

Session 090: Applications of Vehicle History in Auto Insurance Rating and Underwriting

SOA Antitrust Compliance Guidelines SOA Presentation Disclaimer



INSURING THE MODERN VEHICLE

Applications of vehicle-specific attributes in auto insurance rating and underwriting

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The power of segmentation

 Insurers discriminate between risks to determine the costs associated with providing insurance coverage.



Effective segmentation

Lift

- Members of segments must be effectively identified.
- There must significant differences between the segments

Performance

- Between Average frequency or severity must be different for different segments
- Among Variance between members of the same segment should be random and low.



Increasing Segmentation

LESS SEGMENTED

Driver Classification

- Age, gender, marital status
- Driving records

Territory Classification

- Urbanity
- Population density

Vehicle Classification

- Year, make and model
- Cost new (Symbol)

MORE SEGMENTED

Driver-Specific Data

- Credit history
- Driving behavior (UBI)

Location-Specific Data

- Weather models
- Commute and traffic data

Vehicle-Specific Data

- Advanced safety features
- Vehicle history



Vehicle-level rate adjustments

MORE COMMON

- Passive Restraint Systems
 - Automatic seat belts.
 - Driver-side and passenger-side airbags.
- Anti-Lock Brakes
- Daytime Running Lights
- Anti-Theft Systems
- Stolen Vehicle Recovery Systems

LESS COMMON

- Rearview Cameras
- Front Collision Avoidance
- Blind Spot Detection
- Lane-Departure Warning Systems
- Tire-Pressure Monitoring Systems
- Emergency Response Systems



Vehicle attributes in underwriting

- Companies are offering discounts on safety features that provide very little effective segmentation.
- Many advancements in vehicle safety are ignored in underwriting and rating.
- Safety features are evolving at a breakneck pace.





Automatic Seat Belts

Raise your hand if you have ever ridden in a car with one of these:





Automatic Seat Belts

Raise your hand if you have ever ridden in a car with one of these:



Now put it down if you have ever watched a broadcast of this show:







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ADAS: ADVANCED DRIVER ASSISTANCE SYSTEMS

The low-hanging fruit of auto segmentation

Vehicle Safety Features





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Advanced Vehicle Safety Features – Prior to 2006

- All-wheel drive systems
- Safety belt pretensioners
- Safety belt load limiters
- Active head restraints
- Advanced airbag deployment systems
- Tire pressure monitoring systems
- Side-impact airbags
- Automatic door locks

- Antilock brakes
- Electronic brake assist
- Electronic stability control
- Traction control
- Sturdy body cell
- Crumple zones
- Cargo barriers
- LATCH



Advanced Vehicle Safety Features – Since 2006

- Visualization and augmented reality
 - Rear-view camera
 - Heads-up display
 - Infrared night vision
 - 360° Overhead View
 - Adaptive headlamps
 - Automatic high beams
 - HID and LED headlights
 - Matrix headlights
 - Traffic monitoring and warning
 - Congestion avoidance GPS
- Adaptive cruise control

- Collision avoidance and mitigation systems
 - Forward automatic emergency braking
 - Rear automatic emergency braking
 - Lane-keeping assist
 - Lane-centering assist
 - Automatic parking
- Collision warning systems
 - Forward-collision warning
 - Blind-spot warning
 - Rear cross-traffic warning
 - Lane-departure warning
 - Driver alertness detection



Safety Equipment Fitment

Insurance Institute for Highway Safety Highway Loss Data Institute



Bulletin | Vol. 31, No. 15 : September 2014 Predicted availability of safety features on regist

