



# HOUSEHOLD AVERAGING

CAS Annual Meeting 2007

Alice Gannon  
November 2007

# Household Averaging

- Background
- Alternatives
- Purpose
- Concerns
- Summary

**PURPOSE:** To discuss household averaging and how it is used to reflect the different relationships between operators and vehicles on a policy.

## **OUTLINE**

- ❖ Background
- ❖ Alternatives
- ❖ Data
- ❖ Implementation
- ❖ Summary

# Background

- Background
- Alternatives
- Purpose
- Concerns
- Summary

- ❖ Most auto policies have multiple drivers and vehicles, thus making rating more challenging
- ❖ Historically, companies assigned drivers to vehicles for the purposes of rating
  - Agent/insured assigned
  - Highest rated operator to highest rated vehicle
- ❖ More recently, companies are using driver averaging for rating

# What is Driver Averaging?

- Background
- Alternatives
- Purpose
- Concerns
- Summary

## ❖ Basic definition

- Operator factors calculated for each of the drivers on the policy
- Rather than using the operator factor of the driver assigned to the vehicle, use an average of all the operator factors

## ❖ Variations

- Straight averaging
- Weighted averaging
- Modified averaging
- Average/Assignment Hybrid

# Example: Actual Assignment

- Background
- Alternatives
- Purpose
- Concerns
- Summary

Vehicle Rate

Vehicle	Rate
V1	\$500
V2	\$450
V3	\$200

Operator Factor

Operator	Factor
Dad	0.80
Mom	0.85
Junior	2.80

Assignment Table

Operator	Vehicle
Dad	V1
Mom	V2
Junior	V3

- ❖ Actual assignment:
  - Based on who insured says drives which vehicles

$$\left. \begin{array}{l} \$500 \times 0.80 \\ \$450 \times 0.85 \\ \$200 \times 2.80 \end{array} \right\} \$1,342.50$$

- ❖ In cases Drivers <> Vehicles
  - D>V: highest rated drivers assigned first
  - D<V: rules define factor for extra vehicle
- ❖ Most commonly used by preferred writers



# Example: Highest to Highest

- Background
- Alternatives
- Purpose
- Concerns
- Summary

Vehicle Rate

Vehicle	Rate
V1	\$500
V2	\$450
V3	\$200

Operator Factor

Operator	Factor
Dad	0.80
Mom	0.85
Junior	2.80

Assignment Table

Operator	Vehicle
Dad	V1
Mom	V2
Junior	



❖ Highest to highest:

- Highest **rated operator** assigned to highest rated vehicle, so does not matter who drives which vehicle

$$\left. \begin{array}{l} \$500 * 2.80 \\ \$450 * 0.85 \\ \$200 * 0.80 \end{array} \right\} \$1,942.50$$

- ❖ Drivers <> Vehicles, same options as for agent/insured assignment
- ❖ Most commonly used by non standard writers

# Example: Straight Averaging

- Background
- Alternatives
- Purpose
- Concerns
- Summary

Vehicle Rate

Vehicle	Rate
V1	\$500
V2	\$450
V3	\$200

Operator Factor

Operator	Factor
Dad	0.80
Mom	0.85
Junior	2.80

Assignment Table

Operator	Vehicle
Dad	V1
Mom	V2
Junior	



- ❖ Straight driver average:
    - Apply straight average of all operator factors to every vehicle on policy
- $$\left. \begin{array}{l} \$500 * [0.80 + 0.85 + 2.80] / 3 \\ \$450 * [0.80 + 0.85 + 2.80] / 3 \\ \$200 * [0.80 + 0.85 + 2.80] / 3 \end{array} \right\} \$1,705.84$$
- ❖ Does not matter who principally operates the vehicles

