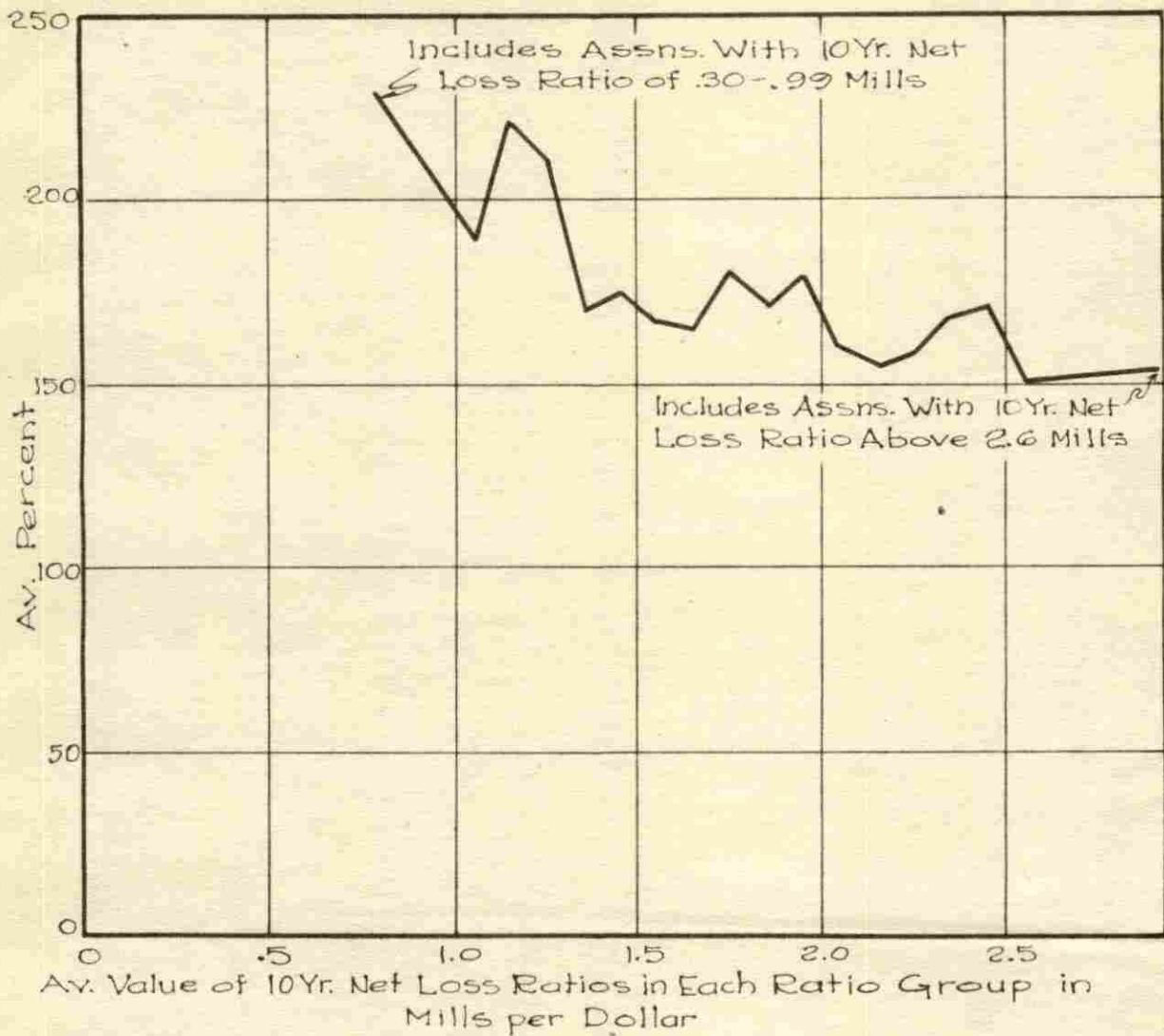


Fig. 8 AVERAGE OF ANNUAL NET LOSS RATIOS EXCEEDING 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY RATIO GROUP, (ONLY ASSNS. OF 2.-4.999 MILLION DOLLARS IN SIZE)

## RESULTS

## Size of Association

Both of the studies in which the size of the county mutuals was considered as a factor influencing the loss expectancies of those mutuals indicate that the smaller mutuals have exceeded 125% of their loss budgets more often than the larger mutuals have and, also, that when 125% of the loss budget was exceeded the smaller mutuals exceeded that figure by a greater amount. Equations were found for curves to fit each of the charts showing frequency of occurrence (Figs. 1 and 3) and amount (Figs. 2 and 4) of annual net losses that exceeded 125% of the loss budgets of the various county mutuals.

All associations

When all associations were considered the equation found for the curve to fit the frequency chart (Fig. 1) was  $Y = -15.7 + 2357/(X + 50.5)$ , where "Y" is the percent of years that 125% of the loss budget was exceeded and "X" is the size of the association in millions of dollars. Table XXV contains the values of "X" and "Y" which were used in superimposing the curve of the above equation on Figure 1; Figure 9 contains the resulting chart.

Likewise the equation  $Y=134-250/(X-1.5)$  was found to fit the chart showing the average amount of annual net losses exceeding 125% of the loss budget (Fig.2). "Y" represents the average value of such losses and "X", the size of the association, as in the preceding equation. Values of "X" and "Y" in this equation, used for plotting the superimposed curve shown in Figure 10, appear in Table XXVI.

Associations with ten year net loss ratios of 1.20-1.69 mills

The equation found for the curve to fit the frequency chart (Fig.3) for associations having the year net loss ratios of 1.20-1.69 mills was  $Y=12.5-139/(X-3.48)$  and the equation found to fit the amount chart (Fig. 4) was  $Y=134-211/(X-1.05)$ . In both equations "X" is the size of the mutual in millions of dollars. "Y", in the former, is the percent of years that the annual net losses exceeded 125% of the loss budget, and, in the latter, "Y" is the average amount of such losses. Tables XXVII and XXVIII, respectively, contain the values for "X" and "Y", in the above equations, that were used to plot the curves shown in Figures 11 and 12 on what were originally the frequency and amount charts shown in Figures 3 and 4.

General

The four foregoing equations seem to indicate that both the amount and the frequency of occurrence of annual net

losses in excess of 125% of the loss budget vary inversely as the size of the associations. Some constants "temper" this variation to some extent so that it is not entirely inversely proportional to the size.

In the separate studies where size was considered as the factor influencing loss expectancy the amounts of the annual net losses exceeding 125% of the loss budget were negligibly different for a specific size group; however, the two studies showed an appreciable difference in the frequency of occurrence of such losses, especially for the size groups containing the smaller mutuals, those less than one million and up to seven million dollars. The difference in the values of frequency of occurrence seems to indicate that the variable (value of ten year net loss ratio) reduced in effectiveness in the second study was influencing the frequency of occurrence of excess losses in the first study; therefore, the equation obtained in the second study for the frequency curve is more reliable if the effect of size alone is desired.