HIGHWAY LOSS

Prior Highway Loss Data Institute (HLD) studies have indicated that some collision anotherce systems The regions can see measure proof sector serve includes the serve consol accurate systems Cain begancy reductors were load across all of the coult related coverages for fract coult prove cam experies reasons were note and an in the crain reaction of the crain reaction of the control of the system body pipy lability claims indicate the systems are backloning as intended because the systems are orang agary manang uninte transient we openmis our nanisariang na national comman we openmis are the severity of base-to-rear crashes, the type of crash-that typically results in a budity rigary kability cla collision warning systems estimated reductions in body riser liability claim frequencies of 4-9 percent terman manage of entry international transmission of the state of the or even question to a source and reactions or source operations and processor associations interact formation broquercy by 14-32 percent. While the reductions are source, these systems were first introduced on a s

Consequently, the impact of these systems in the population of all crashes has been limited. Sensing technologies are evolving. Early trant creats prevention systems were radar based while reveer sy

other grows support and proving bedrocking in the province province grows when one reason when every and max, and or a basics of different sensing bedrockings. As the sensing technologies have reviewed, the provi and, as a consequence, some rare locary vehicles are now available with these inclusions for mample. ann, an a conserption of a stand front creak provention system and lane departure system. A study of that syste interformen a cannor same run som provinsi ginne om non operare grann, o may to om spe Inganssiss across al of the crash related coverages. The body risey labbly reductors was a statistically a i trapareces actus ar or no osno renor solorgan, ser song very nette renorman en al actuation en a solorador de Handa Accard is one of the best soling cars in the linked States. Given the high sales volume of this vehicle. retratementers in one or sen once strang was an one souther atoms, were ere regis south a more or our working forei crash provention system on the Accord could have an impact on group insurance bases. Handa's decise erine orano prevension systeme on tree nacione coutre nare an experi on gross internative income, nonces o ancie this technology may cause other manufactures to equip comparable vehicles with comparable technologies

A prior report from HLDI (2012) showed that it typically takes approximately three decades for technologies to n processor monerana por casa por casa como a special panto approximante en un occasion ne monerangem en De current analysis case amiliar methodologi har foccases en collision avoidance instante. To analysis share t me samme anayos cano amoar menososogo na nocario an colosion menorico materio, ino anayos anno 4 dinados belere mostrochicles an the road could have a given loature, either bocase it came ao standard equip retraction preserves many preserves are non-conservation or a general measure, many preservation in termination or termination or preserve and preserve of all registered vehicles could have near park at en reports to design to the next set state data year on process of an ingeneric retrained out in the label States in 1995, Front crash prevention systems, which rolled out in the label States in 2000, of ne is se universities that is a reactive union provident spectra, where the second state of the second sta * In Summarian in stream on some on supporting, the scalar answerse microsoft in two on answerse to be provide used 2048, Federal mandates would accolorate the fitness of these features. As shown below, a mandate for 201 speed up the persentation of some features in the feet by as much as 8 years.



HLD

Bulletin | Vol. 32, No. 16 : September 2015

Predicted availability of safety features on registered vehicle a 2015 update

Prior Wighway Lans Data Indiada (18.19) studies have indicated that some collision an advector of dama are realizing insure Can begang postdare was bard arms al of the can colded on eages to react build can present a react of presenting system. tudă năry bălăș daine rekole be tost cash presenter system an hindaraty in blandal becano be a dami to present or colleging the same ofly of trank to over a context, the logic of create that hypocally results in a booldy playing same includence of transmit collector security of dataset and analyzations to booldy playing balance can be proportioned of 4-33 liavatite beni is be also grader for these systems that added autorement insiding lepters that practicel autorement locale paper bailing class inseparent in 1.4 16 percent Windo har materian are st date, here system were bed stray reaction of herary valuetin. Conseparents, his impact of these options as the population of all contex has been instan

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Curve-Adaptive Headlights



Highway Loss Data Institute. Sep 2017. Predicted availability and fitment of safety features on registered vehicles. *Loss Bulletin*. Vol. 34, No. 28. Arlington, Virginia.



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FREQUENCY LIFT Curve-Adaptive Headlights





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Front Collision Warning



Highway Loss Data Institute. Sep 2017. Predicted availability and fitment of safety features on registered vehicles. *Loss Bulletin*. Vol. 34, No. 28. Arlington, Virginia.