# Example: Weighted Averaging

- Background
- Alternatives
- Purpose
- Concerns
- Summary

Vehicle	Rate
V1	\$500
V2	\$450
V3	\$200

Operator	Factor
Dad	0.80
Mom	0.85
Junior	2.80

Op	Veh	%Use
Dad	V1	80%
	V2	20%
	V3	0%
Mom	V1	20%
	V2	80%
	V3	0%
Jr	V1	0%
	V2	0%
	V3	100%

- Weighted driver average:
  - Operator factors averaged using weights determined based on the use of the specific vehicle

$$\$500 * [80% * 0.80 + 20% * 0.85 + 0% * 2.80]$$

$$\$450 * [20% * 0.80 + 80% * 0.85 + 0% * 2.80]$$

$$\$200 * [0% * 0.80 + 0% * 0.85 + 100% * 2.80]$$

\$1,343.00

- Determination of weights is key to this calculation
  - Trust insured weights. Perhaps, apply a minimum weight
  - Principal and occasional operator weight structure



# Example: Modified Averaging

- Background
- Alternatives
- Purpose
- Concerns
- Summary

Vehicle Rate

Vehicle	Rate
V1	\$500
V2	\$450

Operator Factor

Operator	Factor
Dad	0.80
Mom	0.85
Junior	2.80

Assignment Table

Operator	Vehicle
Dad	V1
Mom	V2
Junior	



- ❖ Modified average:
  - Applicable when the driver count > vehicle count
  - Number of **operators** averaged limited by number of vehicles
  - Only highest rated operators included in average

$$\left. \begin{array}{l} \$500 * [0.85 + 2.80] / 2 \\ \$450 * [0.85 + 2.80] / 2 \end{array} \right\} \$1,733.75$$

- ❖ Does not matter who principally operates the vehicles

# Example: Hybrid Approach

- Background
- Alternatives
- Purpose
- Concerns
- Summary

Vehicle Rate

Vehicle	Rate
V1	\$500
V2	\$450
V3	\$200

Operator Factor

Operator	Factor
Dad	0.80
Mom	0.85
Junior	2.80

Assignment Table

Operator	Vehicle
Dad	V1
Mom	V2
Junior	V3

- ❖ Hybrid approach:
  - Some **operators** assigned to a specific vehicle (e.g. youthful PO)
  - All other operator factors averaged and applied to other vehicles

$$\left. \begin{array}{l} \$500 \times [0.80 + 0.85] / 2 \\ \$450 \times [0.80 + 0.85] / 2 \\ \$200 \times [2.80] \end{array} \right\} \$1,343.75$$

- ❖ Driver assignment is still critical for those segments that are being directly assigned

