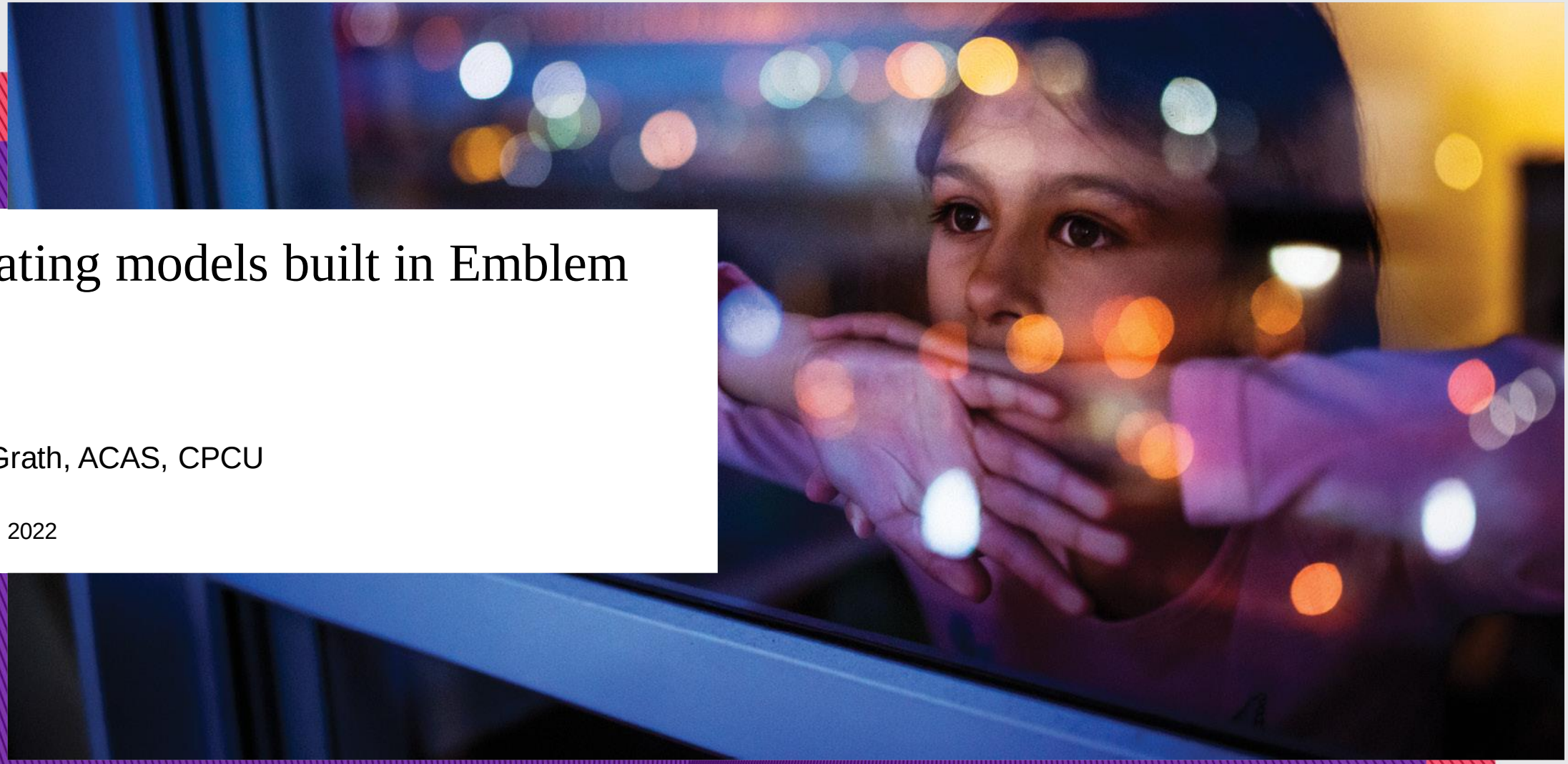

Evaluating models built in Emblem

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WTW

February 22, 2022

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Agenda

- Introduction to Emblem
- Correlations
- Residuals
- Summary Graphs
- Questions

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Emblem

Supports each stage of the analytics process

Explore your data

A variety of visual summary tools to explore and understand data, including correlations, distributions and average response by factor.

