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THE NUMBER OF CLAIMS AND THE CLAIM SIZE OF PASSENGER CAR TRAFFIC ACCIDENTS IN THE NETHERLANDS

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THE NUMBER OF CLAIMS AND THE CLAIM SIZE OF PASSENGER CAR TRAFFIC ACCIDENTS IN THE NETHERLANDS

by

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Abstract

In this paper we analyze which characteristics of an insurant, his car and the insurance conditions, are associated with the number of claims and the claim size of passenger car traffic accidents, in which he is involved. A univariate as well as a multivariate analysis will be performed.

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Contents

1. Introduction[1)]

Two different types of research can be distinguished, that deal with the field of traffic accidents. Firstly, one can investigate the causes of accidents that have occurred at certain places under different circumstances, with the aim of making proposals for the improvement of traffic circumstances, in the hope that thereby road safety will be improved, or with the aim of evaluating measures for improving road safety. Secondly, one can investigate the possibilities of formulating a mathematical model which describes the behaviour of motorists with respect to the costs of damage of accidents. The aim of this is to make predictions about costs of damage of accidents of individual motorists, in the hope that thereby a premium rating system of vehicle accident insurances can be devised, and a well-founded accumulation of the premium reserve can be obtained.

Research of the first type has been carried out in the Netherlands for many years by the "Stichting Wetenschappelijk Onderzoek Verkeersveiligheid" (Institute for Road Safety Research (SWOV)), which has published many studies in this field. In the United Kingdom, for example, studies in this field are published by the Road Research and Traffic Laboratory (RRTL). A leading journal in this field is Accident Analysis and Prevention.

Publications concerning the second type of research, insofar as they are based on Dutch data, are scarce. Research of this type is mainly done by car insurance companies, which do not, in general, publish their results. With respect to extented studies of this type we refer to the relevant articles in Accident Analysis and Prevention (e.g. Foldvary (1975-1979)) and to e.g., the California Driver Record Study (California Department of Motor Vehicles, state of, 1964-1967).

A Dutch insurance company enabled us to collect data about passenger car insurances, for the years 1971 and 1972, in order to do (empirical) research of the second type.

The purpose of this study is to find out which factors (statistically) influence the number of claims and the amount of passenger car traffic

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1. The authors thank AGO verzekeringen (now called AEGON Verzekeringen following a merger) in Groningen, a national Dutch insurance company, which provided us with the policy and claim data, and the Netherlands Central Bureau of Statistics at the Hague, which provided us with data concerning number of miles driven per year by Dutch motorists.

accidents of individual motorists in the Netherlands. The study is based on the insurance and claim data mentioned above, supplemented with data on the ownership and use of passenger cars in the Netherlands, provided by the Netherlands' Central Bureau of Statistics. This supplementary data is necessary, because the insurance company could not give us data on the number of miles driven per year by its insurants[2].

We discuss the points as follows. Section 2 gives a short description of the data, and the procedure used to connect them. In Section 3 we give some definitions and assumptions. In Sections 4 and 5 we consider the possible relationships between the number of claims and the claim size on the one hand, and several other variables on the other hand. We look at possible interrelationships between these other variables. An extensive description of the insurance and claim data is given in Appendix A. In Appendix B. we describe the way in which we attach annual distance runs to individual insurants.

2. The data and the procedure to add annual mileage to the insurance data

2.1. The data

The insurance and claim data concerns data about vehicle traffic accident insurances currently running on 1 January 1972, as well as about vehicle traffic accident insurances currently running on 1 January 1973, which satisfied the following conditions:

- the insured car is a motor car or an estate car;
- the car is used for private and/or for business purposes, with or without limited use;
- the insurants do not have an additional excess imposed by the company, except the excess imposed on young drivers who cause an accident.

In addition to the last condition we mention that when the driver of the vehicle was 23 years old or younger at the time of the accident involvement, an additional excess of Hfl. 150.= was imposed for the claim of casco damage. We will call these drivers: youthful drivers.

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2. An insurant is the insured person, or insurance (policy) holder.

We gathered information about policy and claim data of policies, which satisfied these conditions, from a set of 3161 policy and claim documents as of 1 January 1972, and a set of 9472 policy and claim documents as of 1 January 1973. These two sets together will be called: sample of insurants. An element of this sample will be called: insurant. The size of this sample is 11,981. This is smaller than 12,633, the sum of the two sets, because for 612 policies we have information for both the year 1971 and the year 1972.

We obtained information about each insurant for a number of variables. We take into account in the next sections, information about the following variables. For an extensive description of the data we refer to Appendix A.

Headings concerning the insurant:

1. age,
2. place of residence (Dutch province)
3. degree of urbanization of his residence, where six degrees of urbanization are distinguished,
4. occupation, where six particular occupational categories are distinguished,
5. usage
6. annual mileage, estimated with the help of supplementary data.

Headings concerning the car:

7. list price, which is the list price of a new car, of the same make and type as the car to be insured, at the moment the policy is effected,
8. maximum speed,
9. weight,
10. age.

Headings concerning insurance conditions:

11. type of insurance; the types which occur frequently are:
    a) insurance against third-party risks, and
    b) comprehensive insurance, which covers risks of causing damage to other persons as well as damage to the insurant's car,
12. additional excess home casco,
13. area of coverage: home or home and abroad,
14. number of claim-free years (if an insurant does not claim during one or more subsequent insurance years, he gets a premium reduction, which increases with an increase of the number of claim-free years),

15. month and year of commencing date of the insurance,
16. month and year of the last change in insurance conditions,
17. month of the continuation date.

Headings concerning the accidents:

1. month in which the accident occurred,
2. amount of indemnity paid for third-party damage,
3. amount of indemnity paid for casco damage,
4. driver's year of birth,
5. type of damage (five particular types of accident are distinguished such as accidents resulting from collision with birds or animals, as well as accidents resulting from fire, theft, storm, pane cracks, etc.,

Concerning some insurants, changes occurred with respect to the variables given on pages 2 and 3, during the year under consideration. Concerning those policies, we also have information about the insurant on 1 January of the preceding year, as well as the date when the change took place. We assume that when more than one change has taken place, all changes took place on one date.

The data was checked and, if necessary, corrected. Nevertheless, it should be pointed out that that the data still contains some imperfections.

The data concerning the sample of insurants contains little information about the number of miles the insurant drives per year. It may be concluded from earlier investigations concerning Dutch claim data[3], that the number of miles driven per year has considerable influence on the number of claims per year. We compensated this lack of information with additional data from a study on the possession and the use of Dutch passenger cars.

2.2. The procedure to add annual mileage to the insurance data

The Netherlands Central Bureau of Statistics periodically carries out research on the annual mileage of Dutch motorists. The data they used for the investigations of the ownership and use of passenger cars in 1970[4] are used to make estimates of the annual mileage of the insurants in the sample of

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3. Cf. for example Van der Laan (1979).
4. Cf. Netherlands Central Bureau of Statistics (1973).

insurants. This data has been analysed by Van der Laan and Louter (1984), in order to study the annual distance driven by Dutch motorists. That paper gives an extensive description of the data, and of the checks and corrections of it. For more details we refer therefore to that paper. This collection of data, from now on called: sample of motorists, dealt with 8,495 Dutch motorists.

The set of characteristics concerning the sample of insurants partly coincides with the set of characteristics concerning the sample of motorists. Table 2.1 reviews the common characteristics. The information concerning these common characteristics is used to classify the sample of motorists in a number of more or less homogeneous groups. For each group we compute the average annual mileage. Next, we classify the sample of insurants in a similar way in an equal number of groups. Then we attach to each insurant from a group of insurants the annual mileage of the corresponding group of motorists. The procedure we applied for this "attachement" of estimated annual mileages is extensively described in Appendix B. We pay particular attention there to the problems which had to be solved first, before the procedure could be applied. The application of the procedure produced 326 different groups of motorists, and hence 326 different groups of insurants, implying that we obtained in principle, 326 different values of the annual mileage. These values vary from 5,435 to 34,702 miles per year. 90% of these values lies in the interval (6,484, 25,901). The average mileage per insurant is 10,457 and the standard deviation of the annual mileage is 4,493.

Concerning policies, where changes occur in the characteristics of the vehicle owner or his car during the period considered, a change may imply that the insurant shifts during the period from one group to another. We attach to such insurants two annual mileages, one for the period he belongs to the one group and one for the period he belongs to the other group.

Of course, we should realize that the sample of motorists has been drawn from a different population than has the sample of insurants. Moreover, the information about the characteristics we use is not exactly the same for both samples. This implies that only rough estimates can be made.

We should also realize that the data from the sample with respect to the miles driven by the motorists, are estimates supplied by the vehicle owners. White (1976) compares estimates of the annual mileage of 433 vehicle owners from North Carolina with the "actual" annual mileage as obtained from odometer readings recorded. He shows "that owners of low usage vehicles tend to overestimate annual VMT, whereas, owners of high used vehicles tend to underestimate annual VMT" (where VMT stands for vehicle miles of travel). He warns that "as a result, the use of owner estimates of annual VMT will

invalidate accident involvement rate comparisons among those vehicle groups which differ with regard to annual usage." If this result were extended to the Dutch situation, we would not be able to use the data with respect to the annual mileage from the sample of motorists. So far we have no studies concerning Dutch data, comparable with White's study. We do not know if his conclusion is valid for Dutch motorists. Moreover, it is the only data about annual mileage we have available: we shall have to make do with what we have.

Table 2.1 Overview of characteristics about which we have information both for the sample of insurants and for the sample of motorists

Characteristic	Sample of insurants	Sample of motorists
number of miles driven per year	only the statement: $\leq$ 20000 km/year $>$ 20000 km/year 20000 kilometres = 12427.5 miles)	known
region	residence	province and some large conurbations
driver's age	partly known, partly unknown	known for most motorists
occupation	some occupational categories, including agrarians	classified according to seven occupational categories, including agrarians
age of the car	known	known
list-price of the car	known, both for third-party, as for comprehensive insurances	only known concerning first-hand cars

3. Definitions and assumptions

Given the available data we have to restrict our study to the analysis of passenger car traffic accidents, hereunder called car accidents. We define, particularly for Dutch circumstances:

"A passenger car traffic accident (or car accident), which occurs to an individual motorist, is defined as the event which results in

a. property-damage to the individual's car, the so-called casco damage, and/or
b. personal injury and/or property damage to one or more third-parties, not being the driver or the passengers of the car, the so-called third-party damage, and/or
c. personal injury to the driver or the passengers of the car,

where the event has been caused by the driver or for which he can be held liable, where the originator of the event cannot be held liable, or when the cause of the event cannot be blamed to a natural person."

The type of damage under a. concerns in the Netherlands, for example, damage to one's car resulting from a collison with another object (or upset of the car), and parking damage to one's own car. There is also damage caused by particular types of accidents, as mentioned on page 4. The type of damage under b. concerns the total damage or personal injury to persons other than the driver and his passengers, damage to their properties, and damage to properties of corporate bodies. The definition given above implies that we regard the case of a collision between two or more vehicles as a single event.

In this study we analyze the following types of insurances and damages:

1. third-party insurance in connection with third-party damage;
2. all-risk insurance, which is a third-party plus a casco insurance, with amounts in excess of Hfl. 100.= or Hfl. 150.= in connection with all-risk damage, which is the sum of third-party and casco damage, excluding damage resulting from particular types of accidents;
3. all-risk insurance, with amounts of excess exceeding Hfl. 150.= in connection with all-risk damage, excluding damage resulting from particular types of accidents;
4. limited casco insurance (as an additional insurance above a third-party insurance, or as part of a casco insurance) in connection with particular types of accident.

We distinguish between the two types of all-risk insurance, because it can be expected that the amount of the excess strongly influences the number of claims. Table 3.1 presents the number of all-risk insurants according to the excess they chose. The minimum excess was Hfl. 100.= in 1971 and Hfl. 150.= in 1972. Only about 22% of the insurants chose an excess higher than the minimum amount, and only 2% percent higher than Hfl. 500.=.

