

Vehicle Rating Using Predictive Modeling Techniques

Apex Discussion Series

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Vehicle Rating Using Predictive Modeling Techniques

About the Speakers

LeRoy Boison is a principal and consulting actuary in Pinnacle's New York office. LeRoy has over 40 years of experience as an actuary and previously worked at ISO for over 30 years where he was part of the developmental team for the Vehicle Series Rating (VSR) program.



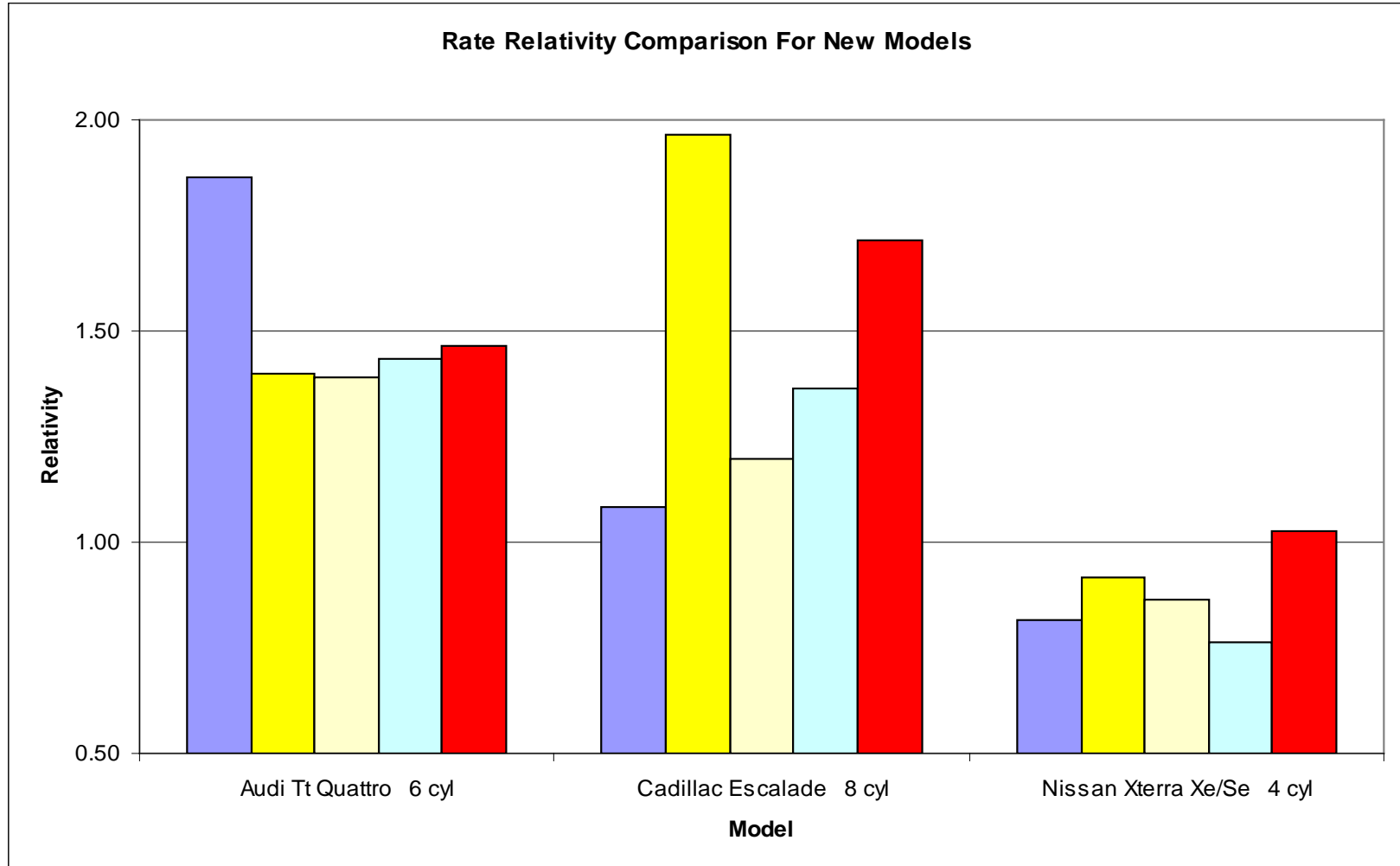
Gary Wang is a consulting actuary in Pinnacle's Bloomington office. Since joining Pinnacle in 2005, Gary has worked extensively on the application of advanced statistical modeling techniques to the insurance process.



Vehicle Rating

- New Vehicles have historically been rated by “comparison to similar” existing vehicle – **becoming less accurate as new, different vehicle type are being introduced.**

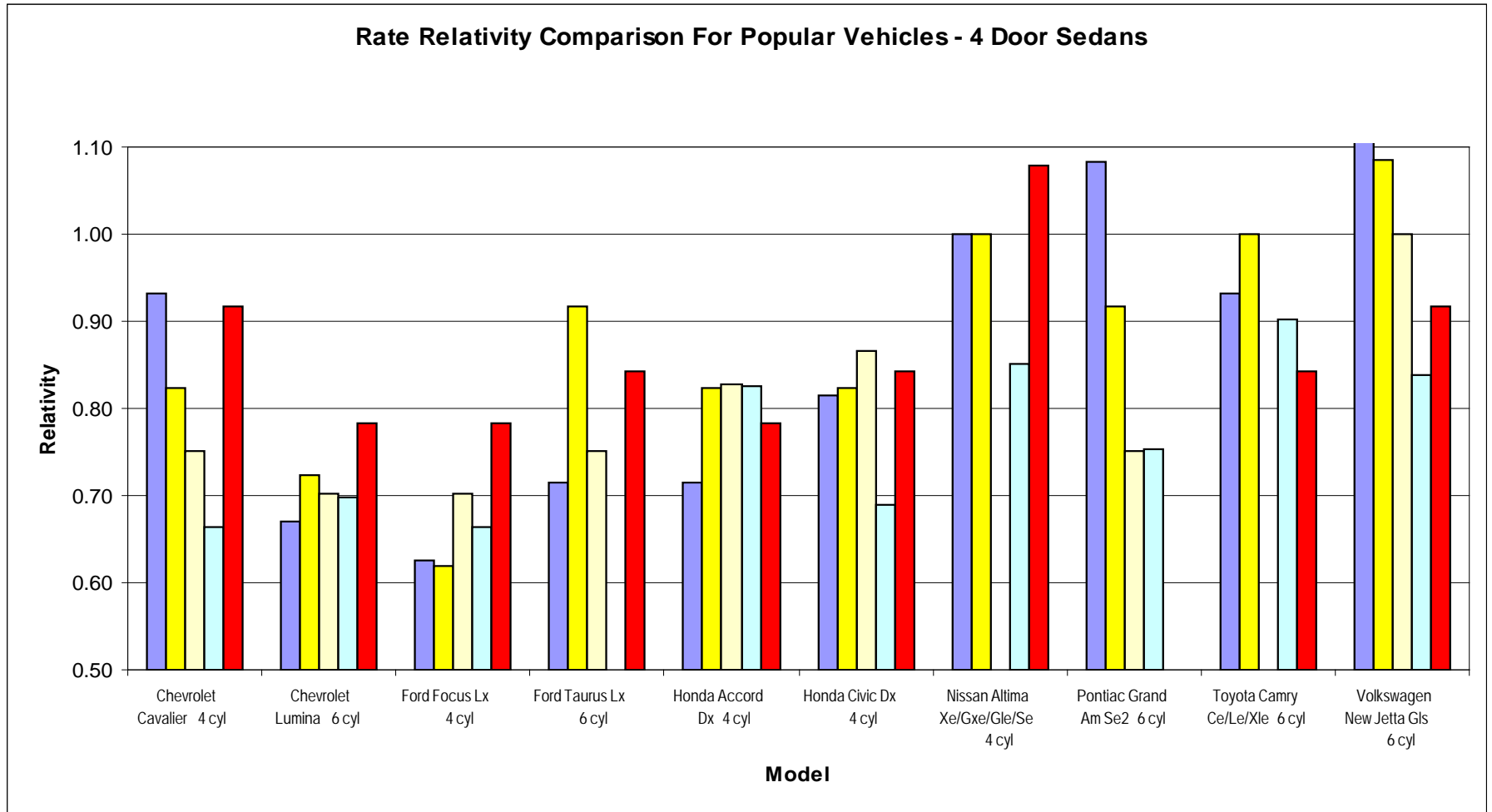
Significant Differences By Company for New Models