TABLE XXV

Values of "X" and "Y"  
for the Equation  
 $Y=15.7+2357/(X+50.5)$

-15.7

X	Y
1	30.1
2	29.2
3	28.4
4	27.5
5	26.8
6	26.0
7	25.3
8	24.6
9	23.9
10	23.3
11	22.6
12	22.0
13	21.4
14	20.8
15	20.3
16	19.7
17	19.2
18	18.7
19	18.2
20	17.7
25	15.5
30	14.3

TABLE XXVI

Values of "X" and "Y"  
for the Equation  
 $Y=134+250/(X+1.5)$

X	Y
.5	259
1.	234
2.	205
3.	190
4.	179
5.	172
6.	167
7.	163
8.	160
9.	158
10.	156
11.	154
12.	152.5
13.	151.2
14.	150.1
15.	149.1
16.	148.3
17.	147.5
18.	146.8
19.	146.2
20.	145.6
25.	143.4
30.	141.9



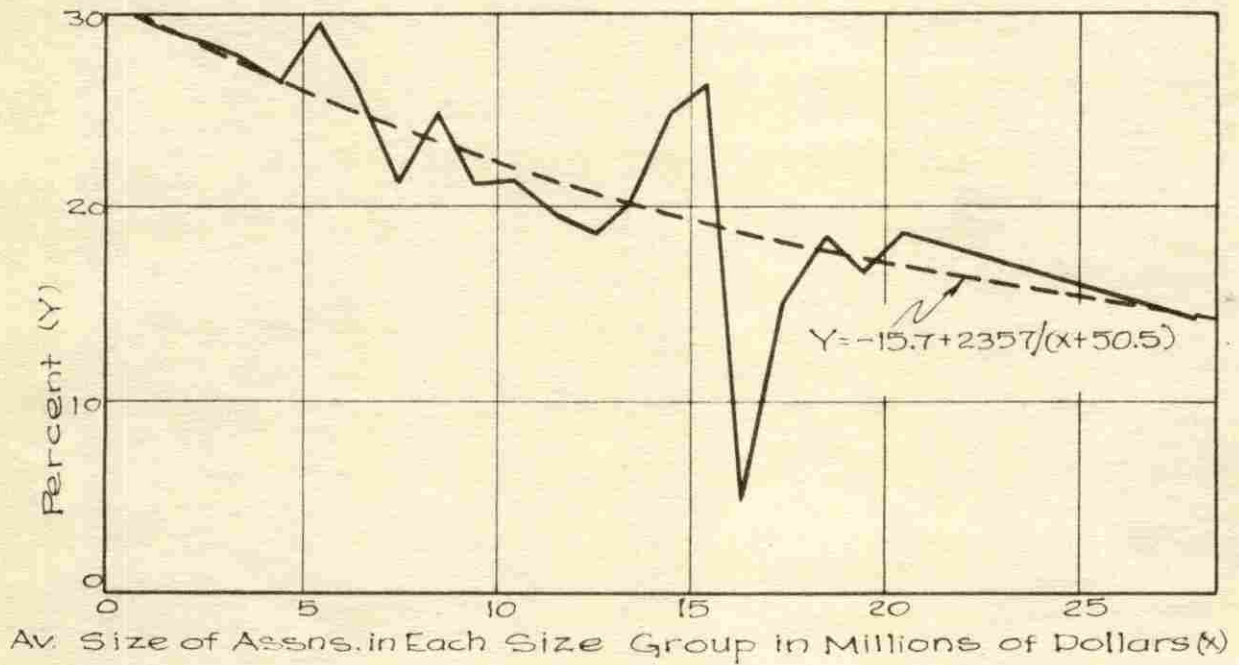


Fig. 9 PERCENT OF SIZE YEARS THAT THE ANNUAL NET LOSS RATIOS EXCEEDED 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY SIZE GROUP, & THE CURVE  $Y = -15.7 + 2357/(x + 50.5)$

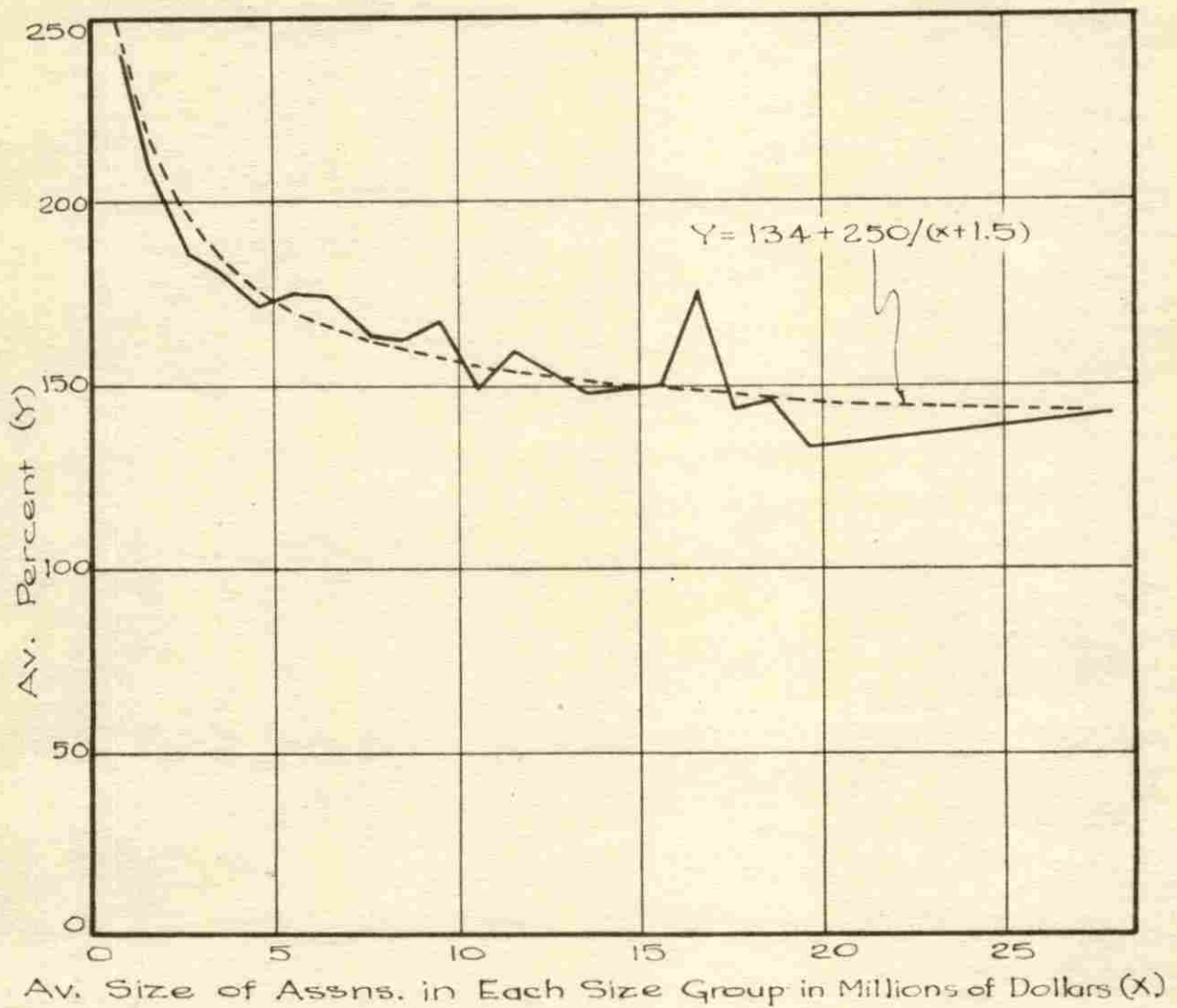


Fig.10 AVERAGE OF ANNUAL NET LOSS RATIOS EXCEEDING 125 % OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY SIZE GROUP, & THE CURVE  $Y = 134 + \frac{250}{(X + 1.5)}$