We analyze the fourth type of insurance separately from the other types, because the amounts of damage of particular accidents are low in general, and the driver is in general not responsible for the damage. Moreover, a claim for damage of a particular type of accident does not influence the no-claim discount, nor in general is it subject to an excess. In other words, the premium remains unchanged, and the company pays the whole amount of the damage. We do not analyze the insurance for particular injury protection, since we do not have data about this insurance.

Table 3.2 shows the distribution of the insurants with respect to the type of insurance. From this table we see that the group of all-risk insurants with excess of Hfl. 150.= is relatively small. Division of this group into groups of about equal size of excess, produces subgroups which are too small for a reliable analysis.

The table also gives the values of the annual mileage. The number of miles driven per year by the group of third-party insurants is much lower than that of the other insurance groups. From Van der Laan and Louter (1984), among others, we know that the number of miles driven per year decreases as the age of the car increases. Moreover, the average age of third-party insured cars is lower than that of cars with a more than third-party insurance. Therefore, it can be expected that the annual mileage of third-party insured cars will be lower than that of cars of the insurants of the other insurance groups.

In determining the influence of some variables we have to make certain assumptions about dates, because of a lack of detailed data. We only know the year that the vehicle was manufactured, the year of birth of the insurant, the month in which he took out his policy or changed insurance conditions, and the month in which he had an accident. Therefore the following approximations will be made. The age of the vehicle is defined as the difference between the calendar year in question and the year of manufacture of the vehicle. The age of the insurant is defined as the difference between the calendar year being considered and the insurant's year of birth. We assume that each insurance has

been started and that a change has occurred on the 15th of the given month. The number of years insured, with respect to some given category of insurants, is defined as the sum of the time periods that all insured individuals, classified according to this category, are insured. Further, we assume that the numbers of claims of an individual insured in nonoverlapping intervals are stochastically independent, and is uniformly distributed over a time interval and a distance interval. Moreover, we assume that the number of claims of any individual insurant in any interval is stochastically independent of the number of claims of another individual insurant in the same or another interval.

Obviously, the assumptions we made give rise to errors in measurement, which we have to take into account when interpreting the results. Most of the assumptions cannot be tested because the available data do not permit this. We can only consider the assumption concerning the uniform distribution of the number of claims over a year.

In general, one assumes that in certain periods of a year relatively more accidents occur than in other periods of the year. In Table 3.3 we give the distribution of the number of claims with respect to the months of the year. We remark that there are striking differences in the number of claims per month. The number of claims in November, in particular, is relatively high. This may be the result of an enormous storm which raged throughout the country in November 1972. This storm caused much damage to vehicles and buildings. The results of Table 3.3 suggest that the assumption concerning the uniform distribution of the number of claims cannot be accepted. However, the sample is not big enough to allow a more detailed analysis. Therefore we are forced to maintain this assumption.

4. Univariate analysis of the number of claims and of the claim size

4.1 Introduction

The number of miles driven per year varies from one insurant to another. To obtain an impression of the distribution of the number of claims per distance driven, we should consider groups of insurants who drove equal distances. We therefore consider subgroups of insurants who drove at least m miles during the period considered. Furthermore, we only consider the first m

miles the insurants of some groups drove, where m equals 1,000 (1,000) 20,000, respectively. Table 3.4 presents some frequency distributions. We see that the frequency of two or more claims is relatively low, even for the group of insurants who drive at least 15,000 miles.

The table also contains the values of the sample mean and the sample variance. It appears that the average number of claims per mile of insurants who drove at least 15,000 miles during their first 15,000 miles is less than that of insurants during their first m miles, where m = 2,500, 5,000, 10,000, respectively. This may be the result of greater driving experience of motorists who have a higher annual mileage.

Next, we consider the distribution of the claim size. Table 3.5 presents for each of the four insurance groups the frequency distribution of the claim size, as well as the average claim and the standard deviation. All four distributions are skew to the right. Moreover, the first three have long tails. A relatively high average claim size and a high standard deviation for the first three distributions is therefore likely.

With respect to insurance groups 1 and 4, it holds that the amount of damage resulting from an accident equals the size of claim. With respect to insurance groups 2 and 3, it holds that the amount of damage corresponding to a claim equals the claim size plus the amount of excess. Table 3.5 also gives the distributions of the amounts of damage of those accidents where indemnification has been paid. These distributions are given in the last two columns. The distributions of the amounts of damage are less skew, but nevertheless they are skew to the right.

In the next subsection we analyze the relationship between the number of claims and the claim size on the one hand, and characteristics concerning the insurant, the car and the insurance conditions on the other hand. The high standard deviations of the distributions disturbs a detailed analysis of the influence of the explanatory variables of the claim size. To get rid of this problem we leave out of the analysis of the claim size, the claims exceeding Hfl. 15,000.=.

In 1971 and 1972 Dutch motorists drove on average about 10,500 miles per year. In order to be able to compare the average number of claims per insurant, we consider the number of claims per 10,000 miles.

Insurance companies are less interested in the average number of claims and the average claim size separately, than in the combination of the two: the

average claim costs, which is the product of the number of claims and the average claim size. Therefore we also compute the average claim costs.

Table 3.6 presents the average number of claims, the average claim size and the average claim costs for each of the insurance groups. The numbers between brackets in the column of the number of claims, denote the number of claims with amount of damage exceeding Hfl. 15,000.=.

One would expect the average claim costs of an all-risk insurant to be significantly higher than those of a third-party insurant. It is remarkable that the average claim costs of insurants with a low excess are scarcely higher than those of insurants with a higher excess. It appears that the lower premium proceeds does not go together with lower claim costs.

Tables 3.4 - 3.16 give, for each of the four insurance groups, an impression of the relationships between the number of claims per 10,000 miles, the average claim size and the average costs on the one hand, and characteristics concerning the insurant, the car and the insurance conditions on the other hand.

4.2. Characteristics related to the insurant

First we consider the age of the insurant, cf. Table 3.7. This table also has a column containing the relative number of claims caused by youthful drivers. It appears that youthful insurants have on average far more claims than older insurants. On the other hand the average claim size, except those of particular accidents, of young insurants is lower than that of older insurants. Nevertheless, the average total costs of young insurants is significantly higher than that of older insurants. These results justify the policy of the insurance company, which is to impose an additional excess for each accident for youthful drivers. However, then one would expect that middle-aged insurants, in the age group 42-55 years, to have on average a relatively higher number of claims per year, because their cars are often used by young motorists. This expectation is not confirmed by the results.

Table 3.8 concerns the Dutch province where the insurant lives. The combination of the results for the four groups of insurance does not give rise to similar conclusions for each of the insurance groups. The province does not, therefore seem to be a valid explanatory variable. The degree of urbanization of the insurant's domicile (cf. Table 3.9) is a better variable to explain, at least, the number of claims. The results suggest that the higher the degree of urbanization, the higher the average claim size.

The insurance company offered a premium reduction of 20% to insurants who have an occupation which belongs to a particular category. Obviously, the lower costs per year of these insurants related to the other insurants justify this policy, as can be concluded from the results presented in Table 3.10. Nevertheless, we remark that the conclusion cannot be made separately for each type of occupation. Moreover, the results are different for the three groups of insurances.

Based on the idea that the more miles one drives per year, the higher will be the average number of claims, the insurance company offered a premium reduction to insurants who claim to drive less than 20,000 kilometres (about 12,427.5 miles) per year. Table 3.11 shows that limited drivers (who claimed to drive less than 20,000 kilometres per year) have lower average total claim costs per year than unlimited drivers, except in the case of insurance group 3. Clearly, this result is caused by the number of miles one drives per year. If we consider the average total claims costs per 10,000 miles, the limited drivers have much higher average total claims costs than the unlimited drivers. These results suggest that the more miles one drives per year, the greater will be the driving experience, and therefore the lower will be the average number of claims per mile. This conclusion is confirmed by the results of Table 3.12, with the exception of insurance group 4.

4.3. Characteristics related to the car

It seems reasonable to assume that the price of the car is associated with the number of claims and the claim size. The more miles driven per year, the bigger the car, the greater the cost of the car, thus the higher the number of claims. On the other hand, the greater the cost of the car, the higher (in general) the costs of repair after a collision, thus the higher the claim size. Moreover, the higher the price of the car, the bigger the car, and the greater damage it can cause to a third-party's car. The results of Table 3.13 lead us to accept the above assumption for all four insurance groups.

For most of the cars we can state that the higher the price, the higher its maximum possible speed and its weight. Therefore we can expect a similar relationship between the maximum speed and the weight of the car on the one hand, and the number of claims and the claim size on the other hand, as we saw in the case of the price of the car.

With respect to the number of claims, we observe from Table 3.14 that the higher the maximum speed of the car, the higher the average number of claims per 10,000 miles for insurance groups 1 and 3, but the lower for insurance groups 2 and 4. From Table 3.15 we cannot deduce any general relationship between the weight of the car and the average number of claims. We can perhaps conclude that the greater the weight, the higher the average number of claims for insurance group 1, but for the other insurance groups the results suggest that there is no relationship between the average number of claims and the weight of the car.

With respect to the claim size, we conclude that the higher the maximum speed of the car, the higher the claim size: a similar relationship to that concerning the price of the car. Concerning insurance groups 1 and 2, we cannot deduce any clear relationship. Concerning insurance groups 3 and 4, the results suggest that the greater the weight of the car, the higher the average claim size.

Comparing the conclusions with respect to the price, the maximum speed and the weight of the car, it may be expected that the price of the car is a reliable explanatory variable for the number of claims as well as for the claim size, and that the maximum speed and the weight are less suitable as explanatory variables.

Finally, we consider the relationship between the age of the car and the number of claims, respectively, the claim size. From Table 3.15 we conclude that the results do not give rise to general conclusions. The average number of claims increases for insurance group 1, and decreases for insurance group 4, as the age increases. Concerning groups 2 and 3, the relationship is not clear. The average claim size decreases as the age increases, for insurance groups 1 and 2. Concerning insurance groups 3 and 4, the relationship is not clear.

4.4. Characteristics related to the insurance conditions

Three characteristics related to insurance condition are considered: the excess, the area of coverage and the number of claim-free years.

The excess is only relevant for casco insured cars. We only consider those amounts of excess, where the number of years insured exceeds 100. Table 2.17 shows the results. The average number of claims per 10,000 miles decreases as the excess increases, as expected. The average claim size, however, increases as the excess increases, likewise the average costs per 10,000 miles. One would not expect this relationship.

We next consider the area of coverage, see Table 3.18. One can expect that more accidents will occur (on average) abroad than in the home country, because of less driving experience in foreign countries. It is therefore remarkable that for insurance group 2, the average number of claims of home and abroad insurants is lower than those of home only insurants, as opposed to the other three insurance groups. Further, it is remarkable that a similar statement can be made about the average claim size and the average total claim costs. The traffic behaviour of all-risk insurants with minimum excess is apparently different from the traffic behaviour of the insurants of the other insurance groups.

Finally, we consider the number of claim-free years. In genenal, people do not claim damage if its amount is less than the no-claim amount. Moreover, one can expect that amounts of damage, which are only slightly higher than the no-claim amount, will also not be claimed. One can expect that the higher the number of claim-free years, the lower the average number of claims and the higher the average claim size. In 1971 and 1972 the maximum no-claim amount was reached after five claim-free year. Therefore one can expect that the average number of claims per 10,000 miles, as well as the average claim size of insurants having six or more claim-free years will be about equal.

With respect to the average number of claims, the above statements are affirmed by the results, which are given in Table 3.19. It is worth noting that the average number of claims per 10,000 miles for insurance group 4 shows the same relationship in spite of the fact that claiming damages for a particular accident has no influence on the no-claim amount.

5. Multivariate analysis of the number of claims and the claim size

In this section we execute a multivariate analysis, in order to trace whether or not there is some association between the number of claims and the claim size on the one hand, and groups of explanatory variables on the other hand. We also examine the extent of the contribution of the different explanatory variables to the explanation of the number of claims and the claim size.

The multivariate analysis is based on estimates of the covariability ratio. This ratio is meant as a measure for the association between population variables. Because we are dealing with a sample of observations, we must understand the computed values of the ratio as estimates of the population

covariability ratio. In order to decide whether some variable can be accepted as explanatory variable, eventually given the contribution to the explanation of a set of other variables, we use a test statistic which is approximately chi-square distributed for samples of sufficiently large size. We choose as significance level 0.05.