Feature engineering

Feature engineering is often described as the biggest driver of model success and is at the core of how Emblem works.

Modeling and validation

Fit highly flexible and interpretable GLMs. No black box, see and control the complexity. Automation capabilities for interaction detection and feature selection.

Model review and maintenance

A framework that provides an efficient and consistent approach to reviewing and assessing models.

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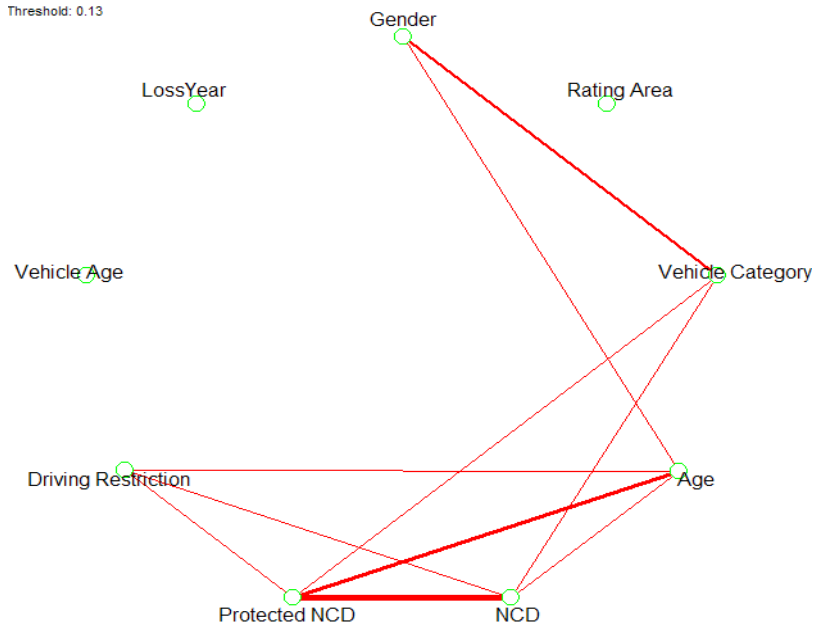
Correlations

- Correlation statistics
  - Measure association between explanatory variables
  - Identify potentially aliased variables (i.e. perfectly/near-perfectly correlated variables)
  - Visualization for easier interpretation

Correlation Statistics

Chi-Square | Continuity Adjusted Chi-Square | Likelihood-Ratio Chi-Square | Phi Coefficient | Contingency Coefficient | Cramer's V

Factor (#Levels)	Analysis Period (3)	Random 10 (10)	Age of Main Driver (68)	Age of Youngest Driver (68)	Age of Youngest Additional Driver (69)
Analysis Period (3)	0.000	0.000	0.000	0.000	0.000
Random 10 (10)	0.010	0.000	0.000	0.000	0.000
Age of Main Driver (68)	0.035	0.039	0.000	0.000	0.000
Age of Youngest Driver (	0.035	0.038	0.736	0.000	0.000
Age of Youngest Additio	0.039	0.037	0.051	0.393	0.000