TABLE XXVII

Values of "X" and "Y"  
for the Equation  
 $Y=12.5+139/(X+3.48)$

X	Y
.8	45.0
1	43.5
2	37.9
3	33.9
4	31.1
5	28.9
6	27.2
7	25.8
8	24.6
9	23.6
10	22.8
11	22.1
12	21.5
13	20.9
14	20.5
15	20.0
16	19.6
17	19.3
18	19.0
19	18.7
20	18.4
25	17.4
30	16.6

TABLE XXVIII

Values of "X" and "Y"  
for the Equation  
 $Y=134+211/(X+1.05)$

X	Y
.8	248
1	237
2	203
3	186
4	176
5	169
6	164
7	160
8	157
9	155
10	153
11	151.5
12	150.2
13	149
14	148
15	147.2
16	146.4
17	145.7
18	145.1
19	144.5
20	144
25	143.6
30	143.2

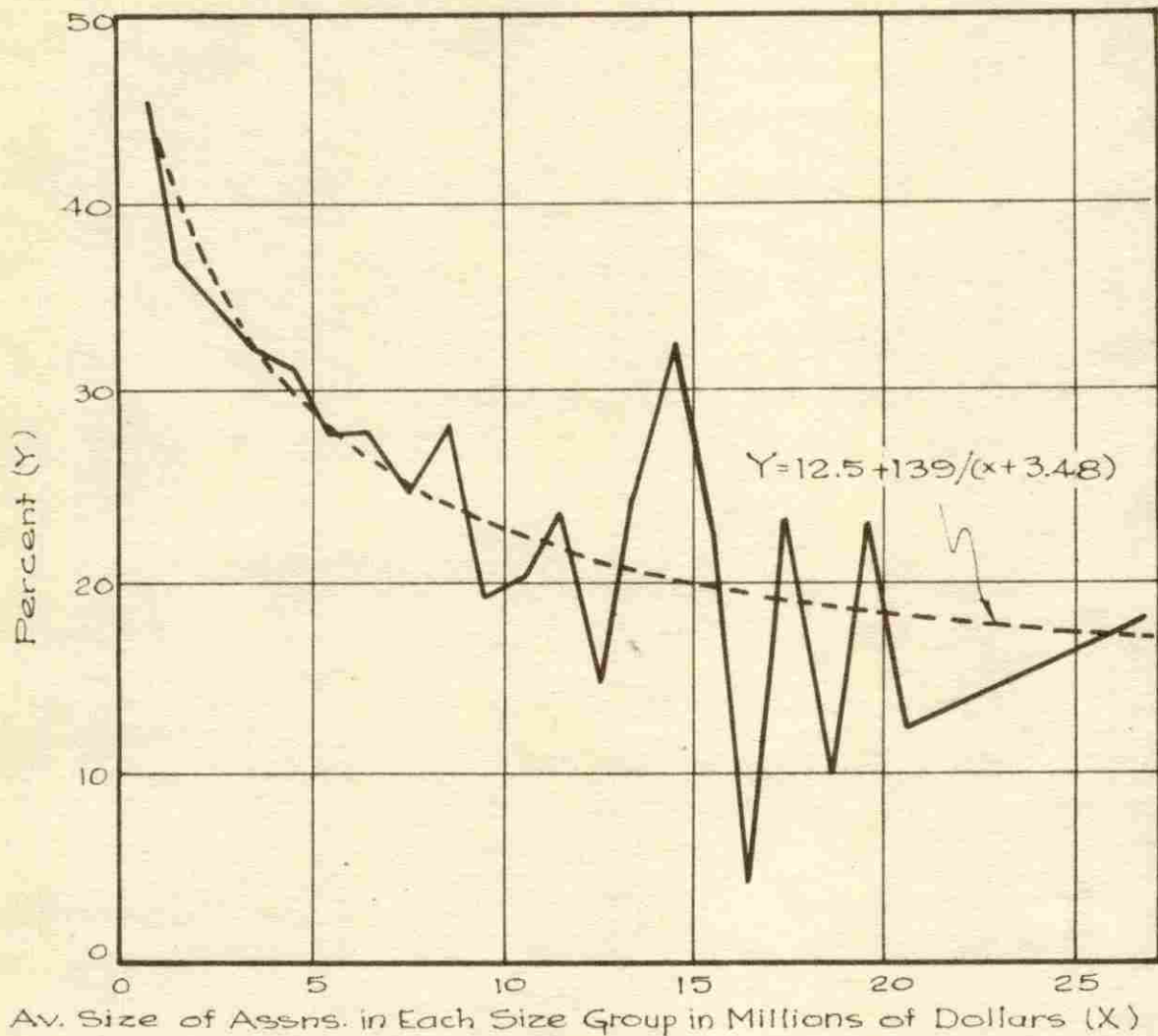


Fig. 11 PERCENT OF SIZE YEARS THAT THE ANNUAL NET LOSS RATIOS EXCEEDED 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY SIZE GROUP, (ONLY ASSNS. WITH 10YR. NET LOSS RATIOS OF 1.20-1.69) & THE CURVE  $Y = 12.5 + 139/(x + 3.48)$