We will speak of a significant value of the covariability ratio of a dependent variable on a set of explanatory variables, when the contribution of each of the explanatory variables is significant, given the joint contribution of the other explanatory variables. We will also speak of the simple covariability ratio if there is only one expanatory variable, and of the multiple covariability ratio if there are two or more explanatory variables.

The application of the covariability ratio requires that the variables be measured on a nominal scale. Some variables are already measured on a nominal scale, other variables must be classified into a number of classes. This classification has been constructed on the basis of the results given in Subsections 3.2 - 3.4. Table 3.20 presents a list of the variables and the number of classes in which they are classified.

As a matter of course, there will be mutual association between the explanatory variables. For example, a youthful insurant cannot have many claim-free years. There will also be associations between the variables price, maximum speed and weight of car. However, the procedure to compute the values of the covariability ratio of Y_1 or Y_2 takes into account, in a certain sense, these mutual associations between the explanatory variables. For, let X_1, ..., X_k be explanatory variables and Y the dependent variable. Let there be a high associaton between X_1 and X_2. Then, if there is a high degree of association between Y and X_1 and a low degree of association between Y and X_2, the value of the simple covariability ratio of Y on X_2 may be significant, because of the association between X_1 and X_2. However, the value of the (conditional) covariability ratio of Y and X_2, given the contribution of X_1, will be low, implying that we shall accept X_1 and reject X_2 as explanatory variable for Y.

Tables 3.21 and 3.22 contain estimated values of the covariability ratio with respect to the number of claims and with respect to the claim size. As is to be expected the number of claim-free years X_{11} is by far the most important variable to explain the number of claims, except for claims for damage of particular types of claims.

Clearly, the insurants frequently apply the no-claim rule. The no-claim rule is irrelevant with respect to claims for damage from particular accidents. We see that the results support this fact.

Besides the number of claim-free years, the age of the insurant, X_1, and the degree of urbanization of his residence, X_2, contribute significantly to the explanation of the number of claims. As we have seen in Table 3.17, the size of the excess, X_9, does not greatly influence the number of claims.

We see that the available variables explain very little of the variability of the number of claims for damages from particular accidents. Although the value of the covariability ratio of four explanatory variables is significant, this value is very low.

Table 3.22 shows that the contribution of the explanatory variables to the explanation of the claim size is only slight. Apparently, the variability of the size of the claim is in general randomly determined.

Tables

Table 3.1 All-risk insurants by excess

Size of excess in Hfl.	Number of insurants
100	808
150	4015
200	52
250	86
300	8
350	210
400	90
450	8
500	813
550	30
600	13
650	25
1000	34
2000	7

Table 3.2 Number of insurants and annual mileage, by insurance group.

group of insurances	number of years insured	average annual mileage
1. Third-party	7755.8	9521
2. All-risk, with amounts of excess Hfl. 100.= or Hfl. 150.=	3169.3	12589
3. All-risk, with amounts of excess exceeding Hfl. 150.=	848.8	11887
4. Limited casco	5096.4	11867

Table 3.3 Number of claims, claim size and total claim costs, by month of accident.

month of accident	number of insurants per month	number of claims	average number of claims per month	number of insurants per month	number of claims	average number of claims per month
	Insurance group 1			Insurance group 2		
January	8497.5	46	0.0054	3300.0	41	0.0124
February	8400.0	50	0.0060	3299.0	37	0.0112
March	8264.0	50	0.0061	3286.5	35	0.0106
April	8116.0	53	0.0065	3266.5	50	0.0153
May	7995.5	51	0.0064	3232.0	47	0.0145
June	7869.5	60	0.0076	3194.5	43	0.0135
July	7703.5	44	0.0057	3162.0	39	0.0123
August	7526.5	63	0.0084	3132.5	43	0.0137
September	7371.5	62	0.0084	3096.5	28	0.0090
October	7226.5	68	0.0094	3055.0	44	0.0144
November	7099.0	86	0.0121	3018.5	48	0.0159
December	6999.5	56	0.0080	2989.0	41	0.0137
	Insurance group 3			Insurance group 4		
January	800.5	7	0.0087	5248.5	12	0.0023
February	801.0	8	0.0100	5235.0	14	0.0027
March	805.0	6	0.0074	5209.0	6	0.0012
April	814.5	8	0.0098	5179.5	24	0.0046
May	822.5	9	0.0109	5144.5	21	0.0041
June	835.5	7	0.0084	5113.0	20	0.0039
July	854.5	3	0.0035	5090.0	22	0.0043
August	871.0	5	0.0057	5066.5	12	0.0024
September	883.0	9	0.0102	5030.5	23	0.0046
October	892.5	10	0.0112	4982.5	20	0.0040
November	899.0	17	0.0189	4942.5	37	0.0075
December	906.0	10	0.0110	4915.0	17	0.0035

Table 3.4 Frequency distributions of the number of claims per m miles.

Number of claims	Insurance group 1	2	3	4
	m = 2500			
0	7788	3210	1017	5246
1	134	84	19	30
2	4	2	0	1
3	0	0	0	0
Total	7926	3296	1036	5277
Mean	0.0179	0.0267	0.0183	0.0061
Variance	0.0186	0.0272	0.0180	0.0064
	m = 5000			
0	6965	2888	819	4810
1	301	161	40	74
2	9	12	1	3
3	1	0	0	0
Total	7276	3061	860	4887
Mean	0.0443	0.0604	0.0488	0.0164
Variance	0.0456	0.0646	0.0488	0.0173
	m = 10000			
0	1332	1689	344	2484
1	111	160	33	90
2	6	27	2	4
3	0	3	0	0
Total	1449	1879	379	2578
Mean	0.0849	0.1187	0.0976	0.0380
Variance	0.0860	0.1430	0.0989	0.0397
	m = 15000			
0	660	560	94	861
1	59	73	12	32
2	6	12	0	1
3	0	2	0	0
Total	725	647	106	894
Mean	0.0979	0.1592	0.1132	0.0380
Variance	0.1050	0.1898	0.1013	0.0389

Table 3.5 Frenquency distributions of the claim size.

claim size in Hfl.	Insurance group 1	2	3	4	2*	3*
1 - 499	337	157	28	205	119	3
500 - 999	184	115	11	17	126	24
1000 - 1499	63	69	9	4	82	12
1500 - 1999	34	45	13	1	47	11
2000 - 2499	18	28	4	0	27	11
2500 - 2999	18	14	9	0	24	5
3000 - 3499	7	12	6	0	12	7
3500 - 3999	7	8	1	0	8	7
4000 - 4499	3	11	3	1	12	1
4500 - 4999	4	6	2	0	8	3
5000 - 5499	2	5	2	0	4	2
5500 - 5999	0	3	4	0	3	2
6000 - 6499	1	3	1	0	2	5
6500 - 6999	0	3	1	0	5	0
7000 - 7499	2	1	1	0	1	1
7500 - 7999	0	2	0	0	2	1
8000 - 8499	0	1	1	0	1	0
8500 - 8999	1	1	1	0	1	1
9000 - 9499	1	1	0	0	1	0
9500 - 9999	2	3	0	0	3	1
10000 - 12499	1	2	0	0	2	0
12500 - 14999	0	3	1	0	2	1
15000 - 19999	2	0	1	0	1	1
20000 - 49999	1	2	0	0	2	0
50000 - 99999	1	1	0	0	1	0
Total	689	496	99	228	496	99
Average	1101	1857	2310	255	2007	2806
Standard deviation	4242	5166	3524	435	5222	3887

* Distribution of the amount of damage.

Table 3.6 Number of claims, claim size and total claim costs by group of insurances.

group of insurances	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.
1	7755.8	9521	689 (4)	0.0933
2	3169.3	12589	496 (3)	0.1243
3	848.8	11887	99 (1)	0.0981
4	5096.4	11867	228 (2)	0.0377

group of insurances	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
1	877	1226	82	87
2	1534	2021	191	240
3	2180	2314	214	254
4	231	221	9	10

Table 3.7 Number of claims, claim size and total claim costs, by age of the insurant.

age in years	number of years insurant	average annual mileage	number of claims	relative number of youthful drivers	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1									
18-19	94.2	8626	23	0.9565	0.2830	737	711	209	180
20-24	966.3	8826	168 (2)	0.4167	0.1970	832	1260	308	272
25-29	1125.9	9210	95 (2)	0.0105	0.0916	766	1024	100	92
30-34	995.4	9322	89	0.0000	0.0959	1042	1569	100	93
35-39	870.6	10001	74	0.0000	0.0850	707	814	60	60
50-44	772.2	9678	60	0.0500	0.0803	730	664	59	57
45-49	616.4	9831	46	0.1087	0.0759	949	1500	72	71
50-54	499.8	10126	42	0.0952	0.0830	945	1062	78	79
55-59	397.5	9688	25	0.0000	0.0649	1171	1468	76	74
60-64	257.1	9933	20	0.1000	0.0783	1151	2020	90	90
65-69	146.9	7474	11	0.0000	0.1002	1005	1058	101	75
70-74	58.5	7566	6	0.0000	0.1356	1005	964	136	103
$\geq$ 75	35.8	7248	2	0.0000	0.0770	280	88	22	16
unknown	919.1	10170	28	0.0714	0.0300	1166	1237	35	36
18-23	798.5	8661	153	0.5948	0.2213	817	1257	181	156
$\geq$ 24	6038.1	9536	508 (4)	0.0315	0.0882	880	1213	104	100
Insurance group 2									
18-19	1.2	11191	3	1.0000	2.2186	2285	1230	5070	5674
20-24	184.5	11850	51	0.3333	0.2332	1320	1486	308	365
25-29	386.2	12119	55	0.0182	0.1175	1769	2185	208	252
30-34	377.2	12513	66	0.0000	0.1398	1775	2256	248	311
35-39	316.5	12595	45 (2)	0.0000	0.1129	1737	2648	500	630
50-44	328.3	12955	53	0.0189	0.1246	1724	2371	215	278
45-49	339.2	12999	52	0.0577	0.1179	1485	1542	172	224
50-54	283.1	12355	38	0.0526	0.1087	1381	1567	150	185
55-59	224.8	12765	44	0.0227	0.1534	1433	1940	220	281
60-64	152.8	11183	23 (1)	0.0435	0.1346	1347	1137	411	460
65-69	94.3	8303	17	0.0588	0.2172	1025	912	223	185
70-74	43.0	8360	4	0.0000	0.1112	550	215	61	51
$\geq$ 75	13.0	8312	1	0.0000	0.0928	2119	--	197	164
unknown	425.4	14870	44	0.0227	0.0696	1333	2361	93	138
18-23	132.7	11657	45	0.4444	0.2910	1329	1517	387	451
$\geq$ 24	2611.3	12265	407 (3)	0.0246	0.1271	1578	2027	251	307

Table 3.7 Continued.