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MORE INFORMATION. BETTER DECISIONS

FREQUENCY LIFT Front Collision Warning



Back-up Camera



Highway Loss Data Institute. Sep 2017. Predicted availability and fitment of safety features on registered vehicles. *Loss Bulletin*. Vol. 34, No. 28. Arlington, Virginia.



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FREQUENCY LIFT Back-up Camera



MORE INFORMATION. BETTER DECISIONS

Vehicle Safety Equipment – The next 6 years



Highway Loss Data Institute. 2012, 2015, and 2017. Data compiled from various reports. *Loss Bulletin*. Vol. 28, No 26; Vol 32.16; Vol. 34, No. 28. Arlington, Virginia.



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MORE INFORMATION. BETTER DECISIONS

Advanced Safety Features and Insurance Pricing

Consumer Expectations¹

46.1% of auto insurance customer believe that safety technology like blind spot warning or a rear-view cameras affect their insurance rates.

Average Insurance Rating²

Original Premium	\$1,434	
Electronic Stability Control	- 7	- 0.49%
Electronic Stability Control	0	0.00%
Collision Preparation System	0	0.00%
Blind Spot Monitoring	0	0.00%
Driver Alertness Monitoring	0	0.00%
Lane Departure Warning	0	0.00%
Rear-View Camera	0	0.00%
Heads-Up Display	0	0.00%
Night Vision	0	0.00%
Discounted Premium	\$1,427	

- 1. The Zebra. *Auto Insurance Awareness* Survey. October, 2017. Austin, TX.
- 2. The Zebra. *Why Car Technology That Makes You Safer Won't Lower Your Insurance Rates.* https://www.thezebra.com/research/new-car-tech-wont-lower-insurance-rates/#key-findings



Challenges

- Fitment data is difficult to get.
 - OEMs limit data based on contractual obligations or competitive concerns.
 - Branding and packaging make identification difficult.
 - Available data is incomplete or contradictory.
- ADAS features are often optional equipment.
 - Insurers are reluctant to trust car buyers to correctly identify what technology their vehicle has on board.
 - Difficult to validate which features are fitted.
- Some features may be turned off by the vehicle owner.
- Limited claims data to accurately determine pricing.
- Performance differences between and even among manufacturers.



The Morale Hazard of ADAS

2018 Survey by the AAA Foundation for Traffic Safety

- About 75% of owners find ADAS useful and trust it.
- About 70% of owners want their next car to be equipped with ADAS.
- 30% feel comfortable looking away from the road to engage in other activities while using adaptive cruise control.
- 55% use the blind spot monitor for lane changes without visual confirmation.
- 33% feel comfortable looking away from the road, making a phone call or sending a text while using lake keeping assist.
- 45% utilize the rear cross traffic feature without a visual check.





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INFOTAINMENT AND CONVENIENCE

Other vehicle attributes that impact insurability

Push Button Start



- Convenience feature becoming ubiquitous
- Eliminates automatic safety interlock
 - Combined with auto-start, people leave vehicles on but unattended
 - Often no audible warning if vehicle is left running
- Vehicles restart and move on their own with no driver
- Carbon monoxide poisoning*
 - 28 deaths
 - 45 others suffered injuries

"Deadly Convenience: Keyless cars and their carbon monoxide toll". *The New York Times*. May 13, 2018. New York, NY.



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MORE INFORMATION, BETTER DECISIONS

Infotainment Systems



Infotainment Systems – The best and worst

Least Distracting

- Fiat Chrysler
- Ford/Lincoln
- GM (except Cadillac)
- Hyundai/Kia
- Nissan

E-Grane &

- Subaru
- Toyota
- Volkswagen

Moderately Distracting

- Audi
- BMW
- Honda (except Accord)
- Infiniti Q50
- Mazda
- Mini

Most Distracting

- Acura
- Cadillac Cue
- Lexus NX, RX, GS, LS, and LC
- Mercedes-Benz
- Tesla Models S and X
- Volvo xC60, xC90, S90, and V90



Infotainment Systems



- Infotainment system designs contribute to distracted driving.
- Navigation is more distracting than texting or calling.
- Newer systems are more distracting.
- Results vary by manufacturer and trim.