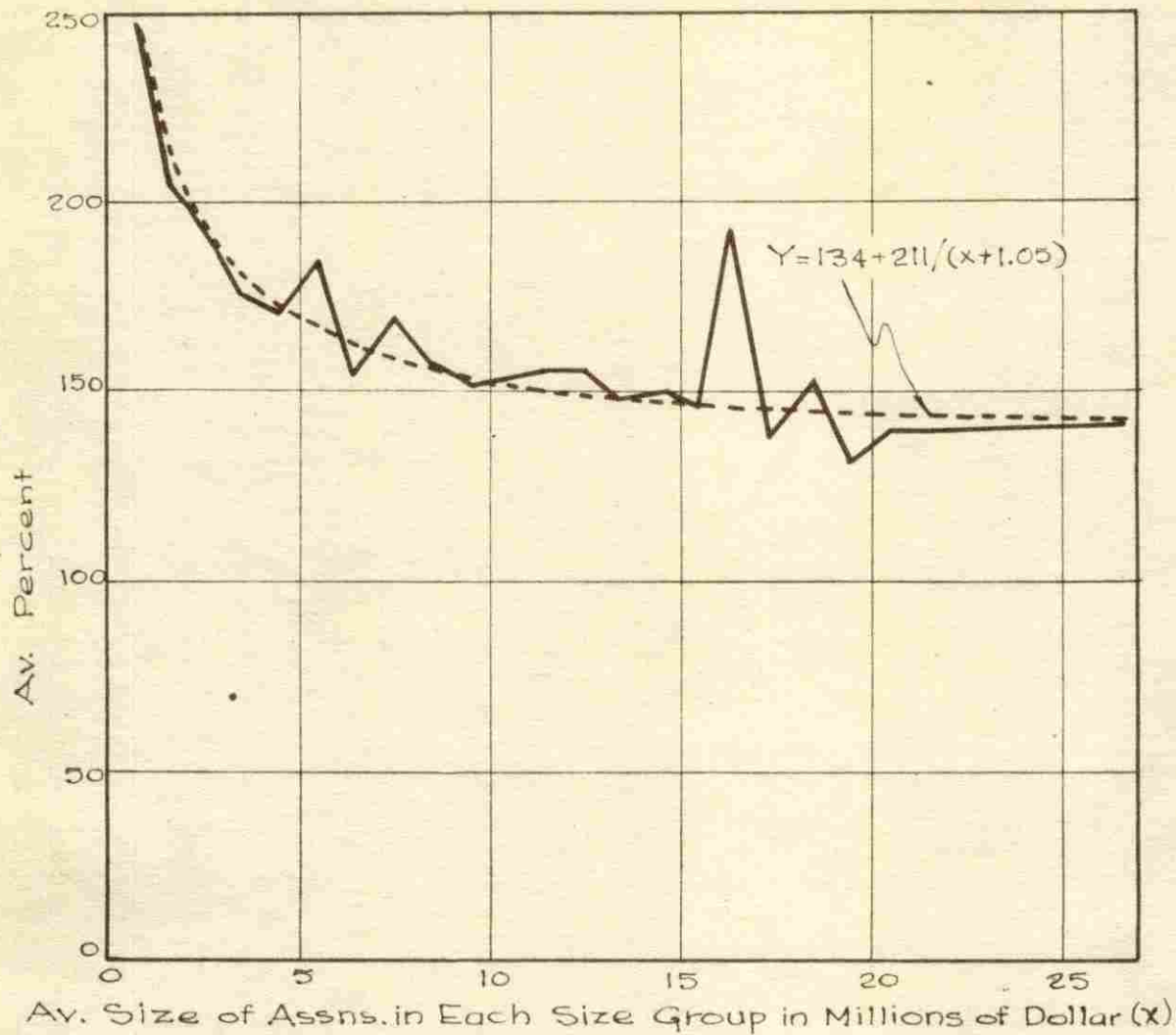


Fig. 12 AVERAGE OF ANNUAL NET LOSS RATIOS EXCEEDING 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY SIZE GROUP, (ONLY ASSNS. WITH 10YR. NET LOSS RATIOS OF 1.20-1.69 MILLS) & THE CURVE  $Y = 134 + 211/(x + 1.05)$



### Value of Ten Year Net Loss Ratio

Both studies involving the value of the ten year net loss ratio of a county mutual as a factor influencing the loss expectancy of that county mutual indicate that the mutuals with relatively large ten year net loss ratios exceeded 125% of their loss budgets less often and to a lesser extent than did the mutuals with small ten year net loss ratios. Equations were found for the curves to fit the two frequency charts (Figs. 5 and 7) and the amount charts (Figs. 6 and 8) for the losses of associations with different ten year net loss ratios.

#### All associations

When all associations were considered the equation  $Y = 2.59 + 41.2 / (X + 302)$  was found for the curve which fits the chart showing the frequency of occurrence of annual net losses that exceeded 125% of the loss budget. "Y" is the percent of years that 125% of the loss budget was exceeded and "X" is the value of the ten year net loss ratio in mills per dollar. The values for "X" and "Y" appearing in Table XXIX were used for plotting the curve shown in Figure 13, superimposed on the frequency chart that originally appeared as Figure 5.

The curve  $Y = 146.8 + 35.5 / (X - .283)$  was found to fit

the chart showing the average of the annual net losses that exceeded 125% of the loss budget. "X" in this equation is the same as in the preceding equation and "Y" is the average of the losses exceeding 125% of the loss budget. To Figure 6 this new curve was added; the resulting chart appears in Figure 14, and the values of "X" and "Y" used for plotting the curve are shown in Table XXX.

Associations 2.000-4.999 million dollars in size

The equation  $Y = 6+30.8/(X-.1)$  and  $Y = 137+48.8/(X-.256)$ , respectively, were found to fit the curves for frequency of occurrence and average amount of annual net losses in excess of 125% of the loss budget of associations 2 to 4.999 million dollars in size. "X" and "Y", in these equations, represent the same units as in the two preceding equations, respectively. Of these newest equations, the former was plotted as a superimposition on Figure 7; the resulting chart is shown in Figure 15; the values of "X" and "Y", used for plotting the curve of the equation, appear in Table XXXI.

The latter of the equations was used to determine the values of "Y" for chosen "X's" (Table XXXII) used to plot the curve shown in Figure 16, which is the same as Figure 8 but for the aforementioned curve, which is superimposed.

General

The two separate studies involving the value of the ten year net loss ratio as a factor influencing the loss expectancy of a county mutual gave values with appreciable difference for frequency of occurrence and average amount of annual net losses in excess of 125% of the loss budget. The curvature of the corresponding equations in each study is very near the same but the relative positions with respect to the coordinate axes are different. This fact would indicate that the variable (size of association) reduced in effectiveness in the second study was an influencing factor in the first study and that equations for the curves in the second study more nearly indicate the loss expectancy as influenced by the value of the ten year net loss ratio. In both studies, however, the indication is that both the frequency of occurrence and the average amount of the losses in excess of 125% of the loss budget vary inversely as the value of the ten year net loss ratio.

It is interesting to note that the mutuals with ten year net loss ratios of less than one-half mill per dollar exceeded 125% of the loss budget more than fifty percent of the time. This apparent oddity may be a result of the fact that only very few such cases occurred and are, therefore, not representative of what would be found if sufficient cases were available. Too, the explanation for this may be that when a

mutual has a ten year net loss ratio of less than one-half mill it seldom keeps that average more than one year because it would not take an annual net loss very much in excess of the ten year average net loss, in actual dollars, to put the ten year net loss ratio back to a higher value.

TABLE XXIX

Values of "X" and "Y"  
for the Equation  
 $Y = 2.59 + 41.2 / (X + .302)$

X	Y
.5	54.0
.6	48.3
.7	43.7
.8	40.0
.9	36.8
1.0	34.3
1.1	32.0
1.2	30.0
1.3	28.3
1.4	26.8
1.5	25.5
1.6	24.3
1.7	23.2
1.8	22.2
1.9	21.3
2.0	20.5
2.5	17.3

TABLE XXX

Values of "X" and "Y"  
for the Equation  
 $Y = 146.8 + 35.5 / (X - .283)$

X	Y
.6	258.9
.7	232.0
.8	215.5
.9	204.4
1.0	196.4
1.1	190.3
1.2	185.5
1.3	181.7
1.4	178.6
1.5	176.0
1.6	173.8
1.7	171.9
1.8	170.2
1.9	168.8
2.0	167.5
2.5	162.8