age in years	number of years insured	average annual mileage	number of claims	relative number of youthful drivers	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 3									
18-19	1.6	8326	0	--	--	--	--	--	--
20-24	73.3	10698	15	0.4667	0.1914	1597	1931	306	327
25-29	124.1	11480	20	0.0000	0.1404	2793	3344	392	450
30-34	116.3	11866	11	0.0000	0.0797	2249	2623	179	213
35-39	94.5	12393	13	0.0000	0.1110	2304	1518	256	317
50-44	82.0	13263	7	0.0000	0.0644	1885	1947	121	161
45-49	80.2	11959	10 (1)	0.0000	0.1043	2071	2018	216	258
50-54	60.5	12563	9	0.1111	0.1184	2233	1718	264	332
55-59	43.8	11007	1	0.0000	0.0207	2693	—	56	61
60-64	31.3	12474	8	0.1250	0.2052	2266	1818	465	580
65-69	19.1	8166	1	0.0000	0.0642	900	—	58	47
70-74	8.8	7816	1	0.0000	0.1455	1967	—	286	224
$\geq$ 75	3.9	7974	0	--	--	--	--	--	--
unknown	109.4	12626	3	0.3333	0.0217	1179	1241	26	32
18-23	52.0	10679	11	0.6364	0.1981	1913	2136	379	405
$\geq$ 24	687.4	11861	85 (1)	0.0235	0.1043	2251	2355	235	278
Insurance group 4									
18-19	13.9	8525	0	--	--	--	--	--	--
20-24	356.1	10868	27 (1)	0.2593	0.0698	279	338	19	21
25-29	666.1	11321	38	0.0000	0.0504	218	168	11	12
30-34	627.4	11788	36	0.0000	0.0487	273	254	13	16
35-39	521.7	12039	26	0.0000	0.0414	239	199	10	12
50-44	527.1	12302	20	0.0500	0.0308	193	94	6	7
45-49	507.8	12256	24	0.1250	0.0386	225	246	9	11
50-54	412.2	12069	14	0.0000	0.0281	189	159	5	6
55-59	335.8	12059	12	0.0833	0.0296	148	120	4	5
60-64	230.3	11380	4	0.0000	0.0153	179	63	3	3
65-69	140.6	8017	6	0.0000	0.0532	164	53	9	7
70-74	64.4	8029	1	0.0000	0.0193	147	—	3	2
$\geq$ 75	22.3	7942	0	—	--	--	--	--	--
unknown	670.8	13566	20 (1)	0.0000	0.0220	268	244	6	8
18-23	260.2	10576	18 (1)	0.3889	0.0654	268	361	18	19
$\geq$ 24	4165.5	11674	190	0.0263	0.0391	224	201	--	10

Table 3.8 Number of claims, claim size and total claim costs, by province.

province	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1								
Groningen	269.2	8685	13	0.0556	1640	2608	91	79
Friesland	773.0	8647	51	0.0763	886	887	68	58
Drenthe	116.9	8961	9	0.0859	1085	936	93	84
Overijssel	719.9	9357	63 (1)	0.0935	835	972	78	73
Gelderland	949.0	10052	70 (2)	0.0734	988	1533	72	73
Utrecht	453.8	10250	44 (1)	0.0946	772	960	73	75
North-Holland	1965.3	9623	202	0.1068	883	1272	94	91
South-Holland	1007.8	9557	112	0.1163	813	1297	95	90
Zeeland	145.5	8997	8	0.0611	544	498	33	30
North-Brabant	962.5	9674	84	0.0902	761	851	69	66
Limburg	374.4	9356	32	0.0913	982	1074	90	84
Southern IJssel-lake polders	17.5	10004	1	0.0573	3632	--	208	208
Insurance group 2								
Groningen	95.4	13015	14	0.1127	2476	2971	279	363
Friesland	305.1	13310	45	0.1108	1214	2261	135	179
Drenthe	54.1	12749	7	0.1015	1038	529	105	134
Overijssel	195.3	11745	30	0.1308	1521	2117	199	234
Gelderland	304.0	12364	41 (1)	0.1091	1839	2003	206	255
Utrecht	186.6	13858	23	0.0899	1923	2742	171	237
North-Holland	784.0	12263	109 (1)	0.1134	1420	1617	161	197
South-Holland	648.3	12780	126	0.1521	1561	2225	237	303
Zeeland	27.6	11821	6	0.1840	1350	1332	248	294
North-Brabant	487.1	12529	73	0.1196	1451	1651	174	218
Limburg	79.3	11498	22 (1)	0.2413	1423	1452	343	395
Southern IJssel-lakepolders	2.6	11010	0	--	--	--	--	--

Table 3.8 Continued.

province	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 3								
Groningen	30.5	11824	5	0.1388	2916	2355	405	479
Friesland	90.6	12214	10	0.0903	2916	2008	236	289
Drenthe	14.8	12692	1	0.0534	826	--	44	56
Overijssel	85.0	11715	5	0.0502	2020	1108	101	119
Gelderland	119.5	11464	15	0.1095	1580	2274	173	198
Utrecht	39.9	12692	3	0.0592	3701	2411	219	278
North-Holland	164.9	12049	19	0.0956	1906	2417	182	220
South-Holland	84.5	11586	15	0.1532	2160	1287	331	384
Zeeland	18.7	12195	4	0.1757	4234	5619	744	907
North-Brabant	161.5	12018	21 (1)	0.1082	1924	1641	208	250
Limburg	37.9	11063	1	0.0238	3186	--	76	84
Southern IJssel-lakepolders	1.0	8594	0	--	--	--	--	--
Insurance group 4								
Groningen	155.4	12021	10	0.0535	180	63	10	12
Friesland	543.8	11816	24	0.0374	277	321	10	12
Drenthe	82.5	12243	3	0.0297	546	518	16	20
Overijssel	349.4	11388	22	0.0553	211	199	12	13
Gelderland	548.1	11742	24	0.0373	214	176	8	9
Utrecht	275.4	13251	18	0.0493	227	112	11	15
North-Holland	1300.8	11584	43 (1)	0.0285	284	287	8	9
South-Holland	844.4	12246	38	0.0367	209	179	8	9
Zeeland	65.2	11247	0	--	--	--	--	--
North-Brabant	749.6	12059	40 (1)	0.0443	182	110	8	10
Limburg	178.1	10625	6	0.0317	217	132	7	7
Southern IJssel-lakepolders	3.9	10245	0	--	--	--	--	--

Table 3.9 Number of claims, claim size and total claim costs, by degree of urbanisation.

degree of urbanisation *)	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1								
1	2052.0	9327	114	0.0596	957	1401	57	53
2	1339.3	9808	107 (2)	0.0815	921	1408	75	74
3	465.6	9891	51	0.1107	968	1265	107	106
4	915.4	9763	75 (1)	0.0839	939	1174	79	77
5	1086.5	9378	105	0.1030	801	899	83	77
6	1895.9	9405	237 (1)	0.1329	814	1175	108	102
unknown	1.0	5603	0	--	--	--	--	--
Insurance group 2								
1	626.8	11660	82 (1)	0.1122	1472	2183	165	193
2	437.3	12801	78 (1)	0.1393	1518	1800	211	271
3	313.3	12766	30	0.0750	2068	2243	155	198
4	288.0	12510	35	0.0971	1307	1145	127	159
5	484.8	13083	97	0.1529	1073	1193	164	215
6	1019.1	12803	174 (1)	0.1334	1781	2405	238	304

*) 1. Rural municipalities.
2. Urbanized rural municipalities, having less than 20000 inhabitants.
3. Dormitory towns.
4. Municipalities, having less than 30000 inhabitants.
5. Medium-sized towns, having 30000 - 99999 inhabitants.
6. Large conurbations, having 100000 inhabitants or more.

Table 3.9 Continued.

degree of urbanisation *)	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 3								
1	224.0	11864	21	0.0790	2418	2253	191	227
2	176.6	12459	19 (1)	0.0863	1695	1706	146	182
3	65.4	12085	8	0.1013	2401	1549	243	294
4	118.4	11599	17	0.1238	2237	3263	277	321
5	115.4	11376	11	0.0838	3090	2669	259	295
6	149.0	11781	23	0.1310	1790	1729	234	276
Insurance group 4								
1	1154.5	11066	49 (2)	0.0384	253	288	10	11
2	770.8	12187	40	0.0426	200	111	9	10
3	441.8	12256	19	0.0351	244	245	9	10
4	502.8	11853	23	0.0386	223	133	9	10
5	706.9	12325	26	0.0298	254	276	8	9
6	1519.7	11992	71	0.0390	225	208	9	11

*) 1. Rural municipalities.
2. Urbanized rural municipalities, having less than 20000 inhabitants.
3. Dormitory towns.
4. Municipalities, having less than 30000 inhabitants.
5. Medium-sized towns, having 30000 - 99999 inhabitants.
6. Large conurbations, having 100000 inhabitants or more.

Table 3.10 Number of claims, claim size and total claim costs, by occupation.

occupation	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1								
particular occupations	1487.6	8997	118 (1)	0.0882	779	864	69	62
of which								
- agrarians	436.0	7886	22 (1)	0.0640	842	1265	54	42
- civil servant	785.0	9419	68	0.0920	777	802	71	67
- teachers	126.7	10066	13	0.1019	584	375	59	60
unknown	6268.2	9646	571 (3)	0.0944	898	1287	85	82
Insurance group 2								
particular occupations	976.8	11155	118 (1)	0.1083	1473	1646	160	178
of which								
- agrarians	164.0	9948	15 (1)	0.0919	1333	985	123	122
- civil servant	449.7	10631	64	0.1339	1306	1651	175	186
- teachers	147.3	10905	15	0.0934	1467	1414	137	149
unknown	2192.6	13228	378 (4)	0.1303	1553	2124	202	268

Table 3.10 Continued.

occupation	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 3								
particular occupations	209.2	10586	22	0.0993	1856	1674	184	195
of which								
- agrarians	32.8	10882	1	0.0281	1704	--	48	52
- civil servant	95.9	10277	10	0.1015	2266	1875	230	236
- teachers	36.8	10711	7	0.1774	1029	1205	183	196
unknown	639.6	12313	77 (1)	0.0978	2274	2460	222	274
Insurance group 4								
particular occupations	1434.5	10698	53	0.0345	227	238	8	8
of which								
- agrarians	276.0	9373	6	0.0232	457	418	11	10
- civil servant	669.6	10397	23	0.0330	189	189	6	6
- teachers	207.3	10784	6	0.0268	199	121	5	6
unknown	3661.9	12325	175 (2)	0.0388	232	216	9	11

Table 3.11 Number of claims, claim size and total claim costs, by usage.

usage	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1								
limited	6916.6	6843	611 (3)	0.1022	847	1144	87	75
unlimited	839.1	16763	78 (1)	0.0555	1114	1725	62	104
Insurance group 2								
limited	2458.3	10256	358 (2)	0.1420	1589	2069	226	231
unlimited	711.1	20653	138 (1)	0.0940	1389	1883	131	270
Insurance group 3								
limited	715.0	10079	78 (1)	0.1082	2242	2434	243	245
unlimited	133.8	21544	21	0.0728	1956	1789	142	307
Insurance group 4								
limited	4097.5	9889	170 (2)	0.0420	219	209	9	9
unlimited	998.8	19981	58	0.0291	265	251	8	15

Table 3.12 Number of claims and claim size by annual mileage.

annual mileage	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1								
< 6000	218.8	5842	12	0.0940	1185	1217	111	65
6000 - 6999	255.8	6392	15	0.0917	575	538	53	34
7000 - 7999	1521.6	7443	143	0.1263	816	1069	103	77
8000 - 8999	2419.3	8520	209 (2)	0.1014	939	1378	95	81
9000 - 9999	1997.1	9328	178 (1)	0.0956	781	980	75	70
10000 - 10999	662.0	10361	59 (1)	0.0860	931	1156	80	83
11000 - 11999	166.8	11314	12	0.0636	610	279	39	44
12000 - 14999	22.0	13160	0	--	--	--	--	--
15000 - 19999	129.9	17242	14	0.0625	1136	976	71	122
20000 - 24999	198.7	23145	26	0.0565	695	837	39	91
25000 - 29999	139.1	26469	14	0.0380	1378	2311	52	139
≥ 30000	25.0	32486	7	0.0862	2056	3269	177	576
Insurance group 2								
< 6000	19.0	5634	4	0.3729	816	579	304	171
6000 - 6999	122.5	6649	8	0.1069	1816	2043	194	129
7000 - 7999	303.1	7329	44	0.1980	1305	1269	258	189
8000 - 8999	142.4	8533	24	0.1975	1574	2856	311	265
9000 - 9999	470.0	9574	56	0.1244	1677	2407	209	200
10000 - 10999	683.4	10538	113 (1)	0.1569	1555	2031	244	257
11000 - 11999	416.1	11416	65 (1)	0.1368	1120	1138	153	175
12000 - 14999	445.8	12836	56 (1)	0.0979	2204	2424	216	277
15000 - 19999	114.7	18380	25	0.1186	1471	1439	174	321
20000 - 24999	250.5	22245	44	0.0790	1811	2316	143	318
25000 - 29999	203.9	26933	54	0.0983	1193	1805	117	316
≥ 30000	7.8	33168	3	0.1155	397	312	46	152

Table 3.12 Continued.