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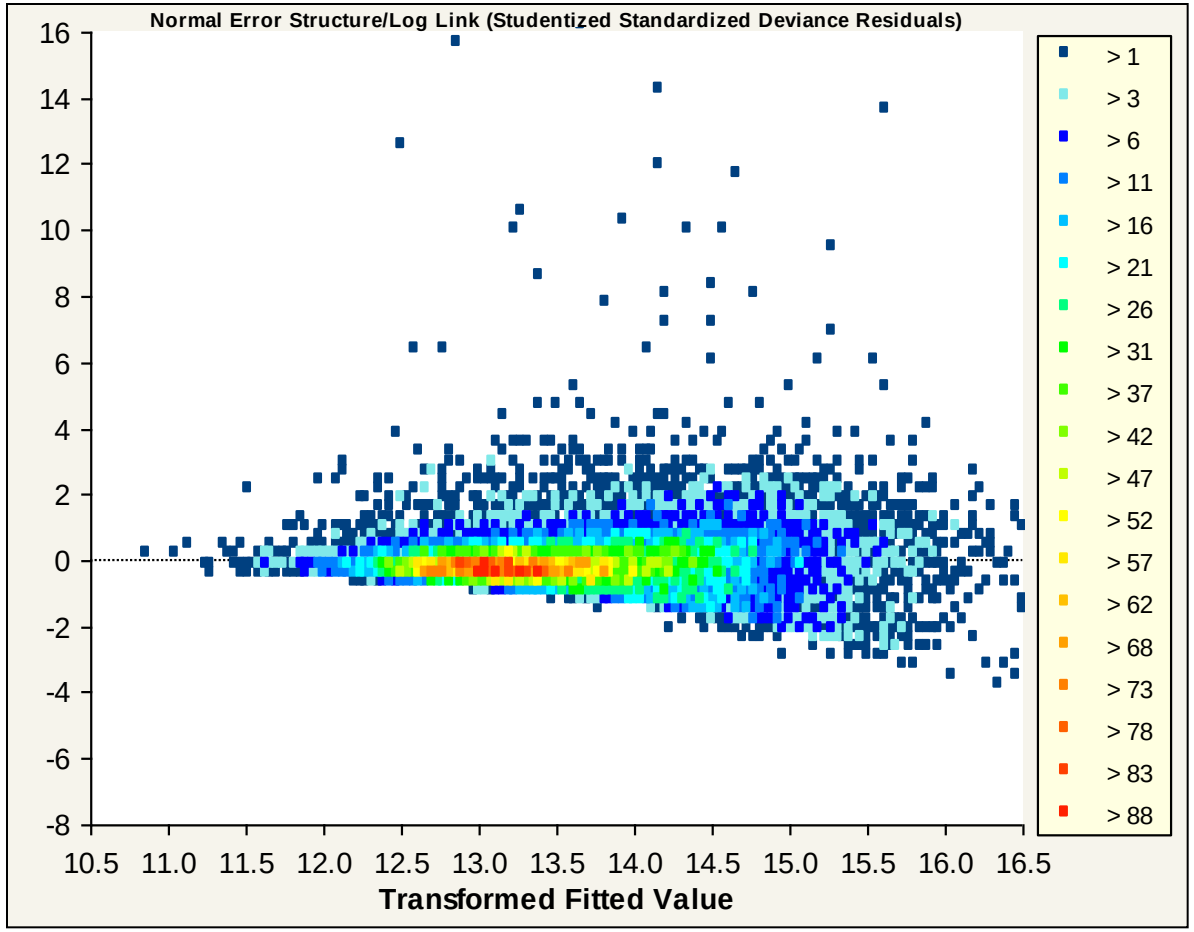
Residuals

Overview



Examining residuals

- Assess the adequacy of the variance function
  - Normality
  - Heteroskedasticity
- Identify mis-fit variables

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Residuals

Overview

Residuals measure the error of our individual predictions

- Pearson – basic residual, difference between predicted and observed

$$r_P = \frac{y - \mu}{\sqrt{V(\mu)}}$$

- Deviance – accounts for non-normal data distributions

$$r_D = \text{sgn}(y - \mu)\sqrt{d}$$

- Standardized Pearson/Deviance - accounts for correlation between predicted and observed

$$r_{SP} = \frac{r_P}{\sqrt{(1-h)}} \qquad r_{SD} = \frac{r_D}{\sqrt{(1-h)}}$$

- Studentized Standardized Pearson/Deviance - accounts for inclusion of scale parameter

$$r_{SSP} = \frac{r_{SP}}{\sqrt{\phi}} \qquad r_{SSD} = \frac{r_{SD}}{\sqrt{\phi}}$$

