Drogi zaufania

Zwiększanie Potencjału
Na Rzecz Bezpieczeństwa Ruchu Drogowego

Building Road Safety Capacity

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NARODOWA STRATEGIA SPÓJNOŚCI

Generalna Dyrekcja Dróg Krajowych i Autostrad

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Effectiveness of Collision Avoidance Systems

(FCW & LDW)

Actuarial Research

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Who are we?

Ron Actuarial Intelligence LTD is an actuarial consulting firm based in Israel and offering consulting services in Israel and abroad.

Ron Actuarial Intelligence LTD was chosen to maintain the market pool data of policies and claims related to Motor Bodily Injury insurance (MBI) in Israel following a bid issued by the insurance regulator at the end of 2009.

the pool data assists the regulator and the insurers with pricing of MBI policies by gathering and analyzing data from all insurers and transportation authorities and advising risk-based price to the regulator and the insurance companies.

Ron Actuarial Intelligence LTD's advise is consider a trusted tool to ensure insurance companies' stability on one hand, and to determine a fair rate for policyholders on the other.

What are Collision Avoidance Systems?

LDW – Lane Departure Warning – when the driver unintentionally departs from the lane (without signaling) the system alerts.

FCW – Forward Collision Warning – in case the vehicle faces a danger of collision with an object in front of it, the system will provide a warning of a few seconds before the collision.

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Who did initiate the study ?

The research of Collision Avoidance Systems (CAS) was conducted at the request of the Israeli insurance regulator (the Israeli Ministry of Finance)

The regulator provided data (license number and date of installation) on vehicles equipped with Collision Avoidance Systems to be analyzed against the whole branch (Motor Bodily Injury) data.

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What did we investigate?

In this study, we investigated the influence of a Forward Collision Warning (FCW) system and a Lane Departure Warning (LDW) system (hereby "the system"), on the expected Motor Bodily Injury claim frequency and cost in Israel.

The main model guideline was to analyze and eliminate the impact of all other factors in order to establish the net impact of the Collision Avoidance Systems on claim frequency.

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What was expected?

The regulator expected us to advise the recommended discount rate in Motor Bodily Injury policies for vehicles equipped with LDW & FCW.

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What was the data?

The database included 9,891 vehicles equipped with the system. The data included the date of installation but not the date of removal or any verification of the system is functionality.

The database included mainly private cars.

We have merged the database we received from the Israeli insurance regulator (that included the vehicles equipped with the system) together with the Israeli database of all insurance companies - a database we already had as part of our market pool data.

Levels of claim frequencies

	Exposure - policy Years 2009 -2012	Number of Claims	Claims Frequency
Privately owned car w/o the system	6,486,415	161,973	2.5%
Privately owned car equipped with the system *	5,366	55	1.02%
Company owned car w/o the system	1,251,264	24,715	1.98%
Company owned car equipped with the system *	824	8	0.97%

*** we didn't add IBNR estimate to the number of reported claims**

So what can we figure out from the table?

The figures in the table suggest that installing the system can reduce claim frequency by 59%.

However, this result should be analyzed after the removal of confounding variable (hereby "confounders") in order to isolate the effect of a particular hazard and to prevent anti-selection.

That's why we used the SAS PROC GENMOD procedure.

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Using the SAS PROC GENMOD…

In order to neutralized the confounders we used **SAS PROC GENMOD procedure** which allows to analyze claim frequency using **Log Linear Regression**, assuming claims are distributed either Poisson or Gamma.

We have tested the validity of the model, and only significant explanatory variables with a rate of significance lower than 5%, were kept in the model.

As we didn't add IBNR estimate to the number of reported claims, the model output allowed analysis the change rate of claim frequency, without providing the ultimate frequency.

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Generalized Linear Model (GLM)…

The results were estimated using a Generalized Linear Model.

The explanatory variables were driver's and vehicle's characteristics (as far as these were available).

We assumed that claim amount distribution is either Poisson or Gamma.

It should be advise that other explanatory variables were not included in our model (such as road safety, infrastructure, etc).

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The Results…

Our calculations concluded that for **privately owned private car,** the frequency of Motor Bodily Injury claims is reduced by approximately 44% for vehicles equipped with LDW&FCW, compared to vehicles without the systems.

For **company owned private car**, the frequency of Motor Bodily Injury claims is reduced by approximately 47%, But the validity of this result is questionable as the level of exposure and number of claims for these vehicles was not statistically significant.

Nevertheless, the two results support each other.

*More detailed results (95% Confidence Interval)

Variable Name	Category	Influence on accident frequency	coefficients
LDW & FCW	Not Equipped	0%	1.00
LDW & FCW	Equipped	-44%	0.56
accident history	No claims	-38%	0.62
accident history	At least 1 claim	0%	1.00
age	17-24	0%	1.00
age	25- 32	-18%	0.82
age	33 -44	-25%	0.75
age	45-120	-28%	0.72
Prod. year	Before 1998	0%	1.00
Prod. year	2001- 1998	-9%	0.91
Prod. year	2006- 2002	-19%	0.81
Prod. year	+2007	-29%	0.71
ESP	Not Equipped	0%	1.00
ESP	Equipped	-22%	0.78

*The results presented are only part of the significant variables

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Thanks for listening,

Any Questions ?

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What is Generalized Linear Model (GLM)?

From Wikipedia, the free encyclopedia

In statistics, the generalized linear model (GLM) is a flexible generalization of ordinary linear regression that allows for response variables that have other than a normal distribution. The GLM generalizes linear regression by allowing the linear model to be related to the response variable via a link function and by allowing the magnitude of the variance of each measurement to be a function of its predicted value.

Generalized linear models were formulated as a way of unifying various other statistical models, including linear regression, logistic regression and Poisson regression. They proposed an iteratively reweighted least squares method for maximum likelihood estimation of the model parameters. Maximum-likelihood estimation remains popular and is the default method on many statistical computing packages.

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What is an actuary?

Actuaries are experts in risk management. They use their mathematical skills to help measure the probability and risk of future events. This information is useful to many industries, including healthcare, pensions, insurance, banking and investments, where a single decision can have a major financial impact.

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Confounders

In statistics, a confounding variable (or confounder) is an extraneous variable in a statistical model that correlates (positively or negatively) with both the dependent variable and the independent variable. A perceived relationship between an independent variable and a dependent variable that has been misestimated due to the failure to account for a confounding factor is termed a spurious relationship, and the presence of misestimating for this reason is termed omitted-variable bias. it is important to control for confounding to isolate the effect of a particular hazard such as a food additive, pesticide, or new drug.

Examples of confounders are anti-selection, such that a bigger group of younger drivers may choose vehicles equipped with or without the system; or that the vehicles equipped with the system are generally safer than the ones without the system.

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