Strayer, D.L. Cooper, J.M., Goethe, R.M., McCarty, M.M., Getty, D. & Biondi, F. Visual and Cognitive Demands of Using In-Vehicle Information Systems. *AAA Foundation for Traffic Safety.* 2017.

Infotainment Systems – OEM vs Phone-based



- Not all created equal
- Voice commands beat center stack
- Android Auto is significantly less distracting in Voice Mode
- Standardized platforms may improve Apple and Android results over time.



Infotainment Systems – Older drivers



- Take longer to complete in-vehicle information system tasks
- Experienced higher levels of cognitive and visual demand
- Effect apparent across all modes of interaction

MORE INFORMATION. BETTER DECISIONS







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VEHICLE HISTORY

Insurance scoring for your car

What is vehicle history?



What is vehicle history?

OWNERSHIP

- Number of owners
- Length of ownership
- Leased vs. owned
- Registration gaps
- Lien
- Repossession

USE

- Total miles
- Average annual miles
- Changes in annual miles
- Registration type
- Historical use
- Gaps in coverage

CONDITION

- Maintenance
 - Scheduled
 - Unscheduled repairs
- Damage
 - Accidents
 - Structural damage
 - Flood, Fire or Hail
 - Thefts
- Open recalls



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Ownership History Number of Owners

- One-owner cars are more valuable in the used-car marketplace.
- Fewer owners means fewer opportunities for neglect.
- Earlier owners tend to have to follow maintenance schedules more closely.
- Cars needing frequent or major repairs may be replaced rather than repaired
- Lemons tend to change hands more often.





Lift from Number of Owners Univariate Analysis



CARFAX Univariate Data Analysis, 2006-2015.



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Ownership History Certified Pre-Owned Vehicles

- Tend to be newer, lower-mileage, second-owner vehicles
- Undergo thorough inspection from manufacturer
 - Meet strict criteria for condition
 - Consistent maintenance history
- Vehicles reconditioned by factory-trained technicians
- Covered under extended warranties
 - Minor repairs are not skipped
 - Repairs done at dealerships





Ford

Backed by

Lift from Number of Owners with CPO Univariate Analysis



CARFAX Univariate Data Analysis, 2006-2015.



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Ownership History Current Owner Length of Ownership

CARFAX studies show that the longer a car is owned, the better the risk becomes.

- Newer cars are less familiar.
- Newer cars are used on longer drives.
- Minor damage is more likely to be reported on newer cars.
- Lemons get moved on to new owners.





Lift from Length of Ownership **Univariate Analysis**



CARFAX Univariate Data Analysis, 2006-2015.



MORE INFORMATION. BETTER DECISIONS

Ownership History Average Length of Ownership



Owners tend to hold on to "good" vehicles

- Repair savings outweigh replacement costs, even when opportunity cost of driving older vehicle is considered
- Problem vehicles change hands often

PROBLEM VEHICLES ARE MORE LIKELY TO HAVE SAFETY ISSUES



Vehicle Use Components

TYPE OF USE

- Personal
- Commercial
- Government
- Police
- Farm
- Seasonal
- Show cars

FREQUENCY AND AREA OF USE

- Mileage
- Registration vs garage ZIP
- Out-of-area service



Vehicle Use Current Registration Type

- Less likely to be fraudulently reported than self-reported use
 - Tax incentives for commercial registrations
 - Significant penalties for misreporting
- Used in underwriting to match customers to most appropriate coverage