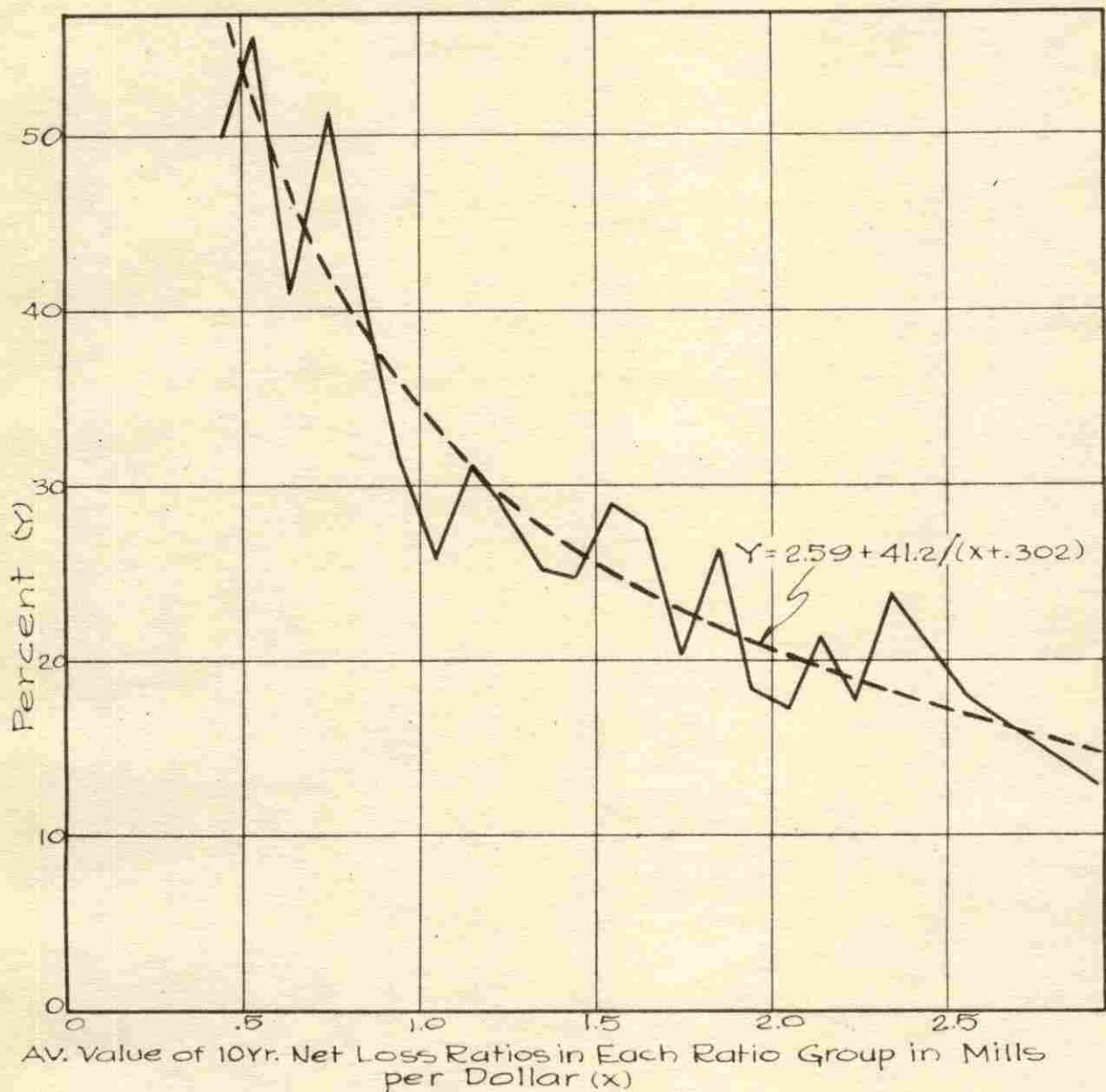


Fig. 13 PERCENT OF RATIO YEARS THAT THE ANNUAL NET LOSS RATIOS EXCEEDED 125% OF THE 10YR. NET RATIO FOR THE PREVIOUS YEAR, BY RATIO GROUP, & THE CURVE  $Y = 2.59 + 41.2 / (x + .302)$

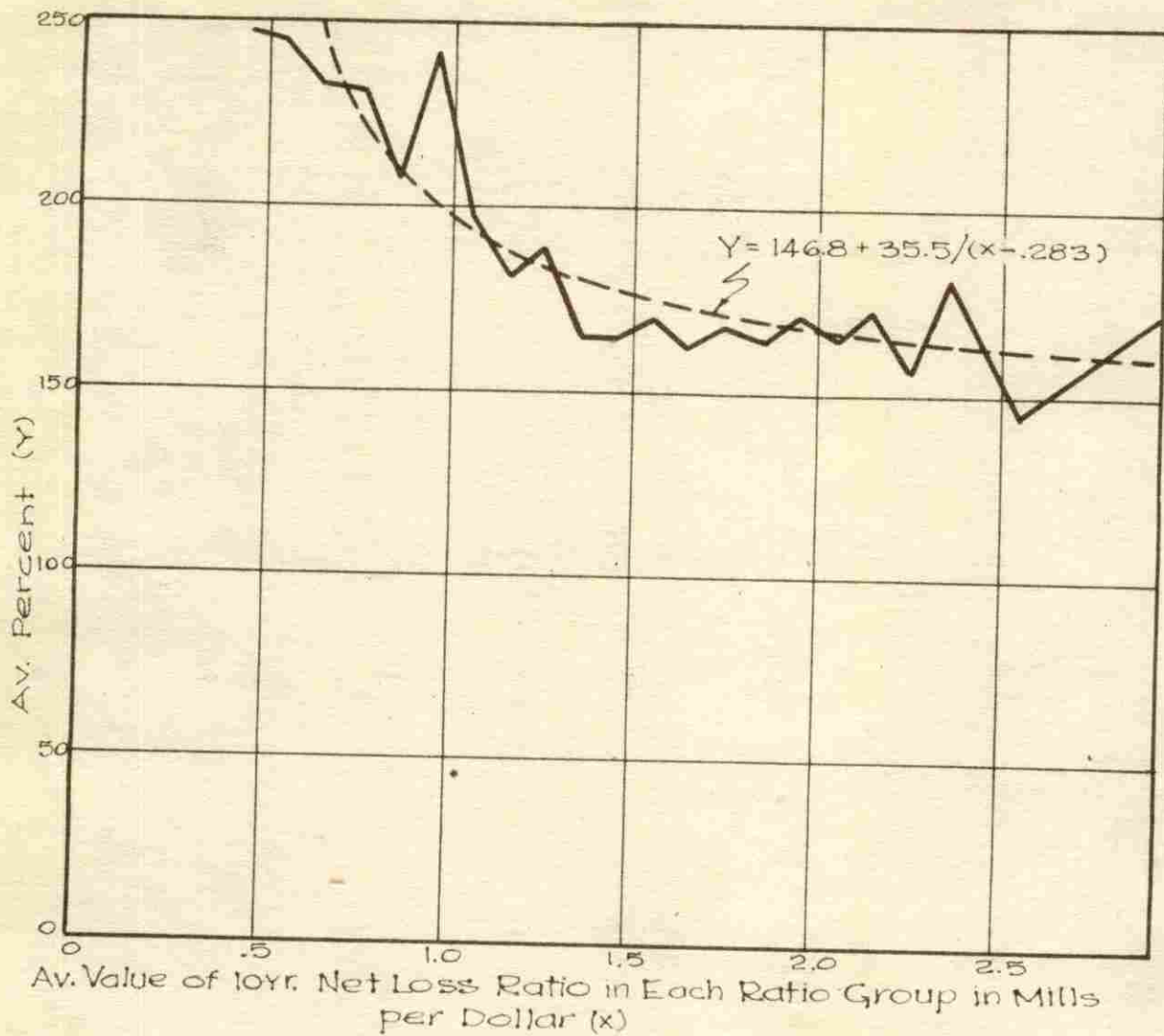


Fig. 14 AVERAGE OF ANNUAL NET LOSS RATIOS EXCEEDING 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY RATIO GROUP, & THE CURVE  $Y = 146.8 + 35.5/(x - .283)$