annual mileage	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 3								
< 6000	5.5	5665	0	--	--	--	--	--
6000 - 6999	24.4	6600	1	0.0621	2070	--	128	85
7000 - 7999	108.1	7446	4	0.0497	2179	1815	108	81
8000 - 8999	51.3	8451	9	0.2078	2345	4343	487	412
9000 - 9999	149.2	9643	12 (1)	0.0834	1894	1509	158	152
10000 - 10999	172.3	10542	21	0.1156	1856	1559	215	226
11000 - 11999	107.3	11436	15	0.1223	3124	2324	382	437
12000 - 14999	111.3	12819	17	0.1191	2103	2423	251	321
15000 - 19999	26.0	18383	6	0.1253	1180	1014	148	272
20000 - 24999	50.5	21993	8	0.0720	2592	2257	187	411
25000 - 29999	43.0	27042	6	0.0516	1927	1495	100	269
≥ 30000	0.0	--	--	--	--	--	--	--
Insurance group 4								
< 6000	54.6	5742	0	--	--	--	--	--
6000 - 6999	182.4	6568	4	0.0334	91	44	3	2
7000 - 7999	588.6	7402	14	0.0321	244	203	8	6
8000 - 8999	496.4	8503	12 (1)	0.0284	212	314	6	5
9000 - 9999	929.1	9505	39	0.0442	160	108	7	7
10000 - 10999	947.7	10523	54 (1)	0.0541	223	207	12	13
11000 - 11999	555.3	11411	21	0.0331	196	193	7	7
12000 - 14999	563.8	12835	31	0.0428	300	238	13	16
15000 - 19999	171.3	18151	10	0.0322	254	139	8	15
20000 - 24999	327.9	22301	22	0.0301	250	369	11	23
25000 - 29999	268.7	26938	21	0.0290	209	84	6	16
≥ 30000	10.7	33183	0	--	--	--	--	--

Table 3.13 Number of claims, claim size and total claim costs by price of the car.

price in Hfl.	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1								
< 5000	423.4	9165	20	0.0515	762	619	39	36
5000 - 5999	1336.3	9044	107	0.0885	776	1002	69	62
6000 - 6999	1979.7	9287	162	0.0881	836	1383	74	68
7000 - 7999	1469.2	9523	124 (2)	0.0886	756	945	67	64
8000 - 8999	778.2	9521	81	0.1093	776	791	85	81
9000 - 9999	738.1	9504	74	0.1055	812	940	86	81
10000 - 10999	401.1	10007	39	0.0972	1272	1586	124	124
11000 - 11999	155.7	10254	18	0.1127	1095	1081	123	127
12000 - 12999	119.9	11143	16 (1)	0.1198	1413	2332	169	189
13000 - 14999	141.3	10934	19	0.1230	1225	1576	151	165
15000 - 19999	147.7	11616	18 (1)	0.1049	900	1052	94	110
20000 - 24999	44.8	13155	7	0.1187	1382	1202	164	216
≥ 25000	20.4	13795	4	0.1423	3345	3827	476	657
Insurance group 2								
< 5000	142.5	9545	14	0.1030	1791	1259	184	176
5000 - 5999	444.6	10599	71	0.1507	1199	1268	181	191
6000 - 6999	680.2	11165	97 (1)	0.1277	1636	2104	209	233
7000 - 7999	694.3	11909	109 (1)	0.1318	1375	1901	181	216
8000 - 8999	356.4	13423	58	0.1212	1339	1875	162	218
9000 - 9999	263.0	14236	41	0.1095	1515	2138	166	236
10000 - 10999	190.9	14137	34	0.1260	2524	2918	318	449
11000 - 11999	109.3	15818	22	0.1272	1563	1801	199	315
12000 - 12999	77.8	15572	15	0.1238	1754	1869	217	338
13000 - 14999	89.3	16858	15	0.0997	2072	3470	207	348
15000 - 19999	85.5	18327	17 (1)	0.1084	1384	1055	150	275
20000 - 24999	25.4	18908	3	0.0625	266	84	17	31
≥ 25000	10.3	23913	0	--	--	--	--	--

Table 3.13 Continued.

price in Hfl.	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 3								
< 5000	28.2	9974	1	0.0355	1874	--	67	66
5000 - 5999	98.1	9534	4	0.0428	1515	1253	65	62
6000 - 6999	185.8	10187	12	0.0634	1264	1177	80	82
7000 - 7999	198.2	11269	24	0.1074	2126	2844	228	257
8000 - 8999	107.1	12492	22 (1)	0.1644	1863	1843	306	383
9000 - 9999	73.3	12689	14	0.1505	2863	2331	431	547
10000 - 10999	48.8	13695	8	0.1196	2815	2214	337	461
11000 - 11999	32.0	15107	5	0.1034	1099	607	114	172
12000 - 12999	19.5	15392	2	0.0666	3061	2377	204	314
13000 - 14999	24.2	14608	2	0.0566	4319	2788	244	357
15000 - 19999	24.3	20260	2	0.0406	3540	725	144	291
20000 - 24999	7.0	20649	2	0.1375	870	458	120	247
> 25000	2.2	16068	1	0.2872	8768	--	2519	4047
Insurance group 4								
< 5000	219.8	9465	5	0.0240	67	24	2	2
5000 - 5999	698.1	10162	31	0.0437	150	119	7	7
6000 - 6999	1156.3	10516	45	0.0370	168	157	6	7
7000 - 7999	1097.7	11414	54 (1)	0.0431	261	225	11	13
8000 - 8999	556.0	12609	22	0.0314	242	169	8	10
9000 - 9999	446.7	12878	20 (1)	0.0348	271	299	9	12
10000 - 10999	305.0	13280	13	0.0321	232	96	7	10
11000 - 11999	161.2	14988	8	0.0331	362	380	12	18
12000 - 12999	118.3	15168	8	0.0446	415	471	19	28
13000 - 14999	138.5	15366	9	0.0423	245	159	10	16
15000 - 19999	137.4	17143	12	0.0509	292	109	15	25
20000 - 24999	44.7	17397	1	0.0129	398	--	5	10
> 25000	16.8	19680	0	--	--	--	--	--

Table 3.14 Number of claims, claim size and total claim costs by maximum speed.

maximum speed in kilometres per hour	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1								
≤ 90	251.5	10786	20	0.0737	550	484	41	44
100	277.9	8885	18	0.0729	1090	929	79	71
110	1068.8	8874	90	0.0949	686	850	65	58
120	2324.8	9089	184 (1)	0.0871	691	722	60	55
130	2169.6	9640	201 (1)	0.0961	898	1372	86	83
140	910.4	9936	106 (1)	0.1172	1137	1597	133	132
150	323.3	10493	27	0.0796	1130	1185	90	94
160	312.7	10269	36 (1)	0.1121	1094	1350	123	126
≥ 170	116.8	12691	7	0.0472	2053	3171	97	123
Insurance group 2								
≤ 90	70.5	10602	10	0.1339	1413	1186	189	201
100	103.0	12170	18	0.1435	893	602	128	156
110	256.3	10482	41	0.1526	1000	1183	153	160
120	551.1	11373	78 (1)	0.1245	1377	1589	171	195
130	916.9	11710	129	0.1201	1448	1893	174	204
140	604.3	13193	108 (1)	0.1355	1718	2504	233	307
150	351.9	14562	60	0.1171	2055	2164	241	350
160	184.4	15379	25	0.0881	1631	2803	144	221
≥ 170	130.9	17372	27 (1)	0.1187	1699	1831	202	350

Table 3.14 Continued.

maximum speed in kilometres per hour	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 3								
≤ 90	16.6	9298	0	--	--	--	--	--
100	30.7	11429	1	0.0285	1874	--	53	61
110	62.9	10329	2	0.0308	841	473	26	27
120	140.6	10005	9	0.0640	1572	1336	101	101
130	238.5	11086	29	0.1097	1949	2758	214	237
140	191.0	12853	33 (1)	0.1344	2157	1806	290	373
150	86.8	13633	10	0.0846	1710	1443	145	197
160	46.6	14407	10	0.1489	3157	2656	470	677
≥ 170	35.2	16353	5	0.0868	4359	3089	379	619
Insurance group 4								
≤ 90	111.1	10583	4	0.0340	75	23	3	3
100	157.7	11613	10	0.0546	158	164	9	10
110	443.4	10079	18	0.0403	188	186	8	8
120	1026.9	10486	48	0.0446	180	156	8	8
130	1458.9	11185	57	0.0349	237	225	8	9
140	931.4	12667	45 (1)	0.0381	270	236	10	13
150	487.6	14049	25 (1)	0.0365	304	316	11	16
160	287.3	14356	8	0.0194	338	262	7	9
≥ 170	192.2	16364	13	0.0413	225	90	9	15

Table 3.15 Number of claims, claim size and total claim costs by weight.

weight in kilograms	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1								
≤ 500	585.1	9378	48	0.0917	740	977	68	64
600	1331.9	8909	96	0.0809	794	738	64	57
700	2241.1	9182	186 (1)	0.0904	680	917	61	56
800	1424.0	9570	125 (1)	0.0917	1032	1584	95	91
900	1180.0	9323	126	0.1145	857	908	98	92
1000	568.3	10432	50	0.0843	1171	1906	99	103
1100	151.0	13363	14	0.0694	714	662	50	66
1200	118.8	10886	22 (1)	0.1702	1255	1533	214	233
≥ 1300	182.7	12593	22 (1)	0.0956	1554	2125	149	187
Insurance group 2								
≤ 500	253.3	10474	29	0.1093	1462	1502	160	167
600	408.3	10356	63	0.1490	1340	1611	200	207
700	979.3	11349	150 (1)	0.1350	1443	1918	195	221
800	512.4	12500	76 (1)	0.1187	1652	2168	196	245
900	461.0	13912	67	0.1045	1469	1719	153	213
1000	320.7	14840	66 (1)	0.1387	2057	2608	285	423
1100	87.4	17956	17	0.1084	1246	887	135	242
1200	73.9	18509	19	0.1390	1682	3170	234	433
≥ 1300	73.0	19028	9	0.0648	565	807	37	70

Table 3.15 Continued.

weight in kilograms	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 3								
≤ 500	75.4	9933	3	0.0401	1753	320	70	70
600	79.2	10221	11	0.1085	1389	1188	151	154
700	296.5	10776	29	0.0908	2300	2904	209	225
800	129.1	11329	20 (1)	0.1367	2175	2230	297	337
900	109.0	13203	15	0.1042	2403	1926	250	331
1000	81.0	14787	11	0.0919	1857	1867	171	252
1100	26.8	16145	4	0.0925	1624	820	150	243
1200	14.4	17721	2	0.0783	3693	1745	289	512
≥ 1300	17.5	19769	4	0.1159	3693	3257	428	846
Insurance group 4								
≤ 500	386.2	10180	27	0.0687	207	264	14	14
600	680.3	10068	28 (1)	0.0409	171	110	7	7
700	1579.2	10843	67	0.0391	231	185	9	10
800	847.7	11606	28 (1)	0.0285	153	114	4	5
900	745.0	12849	25	0.0261	291	288	8	10
1000	484.8	14026	30	0.0441	254	242	11	16
1100	137.2	17117	5	0.0213	359	180	8	13
1200	109.0	17118	5	0.0268	419	536	11	19
≥ 1300	127.1	16921	13	0.0604	277	89	17	28

Table 3.16 Number of claims, claim size and total claim costs by age of the car.

age of the car in years	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1								
0	139.2	12266	19	0.1113	951	808	106	130
1	368.5	12708	29	0.0619	1413	2014	88	111
2	730.7	10699	57 (1)	0.0729	804	1111	59	53
3	998.6	10278	88	0.0857	1023	1486	88	90
4	1118.1	9494	80 (1)	0.0754	774	783	58	55
5	1122.5	9379	121	0.1149	745	1041	86	80
6	1115.9	9380	89	0.0850	968	1665	82	77
7	1020.5	8530	107 (1)	0.1229	791	943	97	83
8	567.5	7954	53 (1)	0.1174	985	1189	116	92
9	286.3	7869	22	0.0976	781	830	76	60
10	144.8	7878	16	0.1402	748	664	105	83
$\geq$ 11	142.8	8033	8	0.0698	655	611	46	37
Insurance group 2								
0	855.0	13540	169	0.1460	1707	2335	249	337
1	1016.4	13310	157 (2)	0.1161	1458	1866	169	225
2	692.5	12747	86 (1)	0.0974	1390	1625	135	173
3	320.6	9775	51	0.1627	1446	1333	235	230
4	161.0	10229	17	0.1032	1694	3372	175	179
5	79.7	10008	8	0.1003	679	410	68	68
$\geq$ 6	44.2	8809	8	0.2054	1928	1844	396	349