# Why Do Companies Do This?

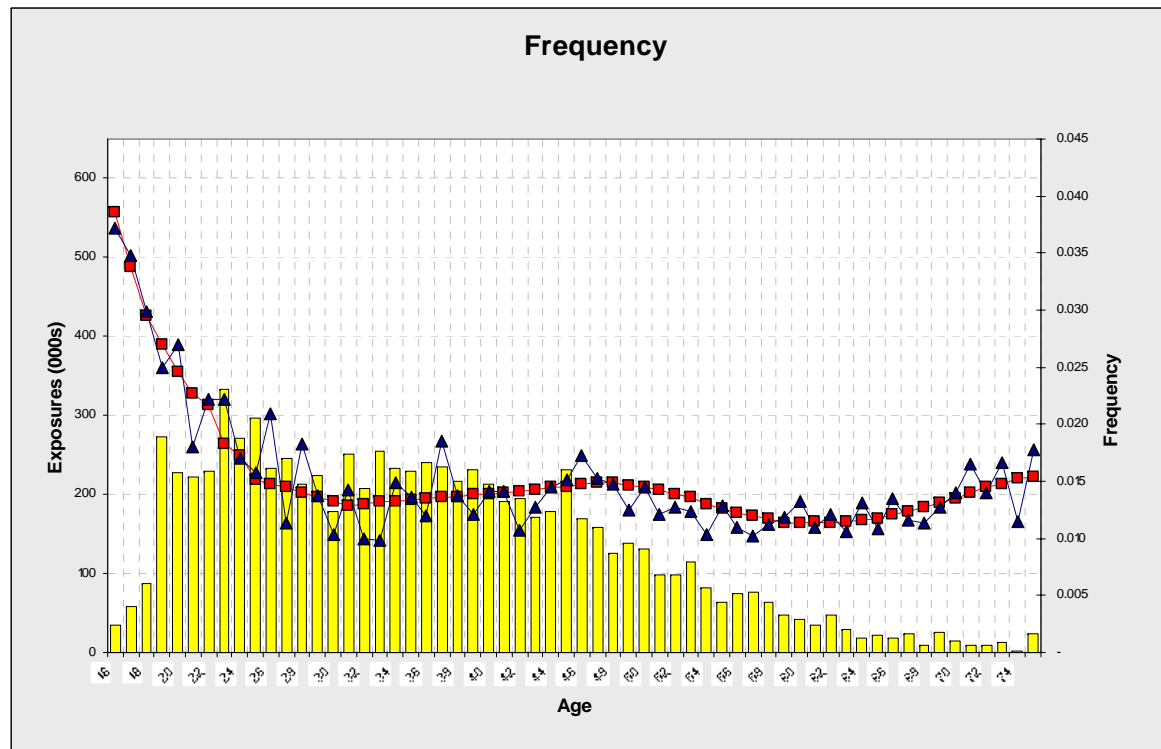
- Background
- Alternatives
- Purpose
- Concerns
- Summary

1. Eliminates company concerns about manipulation
2. Streamlines application process by avoiding assignment questions
3. Minimizes some traditionally difficult discussions
  - Why is “junior” being rated on the expensive car “he” never drives?
  - Why do two similar vehicles have very different rates?
4. Results in a more straightforward rating algorithm
  - Minimizes need for some of the policy variables (e.g., number of youthfuls on policy)
  - No need for an extra vehicle factor
5. Model interpretation is easier

# Model Interpretation

- Background
- Alternatives
- Purpose
- Concerns
- Summary

- ❖ When modeling age, expect a j-shaped pattern



- ❖ “Bump” in the middle when kids are present on policy
  - Need additional variables to account for this
  - **Bump** eliminated when using driver averaging

# Are There Concerns?

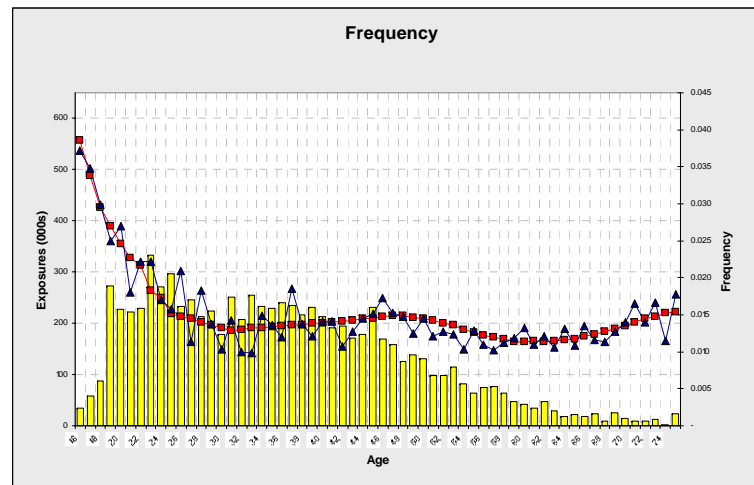
- Background
- Alternatives
- Purpose
- Concerns
- Summary

1. Changes always create issues upon implementation
  - Manual rules need to be changed
  - Quoting process needs to be changed
2. New difficult discussions may be created
  - Why did every vehicle's premium change when "junior" was added?
  - How can I quantify the impact of adding "junior" to the policy?
3. Rating and underwriting algorithms may need to be overhauled

