Insurance factors identification

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The data gives the details of third party motor insurance claims in Sweden for the year 1977. In Sweden, all motor insurance companies apply identical risk arguments to classify customers, and thus their portfolios and their claims statistics can be combined. The data were compiled by a Swedish Committee on the Analysis of Risk Premium in Motor Insurance. The Committee was asked to look into the problem of analyzing the real influence on the claims of the risk arguments and to compare this structure with the actual tariff.

```
Insdata <- read.csv("Insurance_factor_identification.csv")
View(Insdata)

dim(Insdata)
```

```
## [1] 2182    7
```

```
summary(Insdata)
```

```
##    Kilometres         Zone          Bonus            Make
##  Min.   :1.000   Min.   :1.00   Min.   :1.000   Min.   :1.000
##  1st Qu.:2.000   1st Qu.:2.00   1st Qu.:2.000   1st Qu.:3.000
##  Median :3.000   Median :4.00   Median :4.000   Median :5.000
##  Mean   :2.986   Mean   :3.97   Mean   :4.015   Mean   :4.992
##  3rd Qu.:4.000   3rd Qu.:6.00   3rd Qu.:6.000   3rd Qu.:7.000
##  Max.   :5.000   Max.   :7.00   Max.   :7.000   Max.   :9.000
##     Insured             Claims           Payment
##  Min.   :     0.01   Min.   :   0.00   Min.   :       0
##  1st Qu.:    21.61   1st Qu.:   1.00   1st Qu.:    2989
##  Median :    81.53   Median :   5.00   Median :   27404
##  Mean   :  1092.20   Mean   :  51.87   Mean   :  257008
##  3rd Qu.:   389.78   3rd Qu.:  21.00   3rd Qu.:  111954
##  Max.   :127687.27   Max.   :3338.00   Max.   :18245026
```

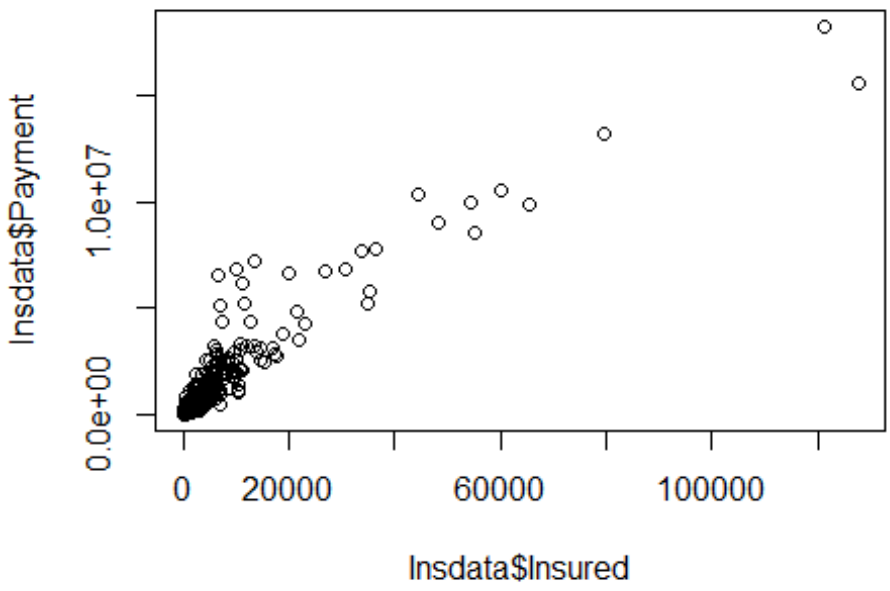
```
cor(Insdata$Claims,Insdata$Payment) #--high +ve correlation
```

```
## [1] 0.9954003
```