Table 3.16 Continued.

age of the car in years	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 3								
0	254.5	13378	38	0.1116	2737	2119	306	409
1	204.0	12409	18	0.0711	2461	2292	175	217
2	175.5	12048	20	0.0946	1140	1052	108	130
3	120.7	9243	15	0.1344	1264	1429	170	157
4	59.8	9081	6	0.1105	3558	4965	393	357
5	21.9	11911	2 (1)	0.0766	2272	--	174	207
$\geq$ 6	12.4	9657	0	--	--	--	--	--
Insurance group 4								
0	1125.1	13487	83	0.0547	267	231	15	20
1	1274.0	13110	53	0.0317	198	170	6	8
2	990.2	12350	55 (1)	0.0450	229	273	10	13
3	605.8	9686	18	0.0307	242	179	7	7
4	385.2	9753	11 (1)	0.0293	185	130	5	5
5	270.0	9836	1	0.0038	96	--	0	0
6	198.0	9849	1	0.0051	67	--	0	0
7	130.6	8721	4	0.0351	121	77	4	4
$\geq$ 8	117.5	8552	2	0.0199	168	57	3	3

Table 3.17 Number of claims, claim size and total claim costs by excess casco, insurance groups 2 and 3.

excess in Hfl.	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
100	456.3	12940	79	0.1312	1342	1848	176	228
150	2704.1	12529	417 (3)	0.1231	1570	2050	193	242
200 - 300	99.2	11866	10	0.0850	1465	1069	125	148
350 - 450	203.0	12063	21	0.0858	2343	1910	201	242
500	475.3	11741	60 (1)	0.1075	2150	2455	231	271
550 - 650	47.7	10549	3	0.0597	1120	763	67	70
1000 - 2000	23.7	16083	5	0.1311	3918	3322	514	826

Table 3.18 Number of claims, claim size and total claim costs by area of coverage.

area of coverage	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1								
home	3687.4	9213	299	0.0880	828	1049	73	67
home and abroad	4068.3	9801	390 (4)	0.0978	916	1346	90	88
Insurance group 2								
home	789.6	11502	124 (1)	0.1365	1529	2012	209	240
home and abroad	2379.8	12950	372 (2)	0.1207	1535	2024	185	240
Insurance group 3								
home	252.5	10939	21	0.0760	1404	1414	107	117
home and abroad	596.3	12288	78 (1)	0.1064	2392	2462	255	313
Insurance group 4								
home	1503.6	10808	59	0.0363	227	198	8	10
home and abroad	3592.8	12310	169 (2)	0.0382	232	229	9	11

Table 3.19 Number of claims, claim size and total claim costs by number of claim-free years.

number of claim-free years	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 1								
0	257.8	10004	321 (1)	1.2445	782	1026	973	974
1	1456.9	9383	150 (2)	0.1097	927	1376	102	95
2	1442.1	9326	61	0.0454	874	1596	40	37
3	1084.6	9432	60 (1)	0.0586	864	967	51	48
4	877.6	9255	32	0.0394	834	835	33	30
5	670.3	9679	23	0.0355	1531	1634	54	53
6	485.3	9463	10	0.0218	1295	939	28	27
7	394.2	9776	7	0.0182	901	1181	16	16
8	322.7	9448	6	0.0197	1062	662	21	20
9	205.6	9913	5	0.0245	848	851	21	21
10–14	416.3	10116	11	0.0261	655	528	17	17
15–19	120.1	11034	2	0.0151	5010	4469	76	83
$\geq$ 20	22.1	10660	1	0.0424	367	---	16	17
Insurance group 2								
0	227.6	13716	257 (2)	0.8232	1430	1908	1177	1614
1	516.3	12836	96	0.1449	1468	2088	213	273
2	521.6	12678	56 (1)	0.0847	1759	1952	149	189
3	423.5	12582	31	0.0582	1937	2579	113	142
4	344.3	12284	18	0.0426	1150	547	49	60
5	281.5	12535	6	0.0170	2800	2348	48	60
6	194.5	11938	7	0.0301	1129	1253	34	41
7	149.4	11978	8	0.0447	1997	2114	89	107
8	133.9	11954	3	0.0187	613	203	11	14
9	99.7	12312	3	0.0244	550	232	13	17
10–14	200.0	12593	6	0.0238	3394	4240	81	102
15–19	63.1	12295	3	0.0387	1947	950	75	93
$\geq$ 20	14.0	15540	2	0.0917	1326	815	121	189

Table 3.19 Continued.

number of claim-free years	number of years insured	average annual mileage	number of claims	average number of claims per 10000 m.	average claim size in Hfl.	standard deviation claim size	average total claim costs in Hfl. per 10000 m.	year
Insurance group 3								
0	41.4	13262	55 (1)	1.0013	2258	2385	2261	2998
1	184.5	12050	20	0.0900	1345	1508	121	146
2	153.2	11790	5	0.0277	2073	2077	57	68
3	100.2	11993	1	0.0083	350	--	3	3
4	83.5	11739	6	0.0612	1393	1248	85	100
5	77.8	11739	3	0.0329	1905	1278	63	73
6	46.1	11698	1	0.0185	6666	--	124	145
7	45.9	11033	2	0.0395	6454	653	255	281
8	37.3	11072	0	--	--	--	--	--
9	27.1	11961	3	0.0925	4202	3339	389	465
10-14	35.9	12251	1	0.0227	190	--	4	5
15-19	13.7	12059	2	0.1214	3863	930	469	565
$\geq$ 20	2.3	12819	0	--	--	--	--	--
Insurance group 4								
0	313.2	13390	15	0.0358	166	80	6	8
1	879.3	12023	49 (1)	0.0463	283	265	13	16
2	844.5	11839	41	0.0410	233	227	10	11
3	652.3	11773	36	0.0469	211	143	10	12
4	553.9	11581	22	0.0343	182	102	6	7
5	465.7	11826	15 (1)	0.0272	197	169	5	6
6	313.6	11460	11	0.0306	378	304	12	13
7	256.8	11262	8	0.0277	173	63	5	5
8	216.7	11250	6	0.0246	140	43	3	4
9	156.8	11865	7	0.0376	439	532	17	20
10-14	315.8	11964	13	0.0344	154	62	5	6
15-19	108.8	11708	5	0.0392	162	56	6	7
$\geq$ 20	19.2	14537	0	--	--	--	--	--

Table 3.20 List of variables and number of classes

Insurance groups	1		2		3		4	
Dependent variable	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2
Y_1 number of claims	2		2		2		2	
Y_2 claim size		4		4		4		2
X_1 age of the insurant	5	4	4	4	3	3	3	
X_2 degree of urbanisation	4	2	3	4	2	2		3
X_3 occupation	2		2					
X_4 usage	2	2	2		2	2	2	
X_5 price	3	2	2	2		2		2
X_6 maximum speed	3	2	2	2	2	2	2	2
X_7 weight		2		2	2	2		2
X_8 age of the car	3	2	2	2	3	2	2	2
X_9 excess			2					
X_{10} area of coverage	2	2	2	2	2	2		2
X_{11} number of claim-free years	3	2	3	2	2		2	

Table 3.21 A selection of estimated significant values of the covariability ratio of the number of claims on sets of explanatory variables

Explanatory variables	Covariability ratio
Y_1 = number of third-party claims	
X_1	0.0171
X_2	0.0122
X_{11}	0.1171
X_1 X_{11}	0.1283
X_2 X_{11}	0.1251
X_4 X_{11}	0.1230
X_1 X_2 X_{11}	0.1513
X_1 X_4 X_{11}	0.1379
X_2 X_4 X_{11}	0.1348
X_2 X_5 X_{11}	0.1375
X_4 X_8 X_{11}	0.1316

Table 3.21 Continued.

Explanatory variables	Covariability ratio
Y_1 = number of all risk claims of insurants having an excess of Hfl. 100.= or Hfl. 150.=, exclusive claims for damage of particular accidents	
X_1	0.0035
X_2	0.0031
X_4	0.0071
X_8	0.0042
X_{11}	0.1882
X_2 X_{11}	0.1938
X_4 X_{11}	0.1976
X_6 X_{11}	0.1922
X_9 X_{11}	0.1977
X_1 X_5 X_{11}	0.2029
X_1 X_6 X_{11}	0.2049
X_2 X_6 X_{11}	0.2015
X_2 X_8 X_{11}	0.2004
X_2 X_4 X_{11}	0.2080
X_4 X_6 X_{11}	0.2082
X_4 X_9 X_{11}	0.2081
X_6 X_9 X_{11}	0.2037
X_8 X_9 X_{11}	0.2031
X_1 X_2 X_5 X_{11}	0.2360
X_1 X_4 X_5 X_{11}	0.2231
X_1 X_4 X_6 X_{11}	0.2327
X_1 X_4 X_{10} X_{11}	0.2265
X_1 X_5 X_8 X_{11}	0.2200
X_1 X_6 X_{10} X_{11}	0.2203
X_1 X_6 X_{10} X_{11}	0.2208
X_2 X_4 X_5 X_{11}	0.2202
X_2 X_4 X_6 X_{11}	0.2281
X_2 X_4 X_9 X_{11}	0.2227
X_2 X_6 X_8 X_{11}	0.2137
X_4 X_6 X_9 X_{11}	0.2220
Y_1 = number of all risk claims of insurants having an excess of Hfl. 200 or higher, exclusive claims for damage of particular accidents	
X_1	0.0182
X_6	0.0218
X_8	0.0110
X_{11}	0.3433
X_1 X_{11}	0.3756
X_{10} X_{11}	0.3574

Table 3.21 Continued

Explanatory variables	Covariability ratio
Y_1 = number of claims for damage of particular accidents	
X_1	0.0035
X_4	0.0056
X_8	0.0084
X_{11}	0.0024
X_1 X_4	0.0157
X_4 X_8	0.0136
X_4 X_{11}	0.0105
X_1 X_4 X_8	0.0254
X_1 X_4 X_{11}	0.0215
X_4 X_8 X_{11}	0.0208
X_1 X_4 X_6 X_{11}	0.0341
X_1 X_4 X_8 X_{11}	0.0347

Table 3.22 A selection of estimated values of the covariability ratio of the claim size on sets of explanatory variables

Explanatory variables	Covariability ratio	
Y_2 = size of third-party claims		
X_5	0.0105	
X_6	0.0067	
Y_2 = size of all-risk claims of insurants having an excess of Hfl. 100.= or Hfl. 150.=, exclusive claims for damage of particular accidents		
X_2	0.0073	not significant
Y_2 = size of all- risk claims of insurants having an excess of Hfl. 200.= or higher, exclusive claims for damage of particular accidents		
X_1	0.0425	not significant
X_8	0.0440	
X_1 X_8	0.0973	not significant
Y_2 = size of the claims for damage of particular accidents		
X_5	0.0353	
X_6	0.0350	
X_7	0.0364	
X_5 X_6	0.0796	

Appendix A. Description of the collection of the insurance and claim data[5])

A.1. Introduction

This appendix provides a description of the insurance and claim data obtained, and the checks and corrections we performed on this data.

The insurance company delivered policy and claim data of 3,440 insurances as of 1 January 1972, and 9,974 policies as of 1 January 1973. The policy and claim data was checked extensively. Some corrections had to be made. First, some policies did not satisfy the conditions given in Section 2, and were therefore discarded. Second, in the case of some policies, the policy and claim documents contained error which could be corrected. Third, in the case of some policies, the policy documents did not give sufficient information about the vehicle insured or its regular driver, so that these policies had to be discarded too. As a result, we have information about 9,472 insurances as of 1 January 1972 and of 3,161 insurances as of 1 January 1973.