# Rating Algorithm Overhaul

- Background
- Alternatives
- Purpose
- Concerns
- Summary

- ❖ Over time, factors added to specifically address issue that all drivers could drive each vehicle
  - # youthfuls in household
  - # points in household
- ❖ Some standard factors automatically adjusted to capture “averaging” effect



- ❖ The rating algorithm will have to be re-reviewed and changed

# Are There Concerns (cont'd)?

- Background
- Alternatives
- Purpose
- Concerns
- Summary

4. Implementation will result in significant premium changes, if applied to renewals

# Winners & Losers

- Background
- Alternatives
- Purpose
- Concerns
- Summary

- ❖ Companies tend to “off balance” implementation, so the overall aggregate premium will not change
- ❖ Impacts can be significant on some policies, so important to understand “winners” and “losers”
- ❖ Difficult to generalize changes, as highly dependent on
  - Current assignment rules and specifics of averaging
  - Class factors, including driving records
  - Vehicle characteristics
  - Coverage carried on different vehicles



# Winners & Losers



- Background
- Alternatives
- Purpose
- Concerns
- Summary

- ❖ Consider a typical family policy
  - 3 Drivers (Dad, Mom, Junior)
  - 4 Vehicles
    - Mom and Dad drive newer vehicles
    - Junior and extra vehicle are older
  - All drivers have minimal driving record activity
- ❖ Change from “Insured Assignment” to “Straight Average”

Vehicle	Vehicle Rate	Assigned Driver	Class Factor	Avg Class Factor
V1	\$500	Dad	0.80	1.36
V2	\$450	Mom	0.85	1.36
V3	\$200	Junior	2.80	1.36
V4	\$200	N/A	1.00	1.36

\$1,543

\$1,836

- ❖ Driver averaging is worse for the family!

# Winners & Losers

- Background
- Alternatives
- Purpose
- Concerns
- Summary

- ❖ Use the exact same example, except now give “Junior” a new vehicle...

Vehicle	Vehicle Rate	Assigned Driver	Class Factor	Avg Class Factor
V1	\$500	Dad	0.80	1.36
V2	\$450	Mom	0.85	1.36
V3	\$450	Junior	2.80	1.36
V4	\$200	N/A	1.00	1.36

\$2,243

\$2,180

- ❖ Driver averaging is better for the family!



# Are There Concerns (cont'd)?

- Background
- Alternatives
- Purpose
- Concerns
- Summary

4. Implementation will result in significant premium changes, if applied to renewals
5. Data will need to change

# Data Setup

- Background
- Alternatives
- Purpose
- Concerns
- Summary

- ❖ In all modeling projects, it is imperative that the data set up mimic the rating
- ❖ Returning to our original example...

Vehicle	Operator	Vehicle Rate
V1	Dad	\$500
V2	Mom	\$450
V3	Junior	\$200

Operator	Class Factor
Dad	0.80
Mom	0.85
Junior	2.80

- Assume Mom had a \$1000 claim in Dad's car
- Assume Junior had a \$2500 claim in Junior's car

# Data Setup

- Background
- Alternatives
- Purpose
- Concerns
- Summary

- ❖ Actual assignment methodology each record represents a single vehicle with one assigned operator

Veh	Op	Sym	MYR	Age	Sex	Type	Yths	Drvrs	Vehs	Exp	Clm	Losses	Prem
V1	Dad	17	2006	45	M	PO	1	3	3	1	1	1,000	400.00
V2	Mom	17	2005	43	F	PO	1	3	3	1	0	0	382.50
V3	Junior	12	2002	16	M	PO	1	3	3	1	1	2,500	560.00

- Operator characteristics based on assigned operator
- Vehicle characteristics based on vehicle
- Policy characteristics “catch” other drivers
- Losses assigned to vehicle

# Data Setup

- Background
- Alternatives
- Purpose
- Concerns
- Summary

- ❖ Straight average methodology each record represents a single vehicle and operator combination