Significant Differences By Company for New Models

- Difference in rates > 80%
- The Porsche Boxster symbol assignment from inception dropped at least 5 symbols.

Significant Differences By Company for Most Popular Models



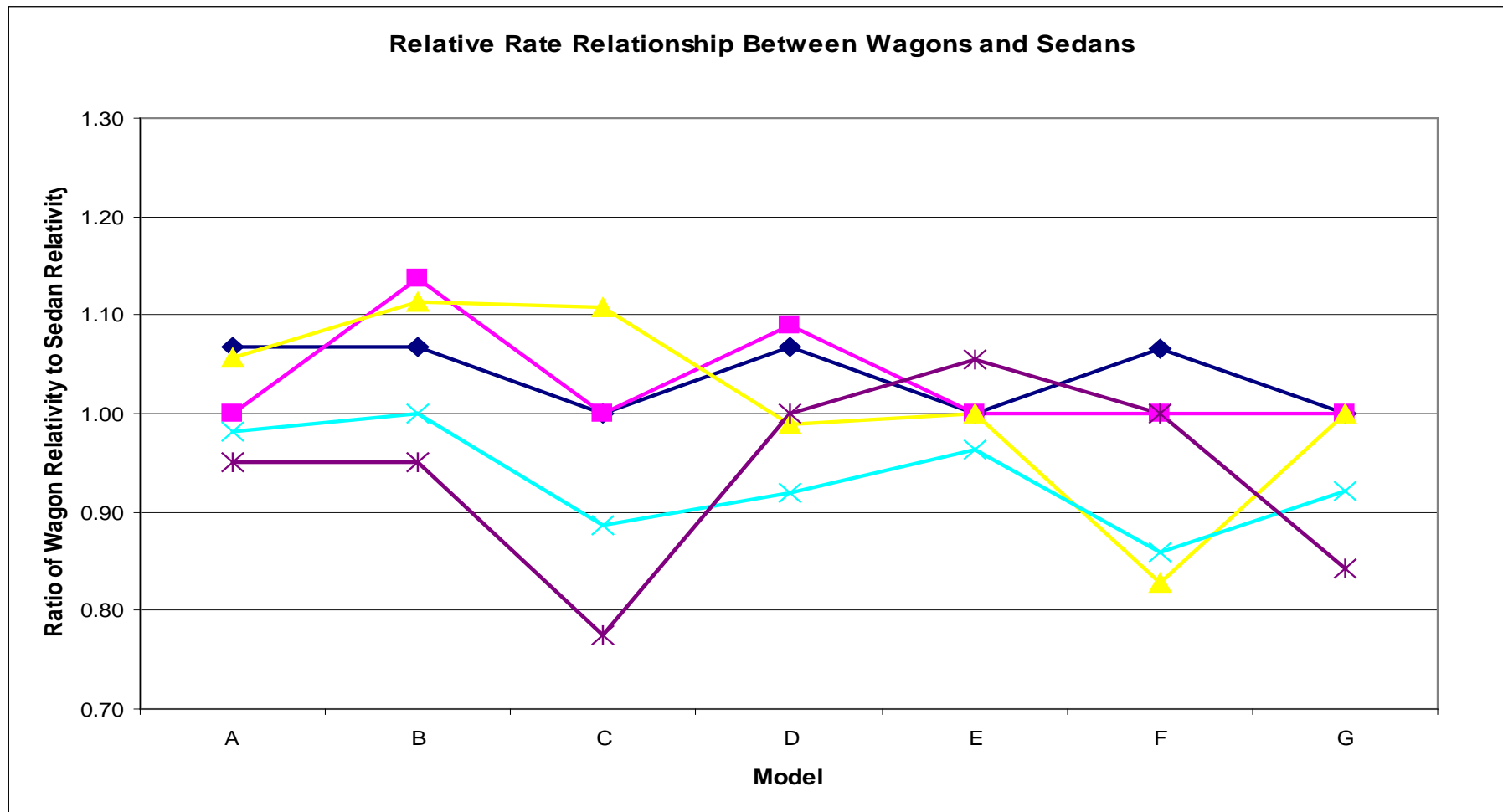
Significant Differences By Company for Most Popular Models

- Smallest difference with high and low company is 16%
- Greatest difference is 44%
- Average difference is 28%