With respect to some policies, changes in insurance conditions appeared during the year 1971. Such changes might, for example, be in the type of (insurance) cover, in the vehicle insured, in the additional excess, change of residence. Concerning those policies, the company also delivered the policy data as of 1 January 1971. This concerned 1,262 policies. In the case of 3,365 of them, changes appeared during the year 1972.

The composition of a file of insurance policies will change during a year, because new insurances are taken out and other insurances are cancelled during the year. This implies that the composition of the file of policies currently running on 1 January 1972 is not the same as the composition of the file of policies currently running on 1 January 1973. We obtained information both about 1971 and 1972, concerning 652 policies and thus we have information about 11,981 different policies.

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5. The authors wish to thank Mr C.W.J.B. Slik and Mr F. Koudenburg, both from the Erasmus University Rotterdam, for their valuable help in collecting the data.

A.2. Description of the policy data

In addition to the information that is given in Section 2 about the sample of insurants, it is useful to make some remarks.

1. For most of the policies, the regular driver is also the policy holder. We apply the term "insurant", who can be either the regular driver, not being the policy holder, or both the regular driver and the policy holder, when it concerns the same person. The insurant's year of birth was not always known, especially in the case of older policies. For the insurance company it was only important to know whether the driver was 23 years of age or younger, or not. For youthful drivers the insurance company imposed an additional excess for each accident of Hfl. 150.=.
2. The data contains information about the insurant's residence. From this information we deduced the province where the insurant lived. We classified the place of residence according to the degree of urbanization, as laid down by The Central Bureau of Statistics (1960, 1968, 1974), with the addition of more detailed information concerning municipalities with over 100,000 inhabitants, and where some categories are combined. Table A.1 contains the several categories, showing the degree of urbanization we use.
3. The insurance company offered a premium reduction to insurants, whose occupation belonged to one of six particular categories. Data about other occupational categories are unknown. The occupational categories are:
   - civil servant,
   - clergyman,
   - teacher,
   - agrarian,
   - fruit grower,
   - nurse,
   - employee of the insurance company in question.
4. The insurance company did not distinguish between private and business use of the car. It applied the following classification for the car insurance division:
   - limited use (use of the car for 12,427.5 miles[6)] per year or less),
   - unlimited use (use of the car for over 12,427.5 miles per year),
   - use of the car including for transport of persons,

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6. The limit was actually 20,000 kilometres per year.

- use of the car including for teaching purposes,
- use of the car exclusively for own pleasure.

Cars used for teaching purposes and cars used for transport of persons formed specific categories. Moreover, these categories were small. These two categories were therefore omitted. The category "car used exclusively for own pleasure" was so small, that we did not deem it justified to treat this category separately. These cars have been classified in the category "limited use". We only distinguish between insurants who claim to drive 12,427.5 miles per year or less, and insurants who claim to drive over 12,427.5 miles per year.

5. We did not consider the make and type of the car to be a suitable factor for explaining the accident behaviour of the driver. It appeared from a former study concerning Dutch car insurances (cf. Van der Laan (1979)) that the weight and maximum speed of the car are associated with the number of accidents and with the amount of damage. We therefore collected information about these two characteristics, which was done on the basis of make and type of the car, its year of manufacture, and its list price. For this we used Bax (ed.) (1948 - 1973), and Autovisie (1962, 1965-1972). These publications give the maximum speed of the cars in ten kilometres per hour. We converted the given values into miles per hour.
6. The insurance company considered as the price of the car: the list price of a new car, of comparable make and type as the car to be insurant, at the moment the policy is taken out. When the type of the car to be insured was not in production any more at the time the policy was taken out, we took as the price of the car, the list price of a car of comparable type.
7. Two main types of insurance are distinguished in the Netherlands:
   (a) insurance against third-party risks, which covers the risks of causing damage to other persons;
   (b) casco insurance, which covers the risks of damage to the insurant's car.

   The insurance company derived from these two types of insurance the following types of coverage:
   - third-party (in the U.S.A. called: liability),
   - limited casco, which covers the third-party risks and the risks of fire, theft, storm, pane crack, etc., (in the U.S.A. called: comprehensive),
   - casco, which covers the risks of collision with another object (or upset of the car), the risks of collision with birds or animals, and the risks

of fire, theft, storm, pane crack, etc. (in the U.S.A. called: collision plus comprehensive),
- third-party plus complete casco, called "all-risk",
- third-party plus limited casco,
- third-party plus casco with additional excess,

A car owner is legally obliged in the Netherlands to insure his car against third-party risks, if this car is used on the public highway. An excess for third-party damages is legally excluded.

The casco insurance does not cover the entire amount of damage of someone's own car. The insurant always has an excess, which amounted to minimal Hfl. 150.= in 1971 and 1972. The insurant could increase his excess, by which the premium would decrease.

8. If an insurant did not claim damages during one or more subsequent insurance years, he got a premium reduction of:
   - 15% of the premium after one claim-free year,
   - 20% of the premium after two claim-free years,
   - 25% of the premium after three claim-free years,
   - 30% of the premium after four claim-free years,
   - 40% of the premium after five claim-free years.

   After a reduction of 30% or 40% has been given, and there has been only one claim in the subsequent insurance year, the reduction sequence starts with 15%, respectively, 20% at the first following premium expiry date after the claim date. This rule implies that the number of claim-free years does not have a one-to-one relationship to the percentage of the premium reduction an insurant obtains. In Subsection A.3 another reason is given for this.

   It may be expected that the insurant will compare the amount of the no-claim discount with the amount of the damage before deciding whether he will claim damages or not. We do not know, however, the amount of the no-claim discount. It seems to us that the percentage of the premium reduction is a better factor for explaining the number of accidents and the amount of damage, than the the number of claim-free years.

   The insurant did not lose his no-claim discount, and did not get an excess in case of damage to his car by fire, lightning strike, explosion, short-circuiting, storm, flood, tidal wave, earthquake, volcanic eruption, crash with free-running animals or with birds, and also not if damage is caused by theft, embezzlement or joyriding, or when it concerns only damage to the panes of car.

Table A.2 Municipality-groups by degree of urbanization*)

1.	Rural municipalities with 20% or more of the economically active male population in agriculture.		
2.	Urbanized rural municipalities with less than 20% of the economically active male population in agriculture and less than 20,000 inhabitants in built-up area.		
3.	Specific resident municipalities (satellite towns, suburbs, etc.) with over 30% non-indigenous commuters among the active male population.		
4.	Municipalities with less than 30,000 inhabitants in built-up areas.		
5.	Medium-sized towns with 30,000 - 99,999 inhabitants in built-up areas.		
6. - 8.	Large conurbations with 100,000 inhabitants or more in built-up areas, where the categories 6, 7 and 8 have the following meaning in the different provinces:		
	Groningen	6	Groningen (city)
	Overijsel	6	Enschede
	Gelderland	6	Apeldoorn
		7	Arnhem
		8	Nijmegen
	Utrecht	6	Utrecht (city)
	North Holland	6	Amsterdam
		7	Haarlem
		8	Hilversum
	South Holland	6	The Hague
		7	Rotterdam
		8	Leyden
	North Brabant	6	Eindhoven
		7	Tilburg
		8	Breda
	Limburg	6	Maastricht

*) Cf. Netherlands Central Bureau of Statistics (1960, 1968, 1974).

A.3. Description of the claim data

We studied the claims documents of all accidents reported by the insurants considered, which occurred in 1971 and in 1972. It could be accurately deduced, in general, the amount of indemnity paid, who was guilty, what type of damage was caused, if personal injury was involved, etc. We considered only those accidents, where the insurant was liable for the accident, and where indemnity was paid. Problems concerning the knock-for-

knock agreement and other agreements were avoided. In the case of those claims for damages where the exact facts of the case were not clear to us, employees of the insurance company kindly explained problems to us.

In addition to the information about the claim documents given in Section 2, we make the following remarks.

1. Concerning the driver's age, the insurance company only attached importance to the information whether the driver of the vehicle was 23 years of age or younger at the time of the accidents, because youthful drivers had an additional excess imposed by the company for each claim for damages. We can be certain that this date is accurate (as stated in the documents). Therefore, we confined ourselves to noting whether the driver was 23 years of age or younger, or not.
2. When the accident was of a particular type, it was traced what kind of accident it was. Damage, resulting from particular types of accidents can be:
   - damage to the panes of the car,
   - damage by theft,
   - damage by storm,
   - damage by fire,
   - damage by crash with free-running animals and with birds.
3. In cases where drivers who were insured with different insurance companies were involved in an accident, the companies did not always agree on the question of guilt. Sometimes it was not possible to reach agareement about who was the guilty party. The police-reports, if drawn up, did not always give a definite answer. In case of accidents which occurred abroad, it was mostly not stated who could be held responsible for the accident. Concerning these accidents, the indemnity was made on the basis of some damage agreement. The following cases occurred:
   - insurant and opponent each pay their own damage (the so-called knock-for-knock agreement),
   - each pays 50% of the total amount of damage (in the case of two parties),
   - each pays 25% of the total damage amount (in the case of four parties),
   - agreement for simplified damage settlement (in Dutch: Overeenkomst Vereenvoudigde Schaderegeling (O.V.S.)), which is an agreement between insurance companies concerning the insurants involved in accidents, who are insured by different companies, and where the accidents are of a particular nature.

- international damage arrangement (in Dutch: Internationaal Schade Accoord (I.S.A.)), where, for parties involved in an accident, each company in this arrangement pays 1/n-th part of the casco damage of the casco insurer, where n denotes the number of companies,
- question of guilt is not clear, the entire amount of damage is paid, the no-claim discount is reduced to 20%, after which this discount may increase again.

A.4. Check and correction of the insurance data

A number of check programs have been performed on the data obtained. It appeared that there were many inconsistences between and within the several headings. Moreover, not all data were known about some insurants. To correct the errors as fully as possible, the policy file of the insurants concerned was studied. In this section we shall discuss a number of problems we met.

The insurant's year of birth was not known in all cases. The study of the files did not always lead to the results desired. In some cases the year of birth might be incorrect, because the insurant had not yet reached 18 years at the moment of taking out the insurance. When studying the files, it appeared that in some cases the insurant had changed in the course of time, in other cases it appeared that the year of birth was incorrectly filled out.

In some cases the full address of the insurant was not filled out, but only the name of the street or the name of the insurant. This error was easy to rectify. There are several towns in the Netherlands with the same name. It was not always possible to determine in which province such a town belonged, or what was the degree of urbanization.

The make and type of the car did not always agree with the type of car (motor car or estate car). In most cases the type of the car was incorrectly filled out.

A small number of vehicles insured was not a motor car or an estate car. In the case of some policies it was stated that the vehicle insured at the end of the year was a motor car or an estate car, while the (same) vehicle insured at the beginning of the year was a delivery van. Such policies have been left out of the sample.

The car's year of manufacture was not known in some cases, but a good estimate of the year of manufacture could be made on the basis of the other known data.

The greatest problem was to determine accurately the number of claim-free years. The number of claim-free years were not always consistent with the accidents reported. These inconsistences may have several causes.

1. As soon as an accident has been reported, the heading "number of claim-free years" of the insurant in question is reduced to zero. However, not each accident implies an indemnity. This may be caused by a) the accident does not imply third-party damage, b) the amount of damage is less than the excess, or c) the insurant cancels his claim because it is more profitable not to claim and thus to retain his no-claim discount. If it turns out that indemnity will not be paid, the number of claim-free years is put back again to the old level. In cases of accidents, which are reported before the date the data were collected, and where it turns out later that indemnity has not been asked, the number of claim-free years is wrongly put equal to zero.
2. Concerning accidents where the knock-for-knock agreement has been applied, indemnity is not paid to the third-party. The amount of third-party damage is thus unknown. Moreover, it appeared that it was not always filled out correctly whether the knock-for-knock agreement was applied or not. If it was filled out that the knock-for-knock agreement was not applied, no indemnity was paid and the damage reserve was zero, the claim of damage was struck off. If, then, the number of claim-free years was zero, this heading might be filled out wrongly. When it was filled out that the knock-for-knock agreement was not applied, nor was the indemnity paid, while the damage reserve was not zero, and the number of claim-free years was not equal to zero or one, the heading "number of claim-free years" might be incorrectly filled out.