Veh	Op	Sym	MYR	Age	Sex	Type	Yths	Drvrs	Vehs	Exp	Clm	Losses	Prem
V1	Dad	17	2006	45	M	PO	1	3	3	1/3	0	0	133.33
V1	Mom	17	2006	43	F	OC	1	3	3	1/3	1	1,000	141.67
V1	Junior	17	2006	16	M	OC	1	3	3	1/3	0	0	466.67
V2	Dad	17	2005	45	M	OC	1	3	3	1/3	0	0	120.00
V2	Mom	17	2005	43	F	PO	1	3	3	1/3	0	0	127.50
V2	Junior	17	2005	16	M	OC	1	3	3	1/3	0	0	420.00
V3	Dad	12	2002	45	M	OC	1	3	3	1/3	0	0	53.33
V3	Mom	12	2002	43	F	OC	1	3	3	1/3	0	0	56.67
V3	Junior	12	2002	16	M	PO	1	3	3	1/3	1	2,500	186.67

- Policy characteristics are same, but less predictive
  - Exposure split amongst the vehicle
  - Losses assigned to vehicle/operator combination
- ❖ Note, this also greatly expands the size of the database

# Are There Concerns (cont'd)?

- Background
- Alternatives
- Purpose
- Concerns
- Summary

4. Implementation will result in significant premium changes
6. Data will need to change
7. Traditional implementation analysis will necessarily change

# Implementation Analysis

- Background
- Alternatives
- Purpose
- Concerns
- Summary

## Actual assignment methodology

Veh	Op	Sym	MYR	Age	Sex	Type	Yths	Drvrs	Vehs	Exp	Clm	Loss	Prem
V1	Dad	17	2006	45	M	PO	1	3	3	1	1	1,000	400.00
V2	Mom	17	2005	43	F	PO	1	3	3	1	0	0	382.50
V3	Junior	12	2002	16	M	PO	1	3	3	1	1	2,500	560.00

## - Aggregations

### Policy

Veh Cnt	Exp	Clm	Loss	Prem
3	3	2	3,500	1,342.50

### Vehicle

Sym	Exp	Clm	Loss	Prem
17	2	1	1,000	782.50
12	1	1	2,500	560.00

### Operator

Sex	Exp	Clm	Loss	Prem
M	2	2	3,500	960.00
F	1	0	0	382.50



# Implementation Analysis

- Background
- Alternatives
- Purpose
- Concerns
- Summary

## ▣ Straight average methodology:

Veh	Op	Sym	MYR	Age	Sex	Type	Yths	Drvrs	Vehs	Exp	Clm	Loss	Prem
V1	Dad	17	2006	45	M	PO	1	3	3	1/3	0	0	133.33
V1	Mom	17	2006	43	F	OC	1	3	3	1/3	1	1,000	141.67
V1	Junior	17	2006	16	M	OC	1	3	3	1/3	0	0	466.67
V2	Dad	17	2005	45	M	OC	1	3	3	1/3	0	0	120.00
V2	Mom	17	2005	43	F	PO	1	3	3	1/3	0	0	127.50
V2	Junior	17	2005	16	M	OC	1	3	3	1/3	0	0	420.00
V3	Dad	12	2002	45	M	OC	1	3	3	1/3	0	0	53.33
V3	Mom	12	2002	43	F	OC	1	3	3	1/3	0	0	56.67
V3	Junior	12	2002	16	M	PO	1	3	3	1/3	1	2,500	186.67