TABLE XXXI

Values of "X" and "Y"  
for the Equation  
 $Y=6+3.08/(X-.1)$

X	Y
.7	57.6
.8	50.0
.9	44.5
1.0	40.2
1.1	36.8
1.2	34.0
1.3	31.6
1.4	29.7
1.5	28.0
1.6	26.5
1.7	25.2
1.8	24.1
1.9	23.1
2.0	22.2
2.5	18.8
3.0	16.6

TABLE XXXII

Values of "X" and "Y"  
for the Equation  
 $Y=137+48.8/(X-.256)$

X	Y
.5	337
.77	232
1.0	203
1.1	196
1.2	189
1.3	183
1.4	179.5
1.5	176
1.6	173
1.7	171
1.8	168.5
1.9	166.5
2.0	165.0
2.5	158.0
3.0	154.8

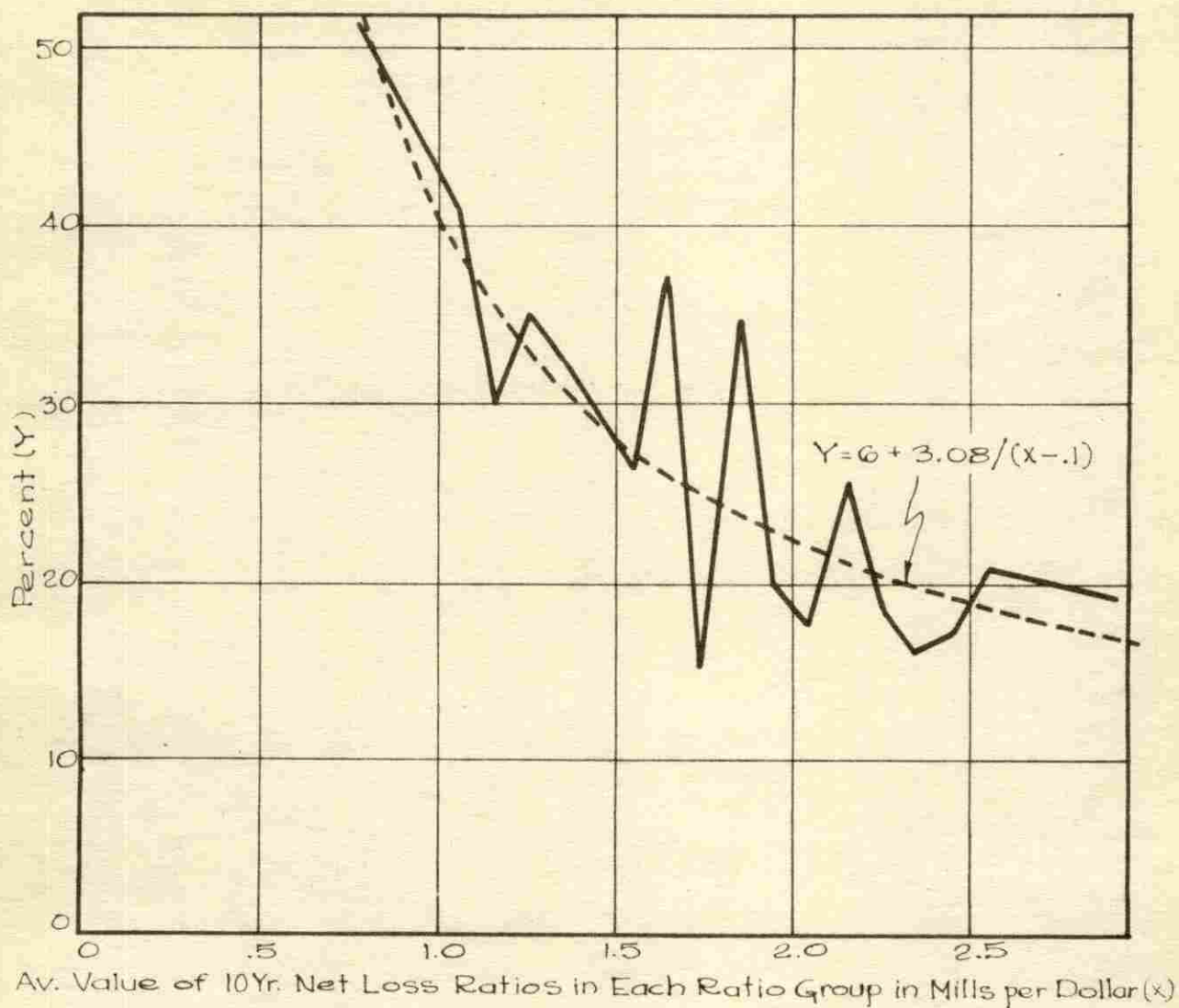


Fig. 15 PERCENT OF RATIO YEARS THAT THE ANNUAL NET LOSS RATIOS EXCEEDED 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY RATIO GROUP, (ONLY ASSNS. OF 2.-4.999 MILLION DOLLARS IN SIZE) & THE CURVE  $Y = 6 + 3.08/(x - .1)$