A.5. The accurancy of the data

In spite of a high degree of accuracy when checking the data, some imperfections in the material must be taken into account. In this section we will discuss some of these.

The price of the car is the most important premium-fixing factor in the operating premium rating system in the Netherlands. It may be assumed therefore that the price is filled out accurately. As mentioned on page 3, we took as the price of the car the price of a new car with the same make and

type at the time of taking out the insurance. This price is equal to the cost price of the car in case of new cars. With second hand cars this price may, however, be considerably higher than the historical cost price. This way of fixing the price implies that two cars, which have the same make and type and year of manufacture, may have different prices, because the cars are insured at different times.

The make and type of the car was not always filled out accurately. It often had to be decided what was the make and type of the car on the basis of insufficient information. Nor was it always possible to find out if the vehicle insured was a motor car or an estate car.

A shortage of material is caused by the fact that concerning each policy we have only information on 1st January and 31st December of some year. During that year more than one mutation may have occurred at different times. Only the date of the last mutation is known. We are compelled to asssume that all changes have occurred as of their last date of change.

The exact date of taking out the policy, of the last change, and of the occurring of an accident is not known. We must content ourselves with the information about the month in which the event occurred.

Only the year of birth of the regular driver and the year of manufacture of the car are known. Information about the exact date is not known.

It is important to know that an insurance company is not able to deliver data about all accidents. It can only procure information about accidents where indemnity has been paid to the insurant and/or the opponent. The number of accidents where indemnity has been paid is always smaller than the total number of accidents. There are three reasons for this.

(1) Not all risks, related to accidents, can be insured; the policy always contains some restrictions. Moreover, not all motorists have a casco insurance.
(2) Casco damages with an amount of damage lower than the excess are not considered for indemnity.
(3) The no-claim discount can rise to several hundred Dutch guilders. It may be profitable for the insurant not to claim damages when the amount of the damage is lower than the sum of the excess and the no-claim discount.

A consequence of this is that accidents with low amounts of damage are under-represented in the sample.

Finally, we should say something about the shortage of data relating to the number of miles driven per year. The only datum which is known of an insurant is his statement about whether he expects to drive either 12,427.5 miles per year, or less, or more. This datum is sufficient to determine whether an insurant is considered for a premium discount. It may be assumed that many insurants underestimate their number of miles driven per year, in order to obtain the premium discount. The correctness of the insurant's statement has been tested only if the insurant sends in a claim form.

Appendix B. Attachment of the annual mileage

B.1. Introduction

In Section 2 we gave an outline of the procedure we applied to connect both samples. In this appendix we discuss this further. We outline the problems we met in the dividing both samples into comparable groups (and subgroups), and describe the way in which we solved these. Finally, we present the results of the application of the procedure.

B.2. Problems with connecting the samples

1. The data with respect to both samples applies to different periods. The sample of motorists contains information about the year 1970, while the sample of insurants contains information about the years 1971 and 1972. As appeared from the publications of the Central Bureau of Statistics (1963, 1967, 1969, 1973), the use of cars by different categories of motorists is subject to change. So, we can expect that the use of cars in 1971 and 1972 will differ slightly from that in 1970. We can only hope that the changes may be ignored within the framework of this study.
2. As outlined in Section 2, we want to divide the sample of insurants and the sample of motorists in a number of corresponding, more or less homogeneous groups, on the basis of certain variables. The information about the sample of insurants, however, does not always concern the whole year. Some insurances are taken out in the (calender-) year 1971 or 1972. Moreover, the values of some variables may change during a calender-year, e.g., the buying of a new car may cause changes of the values of the variables "year of construction" and "price of the car". Such a change may imply that the insurant concerned shifts from one group to another. The number of miles driven per year will not, in general, be equally distributed over the different months of the year. We would need information about the number of miles driven during each month of the year. The sample of motorists contains only information about the whole year. Therefore we can only compute for each group of motorists the average number of miles per year. In order to proceed with the analysis of the number of accidents and the amount of damage in relation to the number of miles driven, we need to

assume that the number of miles driven per year is equally distributed over the different months of the year.

3. The third problem concerns the use of the information provided by the sample of insurants about the number of miles driven per year. It appeared that only about 10% of the insurants said they drove over 12,427.5 miles per year, while about 28% of the motorists appeared to drive over 12,427.5 miles per year. This difference may be partly explained by the difference in the composition of the two samples, but surely also partly by underestimation of the number of miles per year by the insurants. It may be profitable to underestimate the annual mileage, because when someone says that he drives less than 12,427.5 miles per year, he gets a premium reduction.

   In the case of the subset of agrarians, it appeared that over 60% of this subset from the sample of insurants said they drove over 12,427.5 miles per year, while only 13.5% of the subset of agrarians from the sample of motorists appeared to drive over 12,427.5 miles per year. This striking difference may be explained by the fact that a statement of agrarians about their expected annual mileage does not influence the amount of their premium. Agrarians already have the maximum premium discount. Because of this large difference, we consider the subset of agrarians separately, where we do not take into account the information concerning the statement of the insurant about his annual mileage.

   From the sample of motorists it appeared that motorists aged 64 or more, drive on average far fewer miles per year than motorists aged 63 years or less. This may be partly explained by the fact that, in general, retired persons, who form a subset of the set of motorists aged 64 years or more, do not drive for business purposes. Moreover, the number of motorists aged 64 or more is relatively small (5.3% of the sample of motorists). The statement about the number of miles per year of insurants aged 64 years or more, will therefore not be taken into account.

4. The fourth problem we met was in connection with the difference in occupational classification. The sample of motorists contains a category "agriculture and fishery", as well as a category "agrarian occupations and fishers". The insurance data equivalence of both categories is "agrarians". We tackled this problem as follows. Firstly, we combined the categories "agriculture and fishery" and "agrarian occupations and fishers" from the sample of motorists, into one category "agrarians and fishers", and,

secondly, we assumed that the difference between the annual mileage of agrarians and that of fishers is on average small. Then we are able to equate the category "agrarians and fishers" from the sample of motorists to the category "agrarians" from the sample of insurants.

5. In the case of a small number of motorists, we do not know the motorist's age. Of course we can omit these motorists, but it appeared that it is not necessary to do that. The distribution of the annual mileage by age of the motorist produces a division of the sample of motorists into two subsets, the subset of motorists with age $\leq$ 63 years, and the subset of motorists with age $\geq$ 64 years. With respect to the subset of motorists of unknown age, it appeared that a large number of their cars has been registered in name of a firm. The percentage of new cars in this subset, as well as the percentage of cars which are obtained for business purposes, is much higher than the corresponding percentages for the sample as a whole. We can therefore expect that the motorists from this subset do not belong to the subset of motorists with age $\geq$ 64 years. So we classify them in the subset of motorists with age $\leq$ 63 years.
6. The driver's age is not known for each insurant. The subset of insurants whose age is unknown must be considered separately from the subset of insurants whose age is known. We have no reason to assume that the subset of insurants whose age is unknown is a subset of selected insurants. Therefore we assume that whether the knowledge about the insurant's age is or is not present, is subject to accidental circumstances. Given this assumption we can utilize the whole sample both to estimate the annual mileage of insurants whose age is known, as to estimate the annual mileage of insurants whose age is unknown.
7. In the case of the data of the sample of motorists we found that the list price of the car is not known for each car. Knowledge about the price of second-hand cars is not of interest to us, because the sample of insurants does not give information about this datum. We cannot restrict the use of the sample of motorists to first-hand cars, because the sample of insurants contains both new and second-hand cars.

   The sample of insurants, however, gives information about a characteristic which may be helpful to us. This is the characteristic "type of insurance". We believe that the subset of insurants with a comprehensive insurance or with a third-party plus casco insurance with additional excess, will not differ very much from the sample of motorists with a first-hand car, as far

as it concerns the number of miles which one drives per year. Therefore, we identify the subset of motorists with a first-hand car with the subset of insurants with a comprehensive insurance or with a third-party and casco insurance with additional excess, and the subset of motorists with a second-hand car with the subset of insurants who do not have a comprehensive insurance or a third-party and casco insurance with additional excess.

8. Finally, the question arises: up to which expected value of the number of miles driven per year, the non-agrarian insurant aged 63 or younger states that he is a limited driver, that is, that he claims to drive less than 12,427.5 miles per year. This value will differ, of course, from the one insurant to another. It is impossible to trace this value for each individual insurant. The next task is therefore to construct more or less homogeneous groups of motorists, and to make estimates of this value for each group. This will be done in the following subsection.

B.3. The construction of homogeneous groups

The sample of motorists is divided into a number of groups according to the following characteristics of the motorists or their car:

M.1. occupation: (a) agrarian, (b) non-agrarian;

M.2. age of the motorist: (a) $\leq$ 63 years and age unknown, (b) $\geq$ 64 years, (c) all ages and age unknown;

M.3. new or second-hand car: (a) new car, (b) second-hand car;

M.4. price (in case of new cars): different categories;

M.5. age of the car: different categories;

M.6. region: different categories.

On the basis of this division we can form 186 groups of motorists.

Next, we classify the sample of insurants in an equal number of groups, according to six characteristics, which agree with the six characteristics M.1. - M.6., given above:

I.1. occupation: (a) agrarian, (b) non-agrarian;

I.2. age of the insurant: (a) $\leq$ 63 years, (b) $\geq$ 64 years, (c) age unknown;

I.3. type of insurance: (a) comprehensive insurance or third-party and casco insurance with additional excess, (b) other types of insurance;

I.4. list-price (in case of cars which are insurant by an insurance of type (a)): different categories;

I.5. age of the car: different categories;
I.6. region: different categories.

In the cases of the groups of motorists who are agrarian and/or who are aged 64 years or more - which amounts to 46 groups - we compute the average annual mileage for each group. With respect to these 46 groups, we attach to each insurant from the same group the average annual mileage of the corresponding group of motorists.

In the case of the motorists, respectively insurants, who are not agrarian and who are not aged 64 years or more, we apply a more extensive procedure. These motorists, respectively insurants, can be properly classified into 140 groups. With the help of the characteristic "use", we make a partition of each of the 140 groups into two subgroups.

The procedure runs as follows. The subset of the sample of insurants containing insurants who are not agrarian and who are not aged 64 years or more, is divided into 140 groups, on the basis of to the the characteristics:
I.1. (b): non-agrarians,
I.2. (a): age of the insurant $\leq$ 63 years,
I.2. (d): all ages and age unknown,
I.3. (a): comprehensive insurance or third-party and casco insurance with additional excess,
I.3. (c): all types of insurances,
I.4.: list price (in case of cars with a comprehensive insurance or with a third-party and casco insurance with additional excess),
I.5.: age of the car,
I.6.: region.
The sample of motorists is classified according to the characteristics: M.1. (b), M.2. (a) and (c), M.3. (a) and (b), M.4. (in case of new cars), M.5., and M.6. The reason for taking category I.2. (d) instead of category I.2. (c), and category I.3. (c) instead of category I.3. (b) is, that these categories correspond better with the classification of the motorists than a classification on the basis of I.2. (c) and I.3. (b).

Within each group of motorists, we arrange the motorists according to the order of magnitude of the annual mileage. Then, we divide each group of motorists into two subgroups: limited, respectively unlimited, drivers, according to the percentage limited, respectively unlimited, use of the car of the corresponding group of insurants, in such a way that each motorist, classified as a limited driver, drives less than a certain value of the annual

mileage, and each motorist, classified as an unlimited driver, drives more than that value of the annual mileage. As a matter of course, the value of the annual mileage which divides the motorists into limited and unlimited drivers, differ from group to group. In this way we get 280 subgroups of motorists. For each subgroup we compute the average annual mileage.

Next, we go back to the sample of insurants, which is now classified according to the characteristics: I.1. (b), I.2. (a) and (c), I.3. (a) and (b), I.4., I.5. and I.6. Each group is divided into two subgroups on the basis of the characteristic "use". In the case of all, so-determined, 280 subgroups of insurants, we attach to each insurant of any subgroup, the average annual mileage of the corresponding subgroup of motorists.

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