- Anscombe – similar to Deviance, accounts for non-normal distributions

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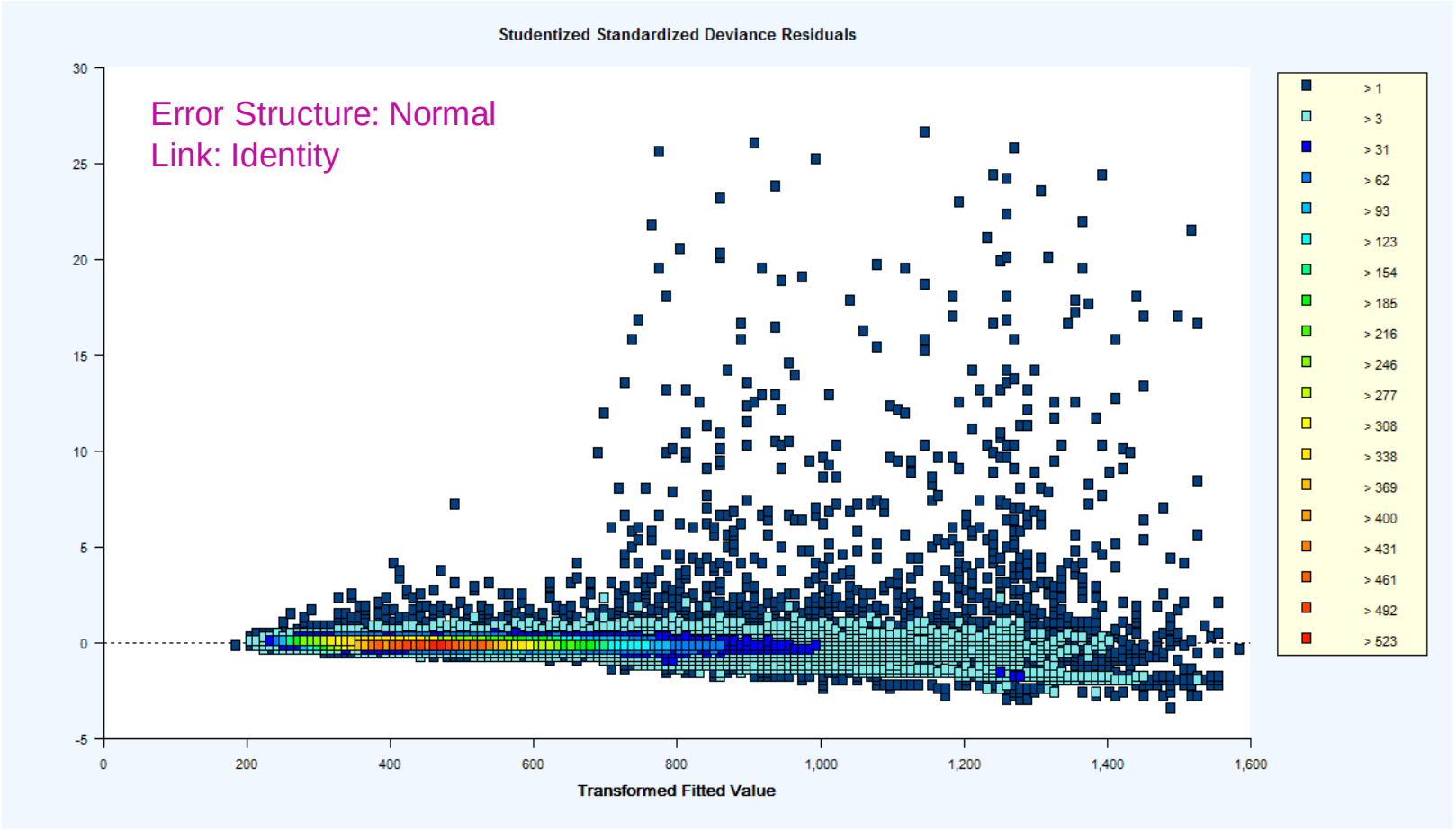
Residuals