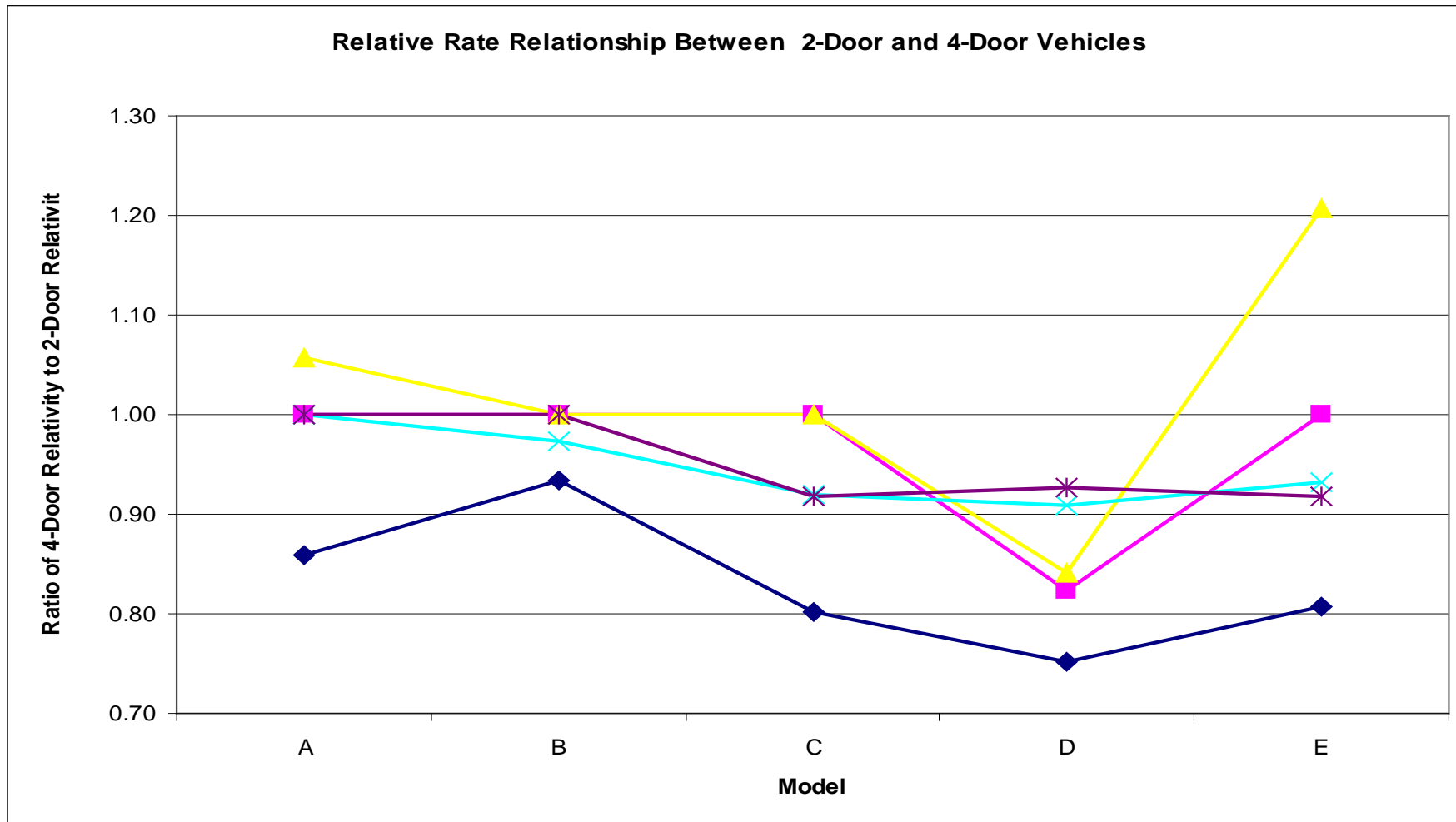
Sports/Luxury Models

- Variations for “published” rates are 32% to 137%
- Differences may be greater as some companies do not provide “published” rates for these models