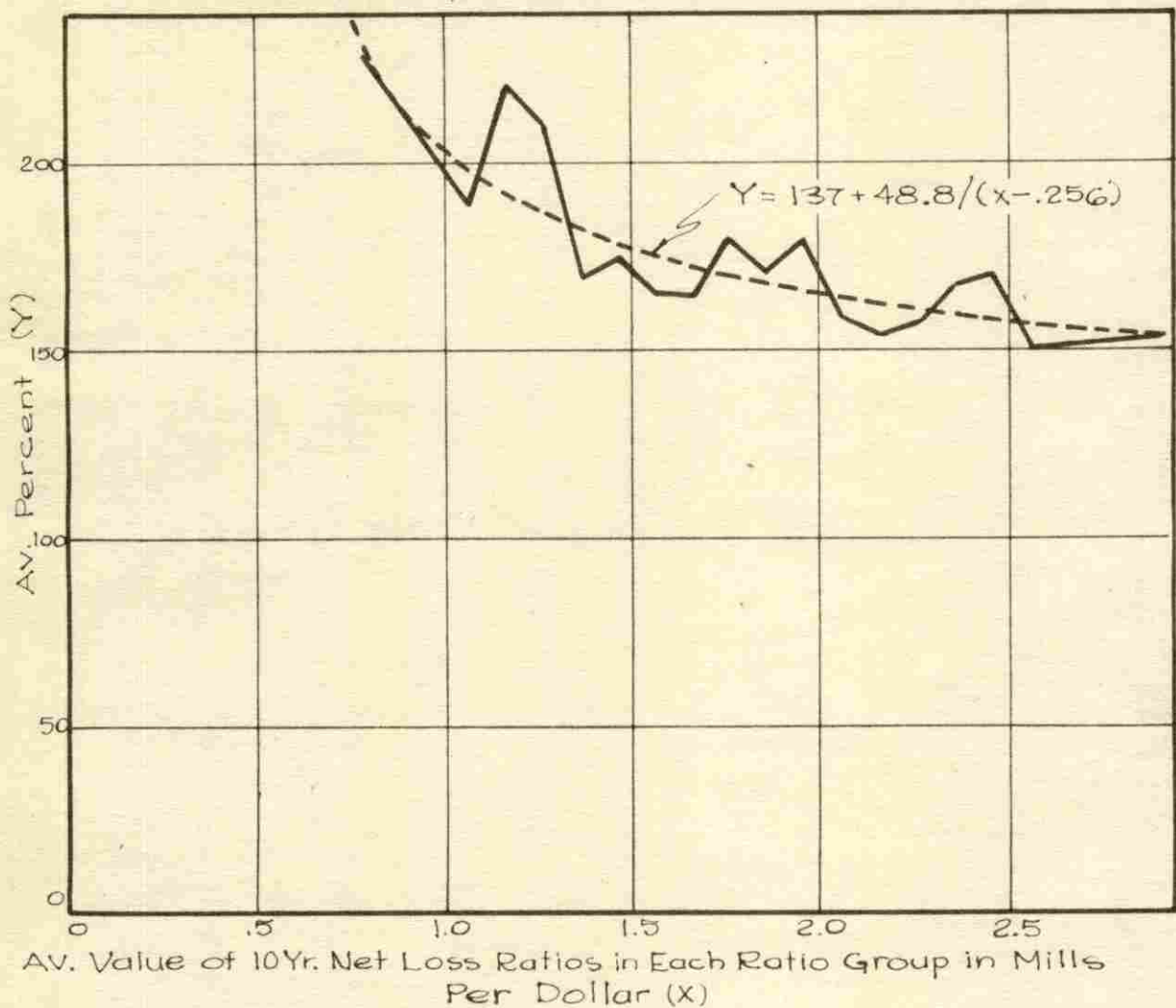


Fig. 16 AVERAGE OF ANNUAL NET LOSS RATIOS EXCEEDING 125% OF THE 10YR. NET LOSS RATIO FOR THE PREVIOUS YEAR, BY RATIO GROUP, (ONLY ASSNS. OF 2.-4.999 MILLION DOLLARS IN SIZE) AND THE CURVE  $Y = 137 + 48.8 / (x - .256)$



## DISCUSSION

It is felt that the problem herein investigated is one which could well receive further attention of one interested in this subject. The graphs shown in the "Investigation" section of this manuscript seem to indicate that if a greater number of years was considered smoother curves could be obtained. However, it is not thought that years prior to those considered in this study should be used, as the financial records of the county mutuals probably become less accurate as earlier years of operation are considered, due to the inexperience which most likely existed in the keeping of such records and the simplicity of the method which was used to prevent a high overhead cost of operation. In consideration of the above possibilities and the accuracy with which the financial records are now kept the further investigation becomes one for the consideration of an additional number of future records or the records of county mutuals (or equivalent) from states other than Iowa if such records are comparable to those of the Iowa county mutuals.

It is felt that definite conclusions can be drawn from the study of size of an association, as a factor influencing the loss expectancy of the association, The value of the ten year net loss ratio as an influencing factor, however,

is a more complex problem. The complexity of this problem is brought about by the fact that the annual net loss ratio affects the value of the ten year net loss ratio. Too, the complexity of this problem is increased by the need that will exist for the "weighting" of each of the two factors herein studied if both are used in combination to determine loss expectancy.

## SUMMARY AND CONCLUSIONS

1. The contention, based on the fundamental principles of averages, of the larger county mutuals that they would benefit less by the purchase of reinsurance than the small county mutuals would and that the smaller county mutuals would benefit at the expense of the larger mutuals is upheld by the findings of this investigation.

2. The 1947 method of calculating blanket reinsurance premiums is more equitable than previous methods used by the Farmers' Mutual Reinsurance Association.

3. Both the size of a county mutual and the value of its ten year net loss ratio affect the loss expectancy of that county mutual.

4. The amount of difference in the loss expectancy of the different sizes of county mutuals warrants consideration in the calculation of blanket reinsurance premium rates and should be considered if a still more equitable plan of distributing the costs of blanket reinsurance among the participating mutuals is to be effected. The results of this investigation make possible such an equitable distribution of the cost of blanket reinsurance.

5. The amount of difference in the loss expectancy of county mutuals with different ten year net loss ratios is

appreciable, but until a further study of this factor can be made the specific consideration of it should not be given when blanket reinsurance premium rates are calculated.

6. Inasmuch as the exact effect on loss expectancy was not determined or completely isolated for the value of the ten year net loss ratio the "Results" of the study involving the "Size of Association, All associations" should be used to determine the loss expectancy of the different sizes of county mutuals. Those results will allow the effect of the value of the ten year net loss ratio to remain until the exact effect of it can be combined with the effect of size alone as determined by the study involving only the mutuals with ten year net loss ratios of 1.20-1.69 mills.

7. The loss expectancy of a specific size county mutual, as affected by its size, may be determined by substituting the size of the mutual, in millions of dollars, for "X" in the equations  $Y = -15.7 + 2357/(X + 50.5)$  and  $Y = 134 + 250/(X + 1.5)$ , the former giving the percent of years that the annual net losses can be expected to exceed 125% of the loss budget and the latter giving the average value, in percent of the loss budget, of the annual net losses which can be expected to exceed 125% of the loss budget. A comparison of these figures obtained for county mutuals of different sizes will indicate a simple calculation for determining the relative amounts that each size county mutual should be

required to pay for blanket reinsurance coverage. A relatively small mutual would be required to pay more as a result of the more frequent occurrence of losses exceeding 125% of the loss budget and also more because of the greater amount of the average excess, the additional amounts to be added in order to determine the total difference in premium. (see Appendix D)

8. Participation by all mutuals in the reinsurance program would make simple the determination of the amount of reserve that a county mutual should have. Specific reinsurance of all risks in excess of the limiting single risk size that applies to blanket reinsurance would make necessary a reserve of not more than 125% of the loss budget plus the expected coming year overhead costs of the mutual concerned if blanket reinsurance is also carried. A reserve of that amount would cover all expenses which the mutual would have to pay from its funds as the reinsurance would cover all losses in excess of that amount.



## GLOSSARY

Annual Net Loss Ratio - The net losses suffered during a year by a county mutual divided by the net risks in force December 31 of that year.

Gross Losses - The total amount of losses suffered less the salvage value of the undestroyed property.

Gross Risks - The total amount of insurance in force.

Loss Budget - The net risks in force January 1 times the ten year net loss ratio for the previous year.

Loss Ratio - The losses suffered during a year divided by the risks in force December 31 of that year. (A general term which is made specific by the addition of "net" or "gross")

Net Losses - The gross losses suffered less the losses that were specifically reinsured.

Net Risks - The gross risks in force less the risks that are specifically reinsured.

Ratio Group - The group into which a county mutual falls as a result of the value of its ten year net loss ratio. Each Ratio Group covers a range of one-tenth mill.

Ratio Year - The occurrence of a specific size ten year net loss ratio for one year.

Reserve - The difference between the assets and the liabilities which a county mutual has at the end of a year.

Size Group - The group into which a county mutual falls as a result of the amount of net risks it has in force December 31. Each Size Group covers a range of one million dollars in net risks.

Size Year - The occurrence of a specific amount of net risks in force December 31 for one year.

Ten Year Net Loss Ratio - For a specific year it is the average of the annual net loss ratio for that year plus the sum of the annual net loss ratios for the preceding nine years.

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The suggestions and advice of Prof. Henry Giese have proven invaluable in the progress of this study.