Vehicle Use Lift from Self-Reported Mileage



Source: TransUnion Performance Analytics Database, 2006-2010



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Self-Reported Mileage

- Often Inaccurate
 - Customers may not know how much they drive
 - Significant cost incentive to underreport
 - Agents underreport to save time
- Can change over time
- Difficult for insurers to verify





Lift from Annual Mileage Univariate Analysis



Source: TransUnion Performance Analytics Database, 2006-2010



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Vehicle Condition Components

KNOWN DAMAGE

- Severe accidents
- Minor accidents
- Title brands
- Flood and water damage
- Fire damage
- Hail damage
- Airbag deployment

PROBLEM CONDITIONS

- Service history
- Collision repair records
- Claims history
- Failed safety inspections
- Open recall
- Stolen and recovered
- Repossessed vehicles



Vehicle Condition Accident Damage

- Structural integrity is compromised
- Repairs may be improperly or incompletely done
 - May cause sensitive electronics to fail
 - Damage to critical structural components may be missed
- Low-quality aftermarket safety components may fail



Lift from Non-Severe Accidents Univariate Analysis



Source: TransUnion Performance Analytics Database, 2006-2010



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Vehicle Condition Flood Vehicles

Flood water can damage several components of vehicle

- Antilock braking systems.
- Electronic safety system sensors.
- Passive and active restraint systems.
- Rusted structural components.
- Water damage inside engine, transmission and other components.

"When a car's electrical systems have been compromised, it may no longer be safe or roadworthy."

- U.S. Department of Justice



Vehicle Condition Branded Titles

Salvage Titles

- Precluded by many underwriting plans
- Need copy of title

Rebuilt Titles

- Repairs may not meet standards
- Often incomplete or improper repair

Fire and Flood Titles

 Possible damage to sensitive electronic or critical structural components

UNDERWRITING RULES

3.1 Ineligible vehicles

The following vehicles are not eligible for coverage under the policy:

 b) Vehicles carrying a salvage, junk, total loss or similar title brand, whether repaired or certified for use on public roads or not.





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Lift from Branded Titles over Time Univariate Analysis



Source: TransUnion Performance Analytics Database, 2006-2010



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Vehicle Condition Potential Damage

Indications of damage that is likely to affect insurability

- Frame inspected
- Police accident report
- Collision repair facility records
- Failed inspections
- Auction damage disclosure



Lift from Vehicle Damage **Univariate Analysis**



MORE INFORMATION. BETTER DECISIONS

Source: TransUnion Performance Analytics Database, 2006-2010



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IMPLEMENTATION

Pulling it all together

Vehicle-based underwriting matters more than ever



IHS Automotive. June 2019. Average Age of Cars and Light Trucks in U.S. Rises Again in 2019 to 11.8 Years. IHSMarkit Online Newsroom. Southfiled, MI

- Vehicles are lasting longer
 - Average age in 2019: 11.8 years
 - More differences as new technologies come to the road
 - More variance in drivability among vehicles of similar ages
 - More history per vehicle
- Model year and symbol don't describe older vehicles well



Use in Underwriting



- Some attributes are already in use
 - Salvage titles not eligible for coverage
 - Mileage verification
 - Commercial use
 - Government or Non-Profit use
- Customer service
 - Establishes a touch-point
 - Helps find the best coverage for hard-tocover risks
- Front-end flags for fraud detection



Use in Rating



- Many interactions between variables
 - Carefully consider impact on other variables
 - Multivariate analysis is needed to get the most out of the data
 - May result in replacement of some proxy variables
- Good candidate for a scoring or tiering model
- Fits well as a modification to symbols
- Can be "averaged" across the policy



Use in Product Development

- Opportunities for new product innovation
 - Advanced safety feature discounts
 - Product enhancements for older one-owner cars or CPO cars
- Can be used as a lead-in for usage based insurance
 - Identify low mileage personal use vehicles
 - Combine with policy information to 'slot' customers into appropriate UBI tiers
- Product differentiator in a commodity market





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QUESTIONS

Vehicle Attributes in Auto Insurance Rating and Underwriting