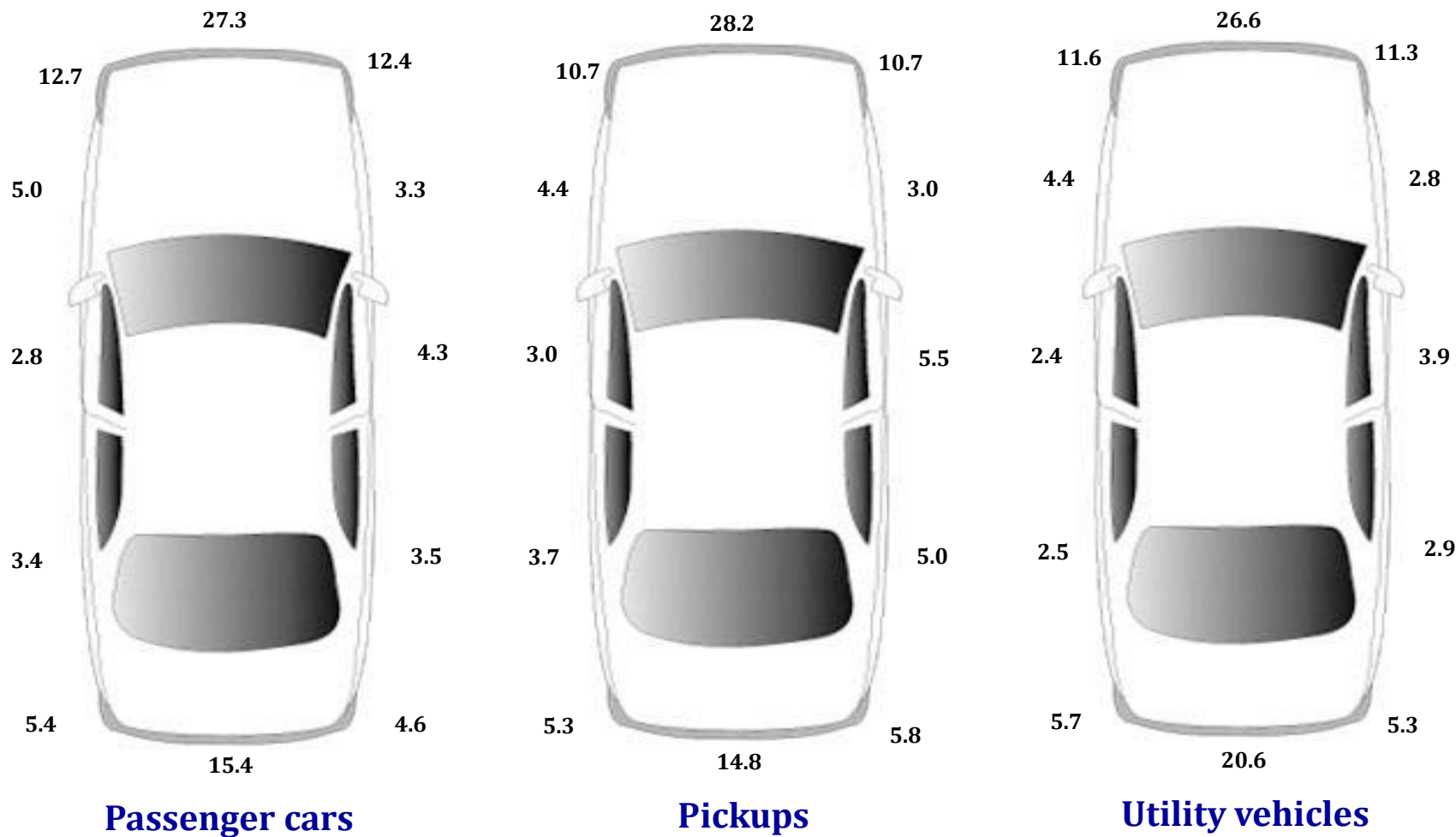
Differences Exist By Type of Models



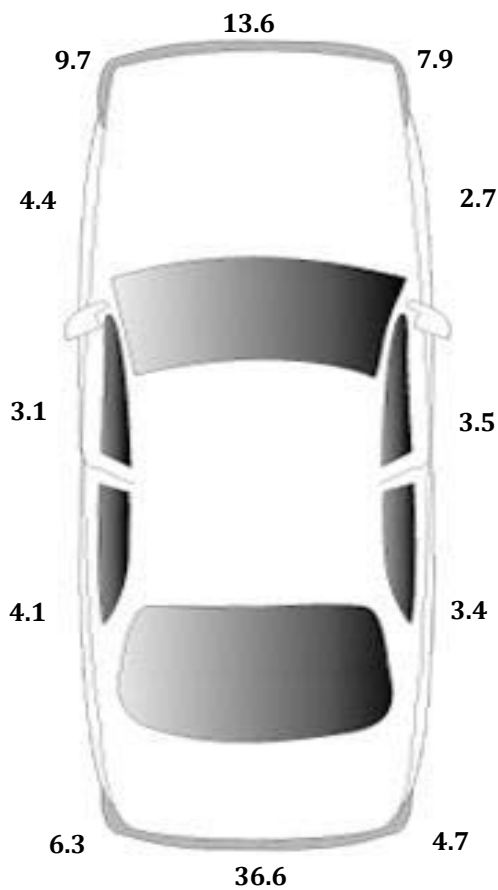
Differences Exist By Type of Models



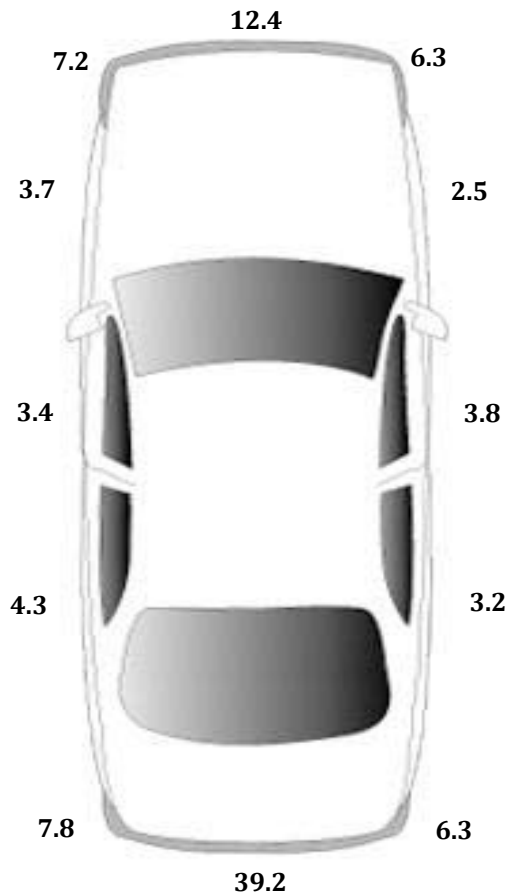
Percent of Collision Claims by Point of Impact By Vehicle Type



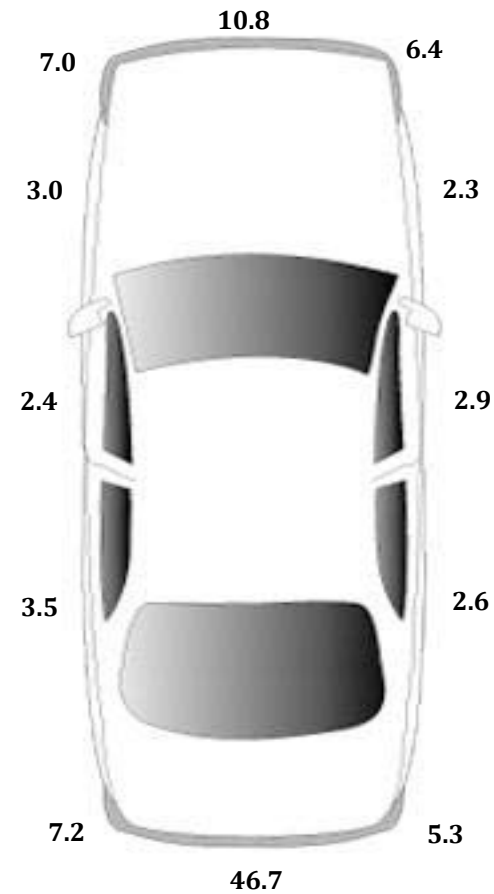
Percent of Property Damage Liability Claims by Point of Impact by Vehicle Type



Passenger cars



Pickups



Utility vehicles

Solution to Rear Accidents

- Back up avoidance device
 - beep, beep, beep
 - camera
- Mirror

Electronic Stability Control

- Electronic stability control could prevent nearly one-third of all fatal crashes and reduce rollover risk by as much as 80%; effect is found on single- and multiple-vehicle crashes

ESC - availability

- ESC is standard on 40 percent of 2006 passenger vehicle models and optional on another 15 percent.
- It's standard on every 2006 Audi, BMW, Infiniti, Mercedes, and Porsche.
- Another 8 vehicle makes (Cadillac, Jaguar, Land Rover, Lexus, Mini, Toyota, Volkswagen, and Volvo) offer at least optional ESC on all of their models.
- But ESC, standard or optional, is limited to 25 percent or fewer models from Chevrolet, Dodge, Ford, Hummer, Mazda, Mitsubishi, Saturn, Subaru, and Suzuki.

Aluminum Parts, Hybrid Cars Boost Crash Costs

- Auto repair costs are going up in part because of changes in parts and new, more complex vehicles, an insurance information management firm said.
-(NU Online News Service, March 3, 12:25 p.m. EST)

Edmunds - Top 10 High-Tech Car Safety Technologies

1. Tire-pressure monitoring
2. Adaptive cruise control/collision mitigation
3. Blind-spot detection/side assist/collision warning
4. Lane-departure warning/wake-you-up safety
5. Rollover prevention/mitigation
6. Occupant-sensitive/dual-stage airbags
7. Emergency brake assist/collision mitigation
8. Adaptive headlights and/or night-vision assist
9. Rearview camera
10. Emergency response

Data Sources

- Company Data
- Industry Data
 - HLDI
- Vehicle Characteristics Data
 - HLDI
 - Polk
 - ISO
- Other Vehicle Data of Interest
 - Carfax

Possible Vehicle Characteristics

Model year	High performance code	Roof type
Symbol	Ton rating	Transmission
Daytime running lights	Vehicle existing damage	Theft deterrence device
Anti lock brakes	Anti theft device	New / Used indicator
ESC (Electronic stability control)	Emergency brake assist/collision mitigation	
Airbags/passive restraint	Cost price new	Blind-spot detection/side assist/collision warning
Height, weight, wheel base	Body type	Tire Pressure Monitoring
Engine type/size	Emergency response	# of doors
Make	Lane Keeping	Backup avoidance
Model	Adaptive headlights and/or night-vision assist	Construction
Segmentation	Fuel type	

Additional Non-traditional Characteristics

- Branded title
- Length of last ownership
- Salvaged
- Prior damage
- Was vehicle repossessed