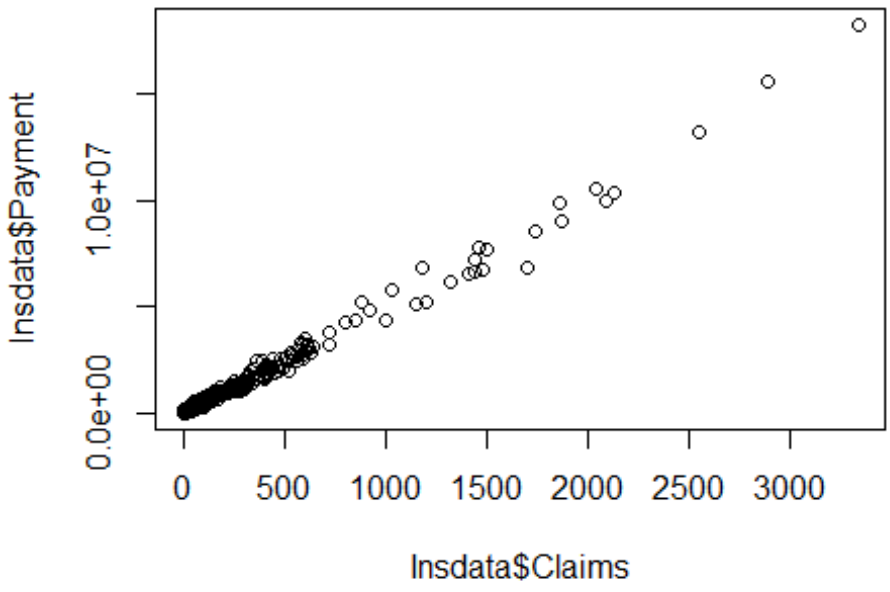
```
cor(Insdata$Insured,Insdata$Payment) #--high +ve correlation
```

```
## [1] 0.933217
```

```
plot(Insdata$Insured,Insdata$Payment)
```




```
plot(Insdata$Claims,Insdata$Payment)
```



```
lineModel <- lm(Payment ~ ., data = Insdata)
summary(lineModel)
```

```
##
## Call:
## lm(formula = Payment ~ ., data = Insdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -806775  -16943   -6321   11528  847015
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -2.173e+04  6.338e+03  -3.429 0.000617 ***
## Kilometres   4.769e+03  1.086e+03   4.392 1.18e-05 ***
## Zone         2.323e+03  7.735e+02   3.003 0.002703 **
## Bonus        1.183e+03  7.737e+02   1.529 0.126462
## Make        -7.543e+02  6.107e+02  -1.235 0.216917
## Insured      2.788e+01  6.652e-01  41.913  < 2e-16 ***
## Claims       4.316e+03  1.895e+01 227.793  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 70830 on 2175 degrees of freedom
## Multiple R-squared:  0.9952, Adjusted R-squared:  0.9952
## F-statistic: 7.462e+04 on 6 and 2175 DF,  p-value: < 2.2e-16
```

```
?apply
```

```
## starting httpd help server ... done
```

```
ZoneResult <- apply(Insdata[,c(5,6,7)],2, function(x)tapply(x, Insdata$Zone,
mean))
ZoneResult
```

```
##      Insured     Claims   Payment
## 1 1036.17175  73.568254 338518.95
## 2 1231.48184  67.625397 319921.52
## 3 1362.95870  63.295238 307550.85
## 4 2689.38041 101.311111 537071.76
## 5  384.80188  19.047923  93001.84
## 6  802.68457  32.577778 175528.47
## 7   64.91071   2.108844   9948.19
```

```
KmResult <- apply(Insdata[,c(5,6,7)],2, function(x)tapply(x,
Insdata$Kilometres, mean))
KmResult
```

```
##     Insured   Claims   Payment
## 1 1837.8163 75.59453 361899.35
## 2 1824.0288 89.27664 442523.78
```

```
## 3 1081.9714 54.16100 272012.58
## 4  398.9632 20.79493 108213.41
## 5  284.9475 18.04215  93306.12
```

```
BonusResult <- apply(Insdata[,c(5,6,7)],2, function(x)tapply(x,
Insdata$Bonus, mean))
BonusResult
```

```
##     Insured    Claims   Payment
## 1  525.5502  62.50489 282921.99
## 2  451.0754  34.23397 163316.62
## 3  397.4737  24.97419 122656.17
## 4  360.3867  20.35161  98498.12
## 5  437.3936  22.82109 108790.50
## 6  805.8167  39.94286 197723.82
## 7 4620.3728 157.22222 819322.48
```

```
md <- lm(Insdata$Claims ~ Insdata$Kilometres + Insdata$Zone + Insdata$Bonus +
Insdata$Make + Insdata$Insured)
```

```
summary(md)
```

```
##
## Call:
## lm(formula = Insdata$Claims ~ Insdata$Kilometres + Insdata$Zone +
##     Insdata$Bonus + Insdata$Make + Insdata$Insured)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1214.57   -25.18    -9.41    10.04  1301.78
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)         37.1230027  7.1270679   5.209 2.08e-07 ***
## Insdata$Kilometres -3.9648601  1.2255209  -3.235  0.00123 **
## Insdata$Zone       -6.2924300  0.8647405  -7.277 4.75e-13 ***
## Insdata$Bonus      -4.2468101  0.8707236  -4.877 1.15e-06 ***
## Insdata$Make        6.7725342  0.6755390  10.025  < 2e-16 ***
## Insdata$Insured     0.0318697  0.0003158 100.933  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 80.14 on 2176 degrees of freedom
## Multiple R-squared:  0.8425, Adjusted R-squared:  0.8421
## F-statistic:  2328 on 5 and 2176 DF,  p-value: < 2.2e-16
```