Impact of error/link



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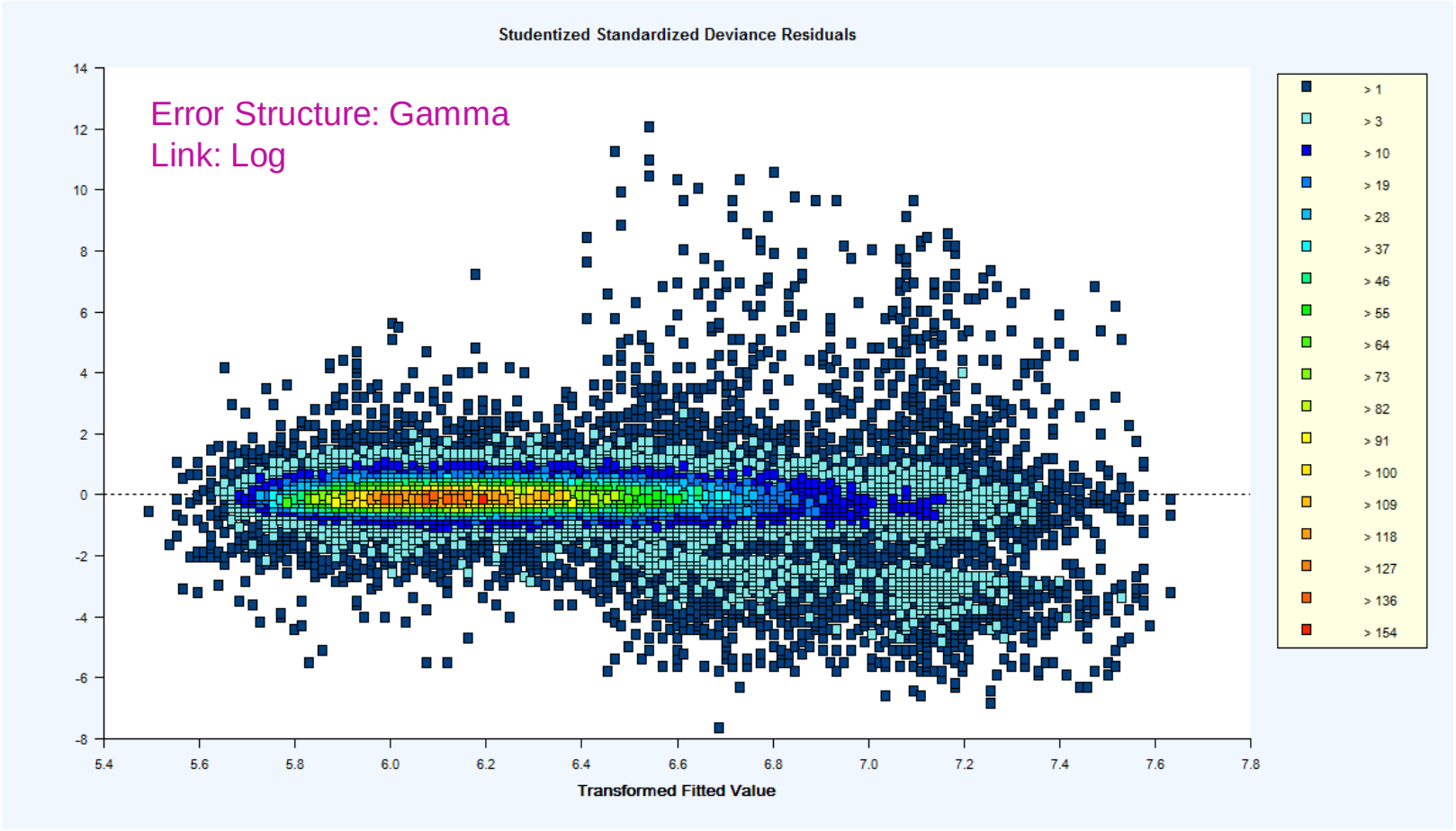
Residuals