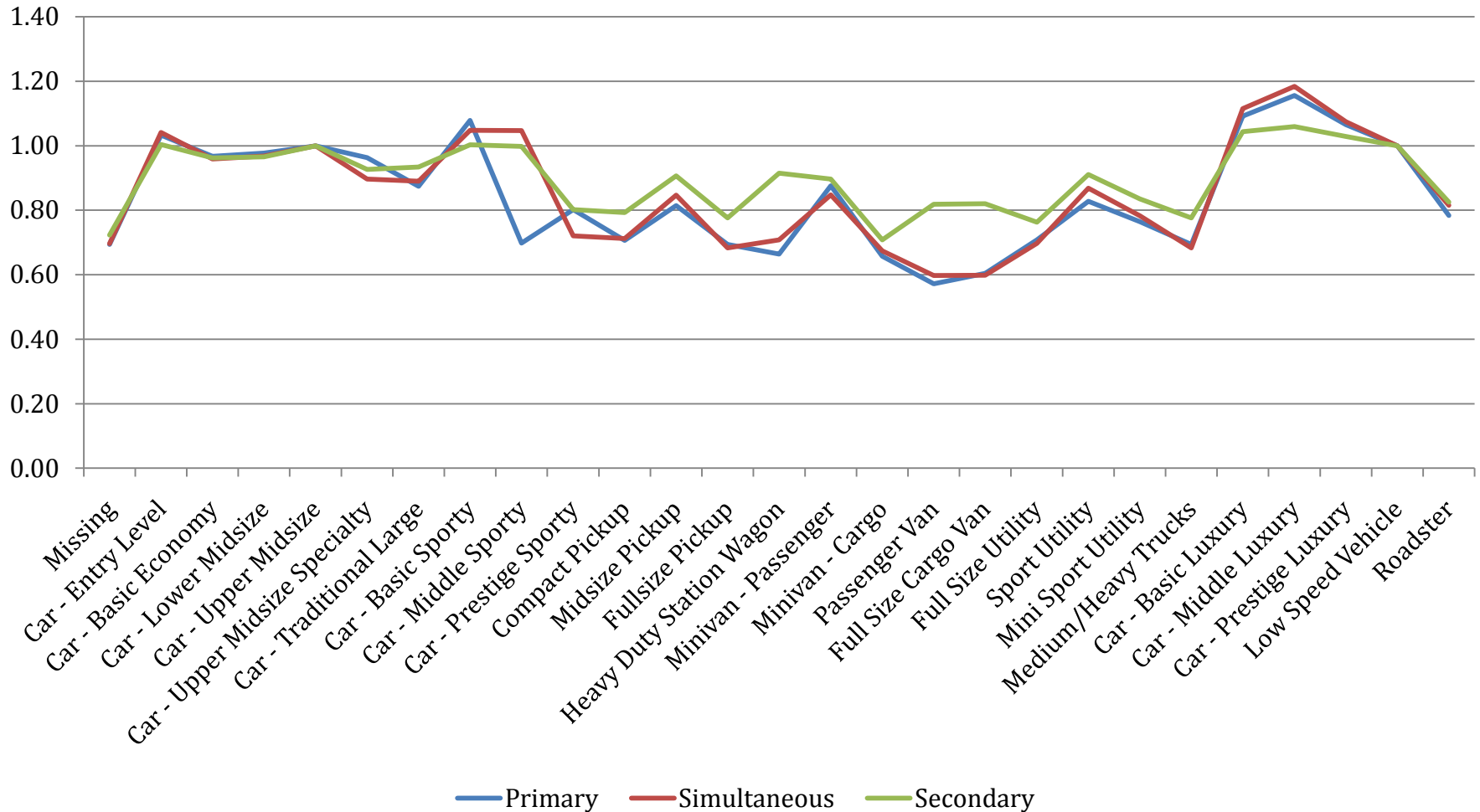
How to Define a Vehicle

- Several approaches to categorizing a vehicle
 - Name
 - Make, Model, Series
 - Raw Dimensions
 - Length, Width, Height, Wheelbase, Weight, Engine
 - Type of Vehicle
 - Segmentation Code
 - Vehicle Size / Vehicle Class

Segmentation Example

Compact Pickup	Full Size Utility	Basic Economy (Car)
Midsize Pickup	Sport Utility	Lower Midsize (Car)
Fullsize Pickup	Mini Sport Utility	Upper Midsize (Car)
Heavy Duty Pickup	Medium/Heavy Trucks	Upper Midsize Specialty (Car)
Minivan (Passenger)	Basic Luxury (Car)	Traditional Large (Car)
Minivan (Cargo)	Middle Luxury (Car)	Basic Sporty (Car)
Passenger Van	Prestige Luxury (Car)	Middle Sporty (Car)
Full Size Van (Cargo)	Entry Level (Car)	Prestige Sporty (Car)

Segmentation – Collision Frequency Example



Segmentation – Collision Frequency Example

- Model results will differ depending on mix of characteristics
 - For example, the introduction of Make/Model will influence the relativities for the Segmentation variable
 - Statistically, none of the alternatives are “incorrect”
 - However, the more variables that correlate with each other, the more difficult one can make intuitive sense of the output relativities