Paul C. Homeyer gave great help in the statistical considerations which this problem involved.





## APPENDIX B

ASSOCIATION Farmers Mutual Ins. Ass'n. of  
Boone County, Iowa  
COUNTY Boone TOWN Boone

No. 13

DATE ORG. 1877

YEAR	RISKS IN FORCE DECEMBER 31	TOTAL YEAR	LOSSES PAID			TOTAL RECEIPTS	COST PER THOUSAND	RESERVE
			DOLLARS PER YEAR	10YR. AV.	20YR. AV.			
1901	2,663,989	2,144	0.80	1.33	60.6	3,416	1.00	4,096
1902	2,838,063	2,872	1.01	1.33	131.8	2,361	2.06	2
1903	2,995,880	3,570	1.19	1.26	111.9	2,544	2.08	44
1904	3,067,389	4,737	1.54	1.33	122.1	4,265	2.91	138
1905	3,118,512	4,345	1.39	1.20	104.5	5,362	1.58	287
1906	3,252,131	5,684	1.75	1.20	146.0	3,725	2.97	218
1907	3,368,603	5,731	1.70	1.34	141.6	5,691	1.90	486
1908	3,481,418	6,342	1.82	1.35	135.9	5,285	3.55	259
1909	3,484,783	3,667	1.05	1.37	77.8	6,393	2.97	255
1910	3,584,843	4,295	1.19	1.34	86.9	8,860	1.48	1,556
1911	3,662,711	5,685	1.55	1.42	115.9	6,113	1.76	2,147
1912	3,762,380	10,202	2.71	1.59	190.9	8,734	2.98	745
1913	3,812,962	6,522	1.71	1.64	107.5	6,215	1.91	590
1914	3,913,839	9,437	2.41	1.73	147.0	8,210	2.66	831
1915	3,931,885	3,630	0.92	1.68	53.1	7,636	1.26	1,993
1916	3,994,817	5,887	1.47	1.65	87.5	7,008	1.82	1,761
1917	4,211,013	6,678	1.58	1.64	95.9	9,064	1.95	428
1918	4,451,376	12,742	2.86	1.95	174.2	13,500	3.27	147
1919	4,617,531	4,861	1.08	1.75	61.7	10,040	1.37	3,762
1920	5,166,643	9,023	1.75	1.80	100.0	11,198	2.11	4,736
1921	5,338,778	12,510	2.35	1.88	130.5	10,800	2.65	1,955
1922	5,510,240	15,033	2.73	1.89	145.1	14,106	3.08	-534
1923	5,752,235	8,697	1.51	1.87	79.9	14,625	1.90	3,390
1924	6,021,815	12,836	2.13	1.84	114.0	12,352	2.43	1,578
1925	6,401,738	8,340	1.30	1.88	70.7	13,561	1.64	5,035
1926	6,425,460	20,793	3.23	2.05	171.9	19,118	3.54	-30
1927	6,494,996	10,853	1.67	2.06	81.1	13,738	1.94	729
1928	6,664,532	7,718	1.16	1.89	56.4	14,274	1.42	5,574
1929	6,712,665	14,233	2.12	2.00	112.1	14,320	2.39	5,860
1930	6,789,684	9,209	1.36	1.96	68.0	14,930	1.66	9,819
1931	6,871,754	7,289	1.06	1.83	54.1	11,138	1.32	11,627
1932	6,667,965	17,081	2.56	1.81	141.2	13,317	2.82	7,567
1933	6,532,822	5,059	0.78	1.74	43.0	14,723	1.06	14,916
1934	6,573,793	10,151	1.55	1.68	89.1	14,724	1.84	17,113
1935	6,441,597	9,584	1.48	1.70	88.1	13,562	1.76	18,366
1936	6,502,072	9,572	1.47	1.52	66.5	13,767	1.77	20,554
1937	6,626,025	13,446	2.15	1.57	141.4	14,156	2.34	19,074
1938	6,664,608	7,824	1.14	1.57	72.4	14,087	1.45	23,825
1939	7,155,853	17,230	2.41	1.60	140.9	14,795	2.79	19,043
1940	7,229,640	8,233	1.14	1.57	71.3	14,784	1.43	23,319
1941	7,407,195	6,165	0.83	1.55	52.9	12,409	1.12	26,574
1942	7,607,340	5,568	0.73	1.37	47.1	15,544	1.03	35,180
1943	7,829,490	7,020	0.90	1.38	65.7	15,409	1.23	40,135
1944	8,028,415	10,296	1.28	1.25	92.8	16,053	1.73	43,786

## APPENDIX C

From the Loss Records of the Farmers' Mutual Reinsurance Association and "Statistical Tables Iowa County Mutuals" the following information was recorded for each county mutual for each year that was considered in this investigation:

1. The number of the association.
2. The year considered less the "19"; thus 1921 became simply "21".
3. The size of the association in thousands of dollars.
4. The annual net loss ratio in mills per dollar.
5. The ten year net loss ratio for the previous year in mills per dollar.
6. The annual net loss ratio expressed as a percentage of the ten year net loss ratio for the previous year.

These data were recorded for the purpose of punching Hollerith cards to be used in International Business Machines for simplifying the necessary tabulations for this study.

The above information was punched on the Hollerith cards in the following columns:

1, 2, & 3-----Number of association

- 4 & 5 ----- The year considered
- 6, 7, 8, 9, & 10 ----- Size of the association in  
thousands of dollars December 31  
of the year considered
- 11, 12, & 13 ----- The annual net loss ratio for the  
year considered, in mills per  
dollar when a decimal point is  
placed between columns 11 and 12.
- 14, 15, & 16 ----- The ten year net loss ratio for  
the previous year, in mills per  
dollar when a decimal point is  
placed between columns 14 and 15.
- 17, 18, & 19 ----- The annual net loss ratio ex-  
pressed as a percentage of the  
ten year net loss ratio for the  
previous year.

## APPENDIX D

Calculation of Relative Reinsurance Premium Rates for  
Mutuals of Different Size

Referring to Table XXV it will be noted that a two million dollar county mutual can be expected to exceed 125% of its loss budget 29.2% of the time and a six million dollar mutual can be expected to exceed 125% of its loss budget 26% of the time. Thus the smaller mutual of these two examples can be expected to exceed 125% of its loss budget 1.12 times as often or 12% more than the larger of the two. This indicates that the smaller mutual should pay 12% more than the larger mutual for the same amount of loss budget protection.

Referring to Table XXVI it can be seen that the average of the annual net losses that exceed 125% of the loss budget of the two million dollar mutual is 205% of the loss budget and the same average for the larger mutual is 167% of its loss budget. The two million dollar mutual would thus receive from the reinsurance association 80% of its loss budget and the six million dollar mutual 42% of its loss budget. The smaller of these two mutuals would be receiving 1.91 times as much or 91% more than the larger mutual and should be required to pay 91% more for the same amount of loss budget protection.



By adding the percentages obtained in the two foregoing calculations it will be seen that the smaller of the two mutuals should be required to pay 103% more than the larger mutual for the same amount of loss budget protection. Thus if the premium rate for the larger of these two mutuals is considered to be unity (1) the premium rate for the smaller mutual would be 2.03.

The reinsurance association can, by this method, calculate the premium rate for any size mutual once the rate is established for a specific size mutual.