Impact of error/link



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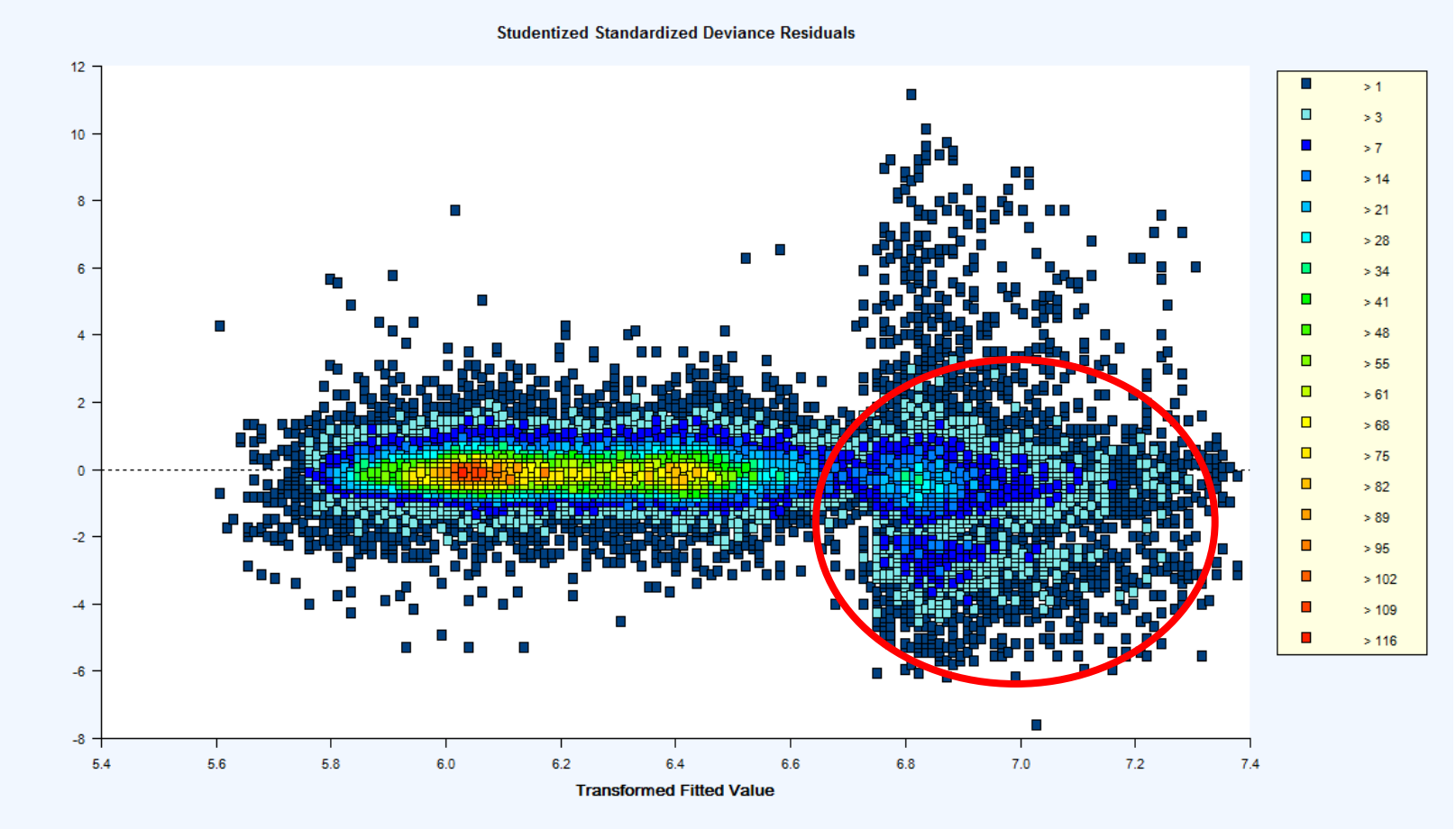
Residuals