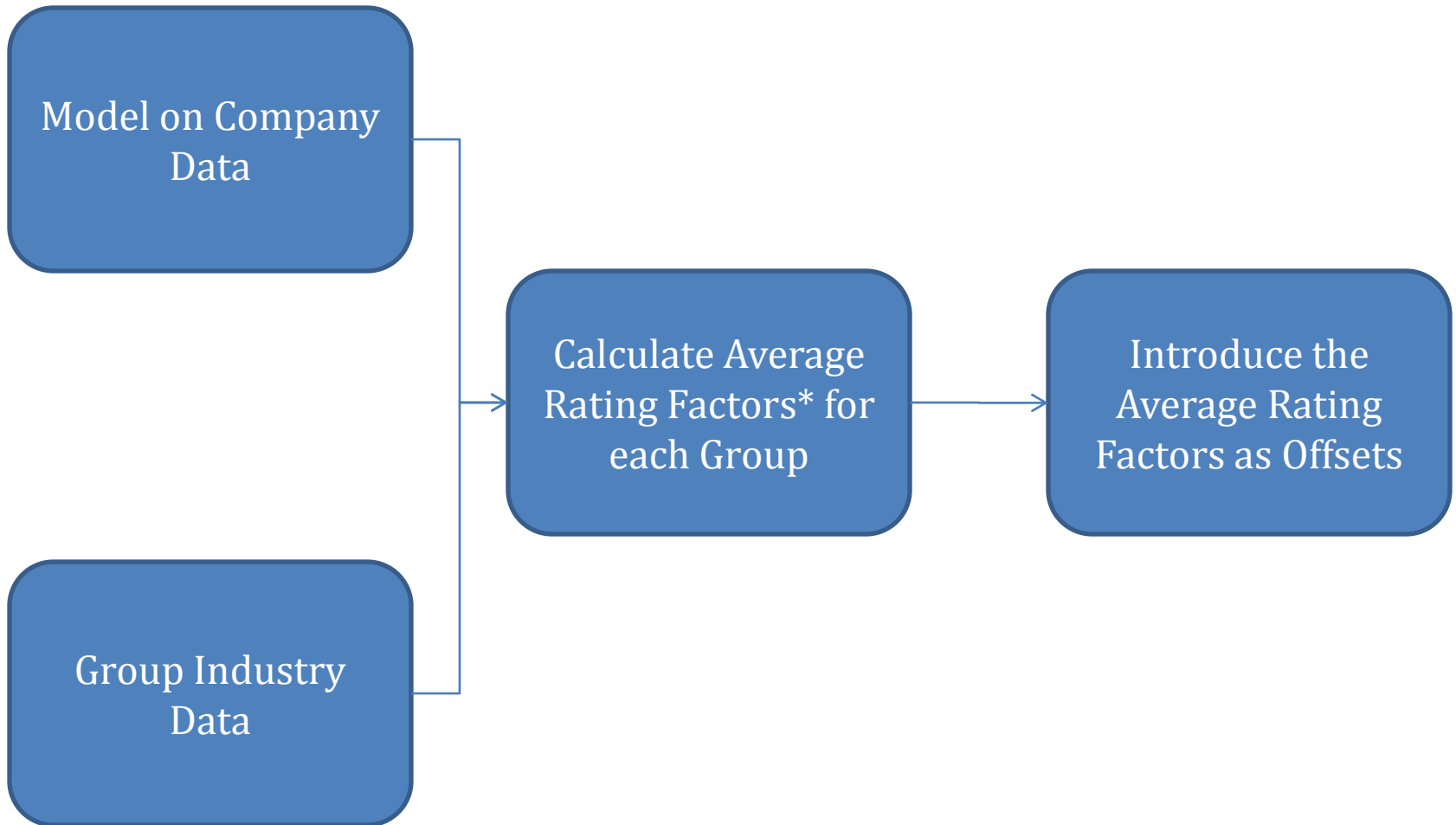
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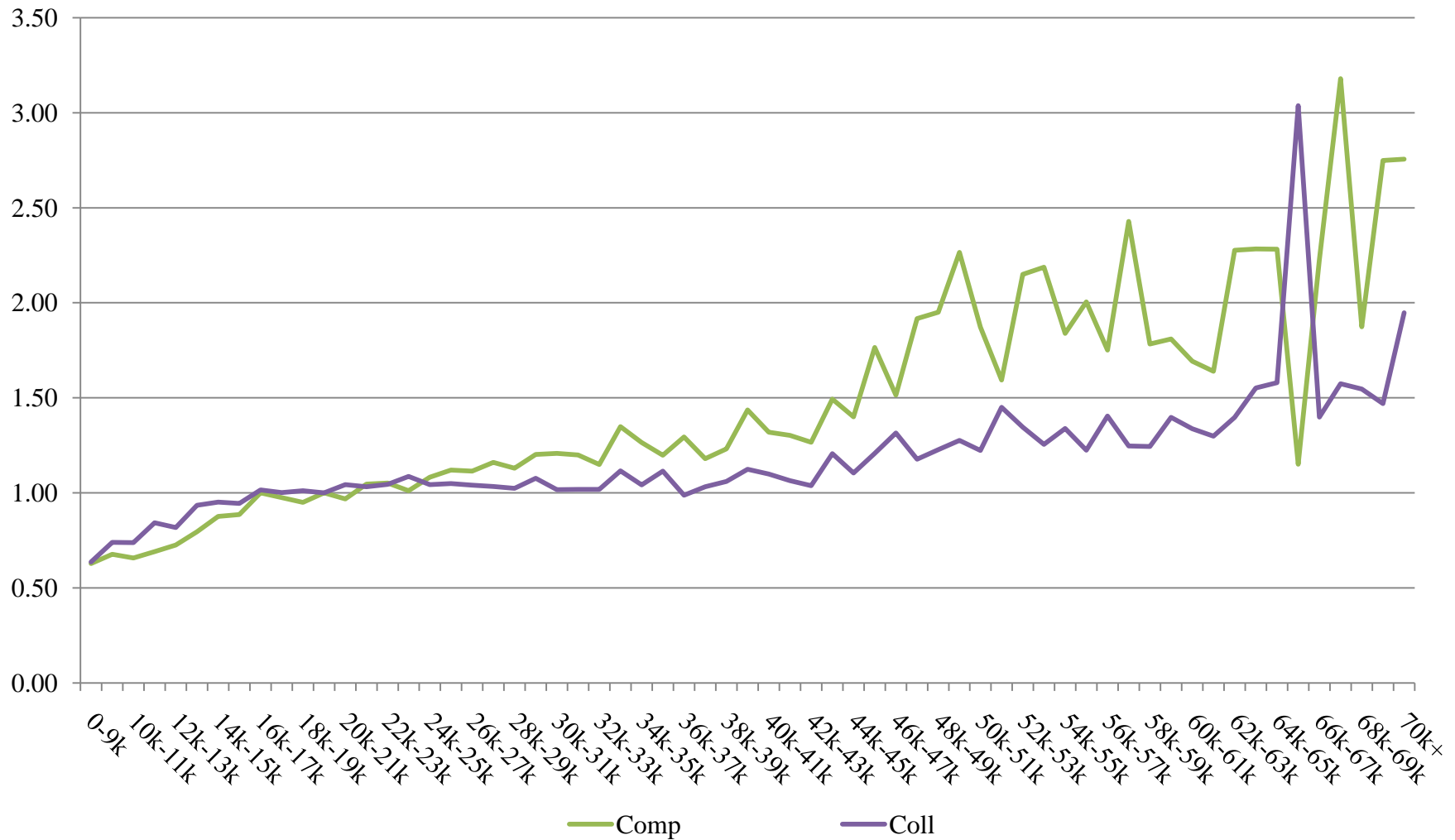
Average Rating Factors

- The vehicle symbol rating is part of the rating plan
- The presence of non-vehicle characteristic elements should be considered
 - Can assume independence of distribution for the non-vehicle characteristics
 - Not realistic in practice
 - Vehicles as a tool
 - Vehicles as a status symbol