## - Aggregations

### Policy

Veh Cnt	Exp	Clm	Loss	Prem
3	3	2	3,500	1,705.84

Vehicle

Sym	Exp	Clm	Loss	Prem
17	2	1	1,000	1,409.17
12	1	1	2,500	296.67

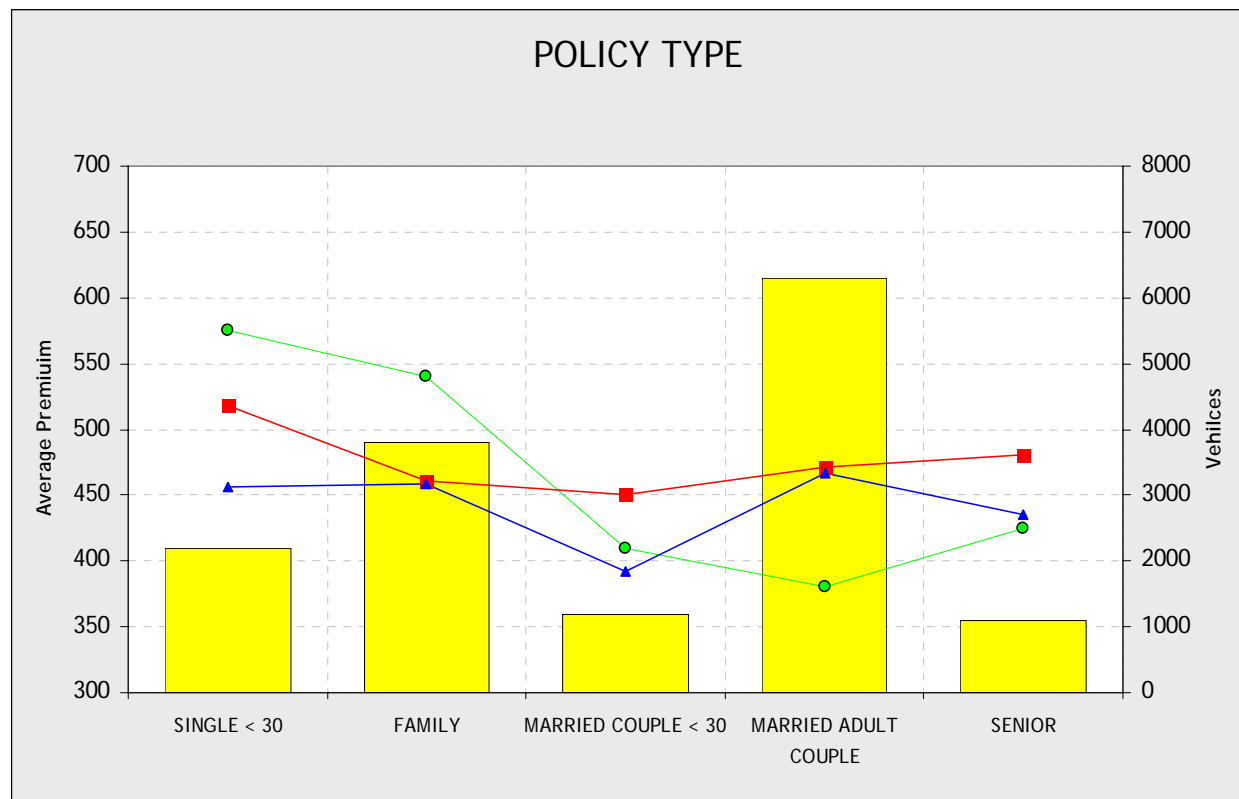
Operator

Sex	Exp	Clm	Loss	Prem
M	2	1	2,500	1,380.00
F	1	1	1,000	325.84

# Implementation Analysis

- Background
- Alternatives
- Purpose
- Concerns
- Summary

- ❖ Companies generally replace operator characteristics comparisons with comparisons of broad policy groupings
  - Young adults
  - Family policies
  - Married couples
  - Seniors
  - Family policies
  - Seniors



# Summary

- Background
- Alternatives
- Purpose
- Concerns
- Summary

- ❖ Many companies are changing from assigning drivers to driver averaging
- ❖ There are operational and ratemaking benefits to switching to driver averaging
- ❖ There are some things to consider when switching from assignment to averaging, including
  - Premium impacts
  - Overhaul of the rating algorithm
  - Data setup issues
  - Changes to implementation analysis