solid state they will mostly be rejected from the dry surface of the hailstone. However, in order to reduce the growth rate noticeably, calculations show that a high ratio of cloud droplets must be frozen.

Die Schadenstruktur in der Kraftfahr-Haftpflichtversicherung von Personenwagen, by JOHANNES MEHRING, *Blätter der deutschen Gesellschaft für Versicherungsmathematik,* Wurzburg, October 1962.

In 1962 all price-fixing agreements for rating in motor insurance were cancelled in Germany. Insurance companies were compelled to develop their own statistics and to compile a record of their individual claim experience. The rate making procedure to be applied became of major importance. The notable German expert Dr. Johannes Mehring, has recently published another paper about the significance of the different risk elements in German motor insurance business and the conclusions to be drawn from such information. The main purpose of the paper was to acquaint all readers who are not mathematically trained with the problems involved in this branch. Mathematical formulae have therefore been replaced by graphs. The influence on the claim frequency of horsepower, territory, mileage, age of driver and experience of driver is shown in tables and graphs.

In another section the significance of finding homogeneous classes is outlined. It is shown that a bonus system gives far better results, especially for groups which have been accident-free for several years, than a breakdown by territories. The claim frequency substantially decreased with the growth of the accident-free period but this effect is weakened by the fact that claim costs for an accident increase concurrently.

As an optimum solution the author describes a form of classification rating that offers rate reduction for accident-free driving and penalizes the driver with repeated accidents. Actually a rate reduction of 50% for accident-free experience during a period of at least six years is granted by most insurers in Germany. On the other hand few insurance companies have a system of surcharged premiums applied in the form of penalties for an adverse experience record.

The analyses by Mehring do not provide new facts but the paper sets out a clear outline of all the important problems involved in this branch and shows how they can be tackled. The foreign reader will find an excellent survey of the standard private passenger classification rating systems applied in Germany and the novice can gain knowledge without being scared off by complicated mathematical formulae from the very beginning.

Der optimale Bonus, by MAX GÜRTLER, *Zeitschrift für die gesamte Versicherungswissenschaft,* Berlin 1962.

In Germany and Switzerland a very simple classification plan is in use as a standard rating procedure in automobile insurance. The characteristics of the plan are: kind of vehicle (private passenger cars, taxi cabs, trucks tractors) and horsepower. To provide for a rate differential between the careful and the accident-prone driver, a credit is granted on renewal if the insurance has not been guiltily involved in an accident during a certain period. This credit, called bonus, is determined according to a scale which

increases with the duration of the accident-free period. Today the maximum bonuses are 50% in Germany and 40% in Switzerland respectively.

The author, Professor at the University of Basle, has already questioned the fairness of such rating procedures in previous papers (see ASTIN Bulletin Vol. I, Part 5). In his latest paper he tries to show that only in a very restricted region does a premium discount equalize the hazards of claim experience and that the unfairness of initially collecting the same premium from each driver is not satisfactorily compensated by a bonus system, whatever this system may be. To prove his conclusions, the author defines a differential which he calls the premium error ratio.

If we have a portfolio with 9,000 careful drivers with a claim ratio of 0,1 and 1,000 accident-prone drivers with a ratio of 1,0 and the average cost of a claim is assumed to be 1,200, then the overall average premium for the portfolio, disregarding any loading, is 228. On the other hand the premium required for a careful driver is 120 and the premium for an accident-prone driver is 1,200. It is obvious that by charging average premiums a careful driver pays 108 too much and an accident-prone driver 972 too little. The premium error ratio is now defined as the proportion between the absolute amount of all premiums paid in excess or default of the required premium and the total amount of premium. If this differential is 0, then the rating procedure is ideal; if it is 1, then all premiums are collected in a way which completely disregards the underlying risk. For the model investigated, the premium error ratio is 0,853 if no bonus is granted.

Although the author has examined all sorts of possible bonus systems, the differential was always rather substantial and even for the optimum bonus system a premium error ratio of 0,545 remained. This means that whatever the system of premium discounts for accident-free driving may be, more than half of the premiums are not levied according to the underlying risk. Fairness can certainly not be claimed for such a tariff. The author has not only examined this model, but a great many others; the claim ratio and the proportion between careful and accident-prone drivers were varied in every possible way, but in each case the author came to the conclusion that the introduction of a bonus system did not lead to a sufficient improvement in the rating procedure.

Thus the purpose of the paper might be considered as achieved. However it must be borne in mind that the conclusions reached by the author are based on certain theoretical assumptions and it is possible that a change of assumptions would lead to results which are not in line with those found by Gürtler.

Nevertheless many will agree with the author that standard rating procedure in Germany and Switzerland might certainly be improved. At present rate revisions are under way in both countries. In Germany the year has been marked by the end of price fixing agreements; every company has to compile its own statistical records for making automobile rates. In Switzerland rates for trucks and taxi cabs have been largely increased this year; for private passenger cars a revision of the standard rating procedures is at present under discussion.

<div align="right">M.D.</div>