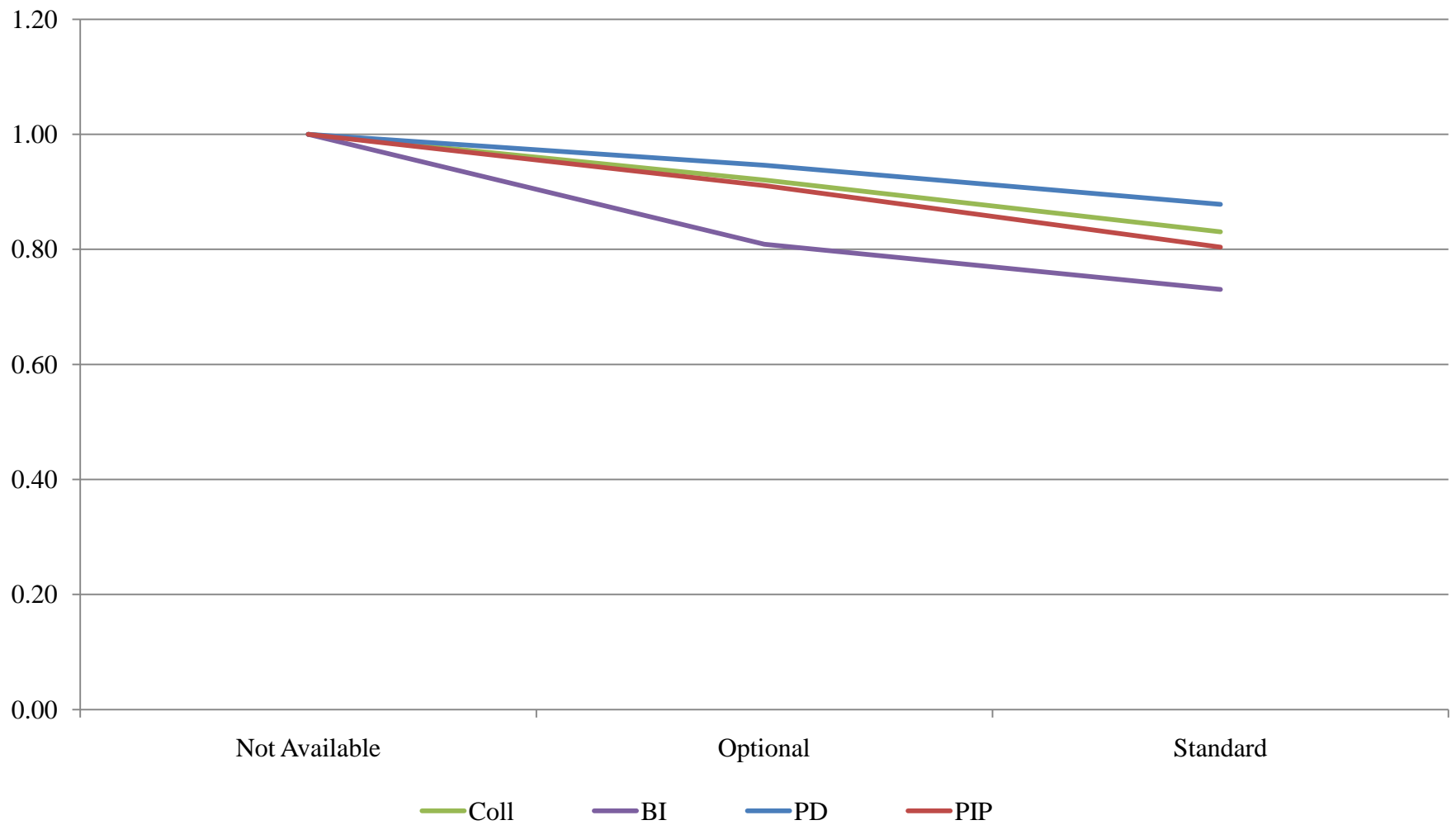
Imputing Average Rating Factors



Results - Base List Price



Results - Electronic Stability Control



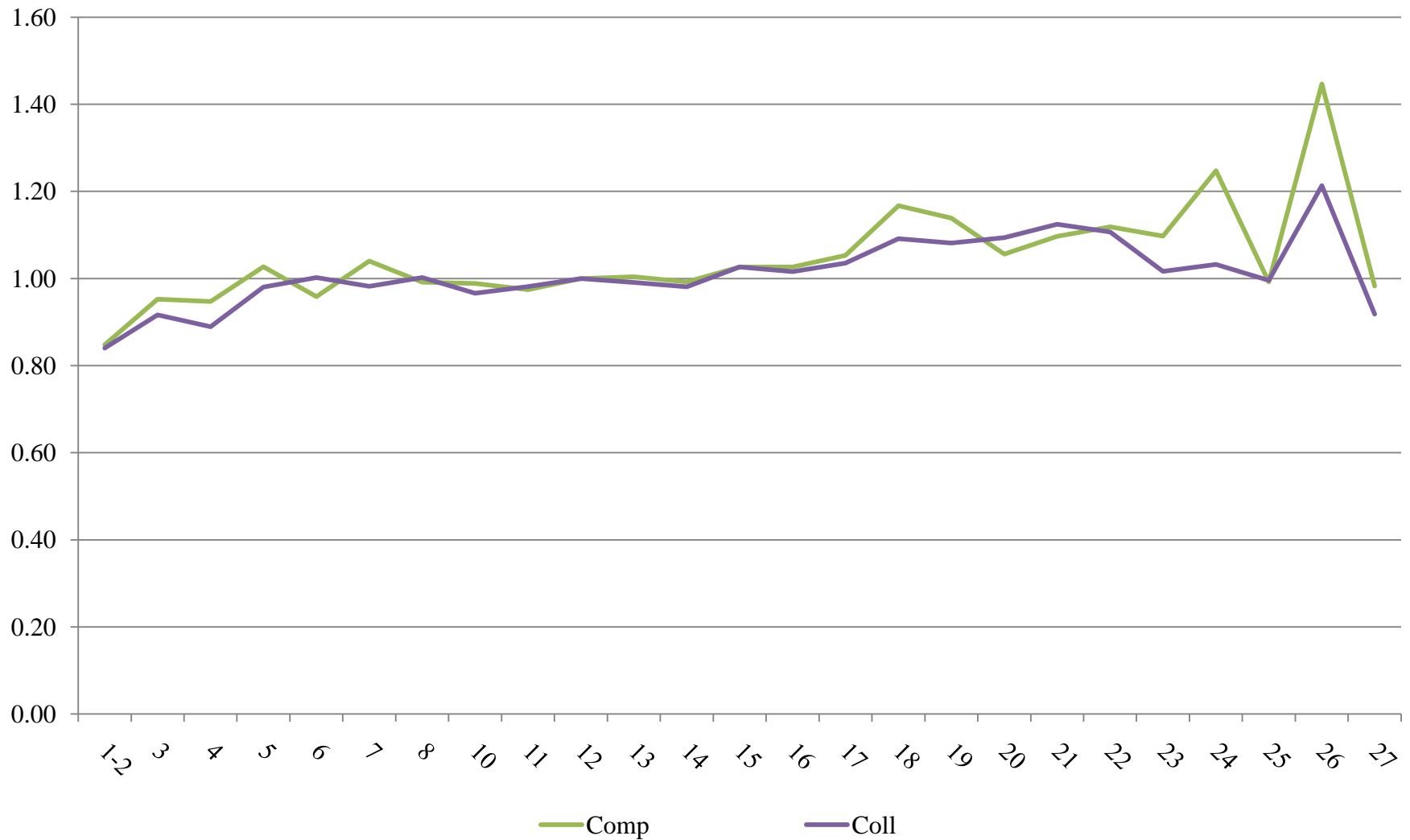
Investigating Make/Model/Model Year

Make/Model/Model Year	Exposure	Pure Prem Relativities	Z Value*
HONDA Odyssey 1997	11,000	1.19	1.22
HONDA Odyssey 1998	16,000	1.08	0.67
HONDA Odyssey 1999	94,000	1.04	0.47
HONDA Odyssey 2000	274,000	1.01	0.32
HONDA Odyssey 2001	272,000	0.95	0.05
HONDA Odyssey 2002	328,000	0.87	-0.38
HONDA Odyssey 2003	367,000	0.86	-0.40
HONDA Odyssey 2004	335,000	0.84	-0.51
HONDA Odyssey 2005	322,000	0.97	0.13
HONDA Odyssey 2006	248,000	0.97	0.12
HONDA Odyssey 2007	93,000	0.98	0.18
*Portfolio Mean = 0.94 Portfolio St Dev = 0.201			

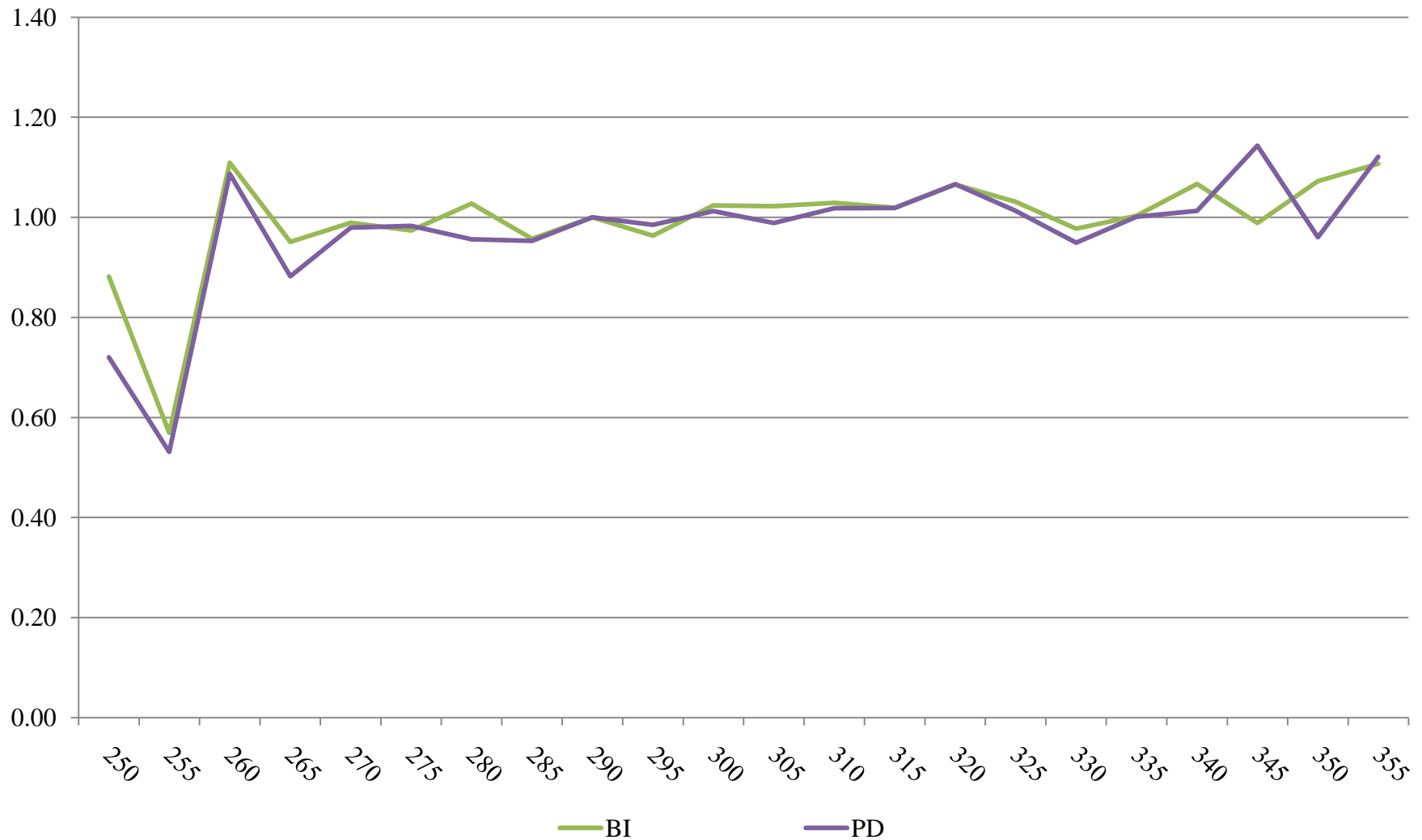
Implementation

- Vehicle characteristics analysis
 - May be used to completely overhaul existing vehicle symbol rating structure
 - May be used to enhance existing vehicle symbol rating structure in the rating plan
 - Model vehicle characteristics on the residual
 - Model vehicle characteristics alongside existing VSR

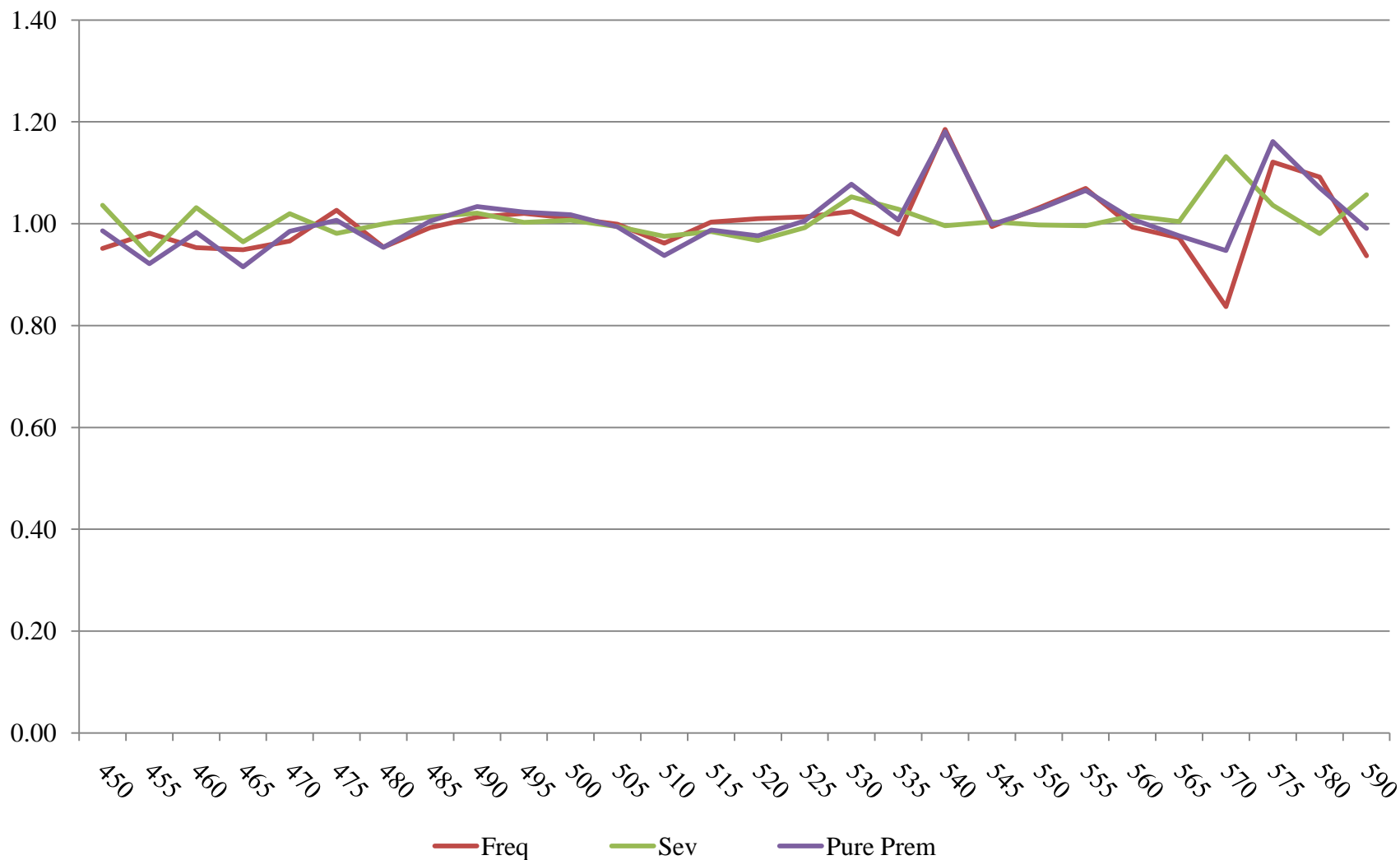
Results - ISO Symbols



Results - ISO Symbols (Liability)



Results - ISO Symbols (PIP)



Adding New Make/Models

- One key consideration in the maintenance of vehicle symbol rating is how to assign symbols to new make/models as they come out
 - Active assignment – gather initial vehicle information and make any category assignments necessary to assign an initial symbol
 - Adjust once sufficient historical data is gathered and analysis indicates necessary relativity changes, if any


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April 21 Apex Discussion Series

Actuaries and Auditors

Join Paul Vendetti as he describes the interactions between auditors and actuaries along with the relevant ASOP's.

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Apex Discussion - Actuaries and Auditors

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Thank You for Your Attention

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