Without vehicle value in the model…



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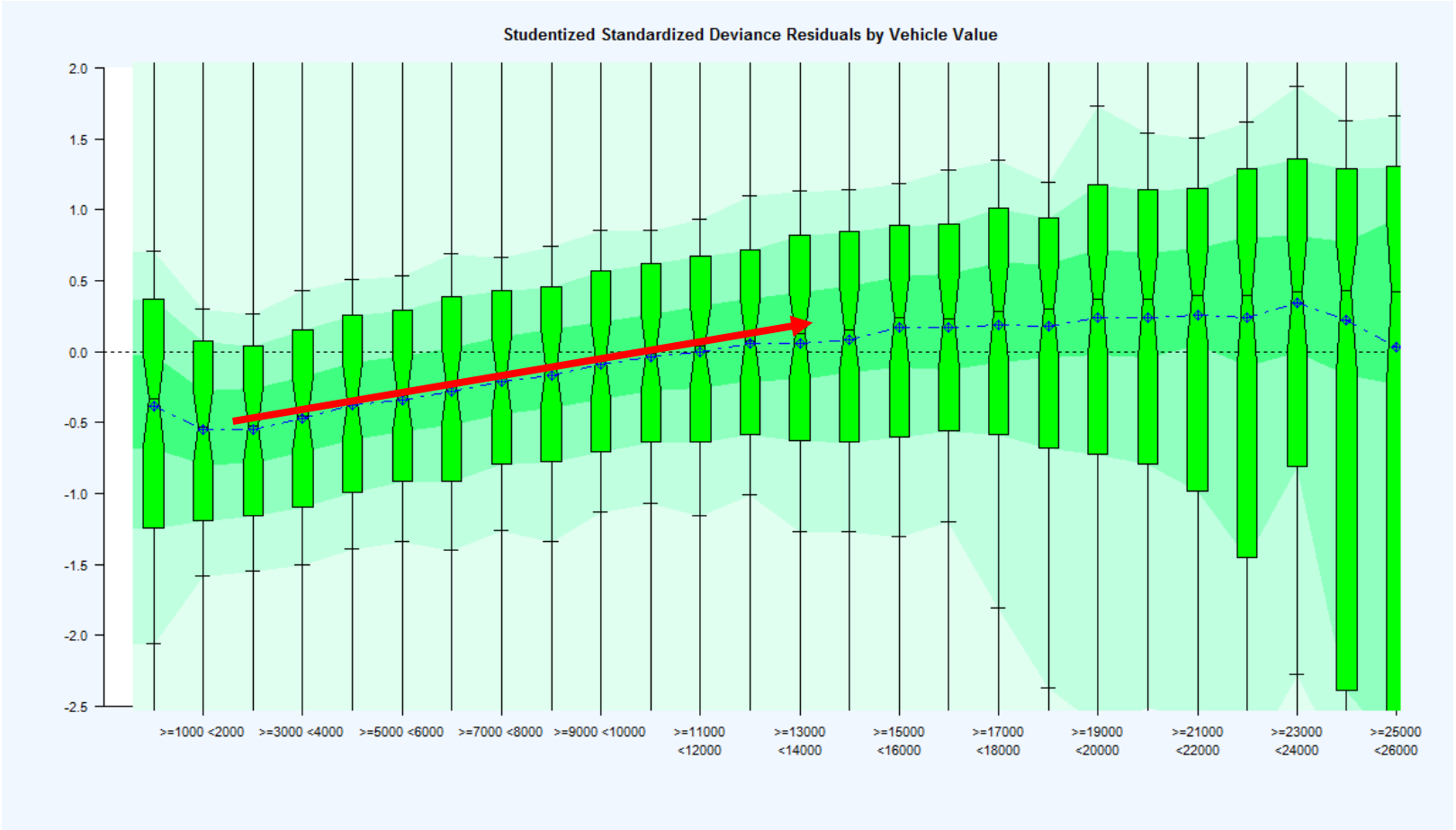
Residuals

Without vehicle value in the model…



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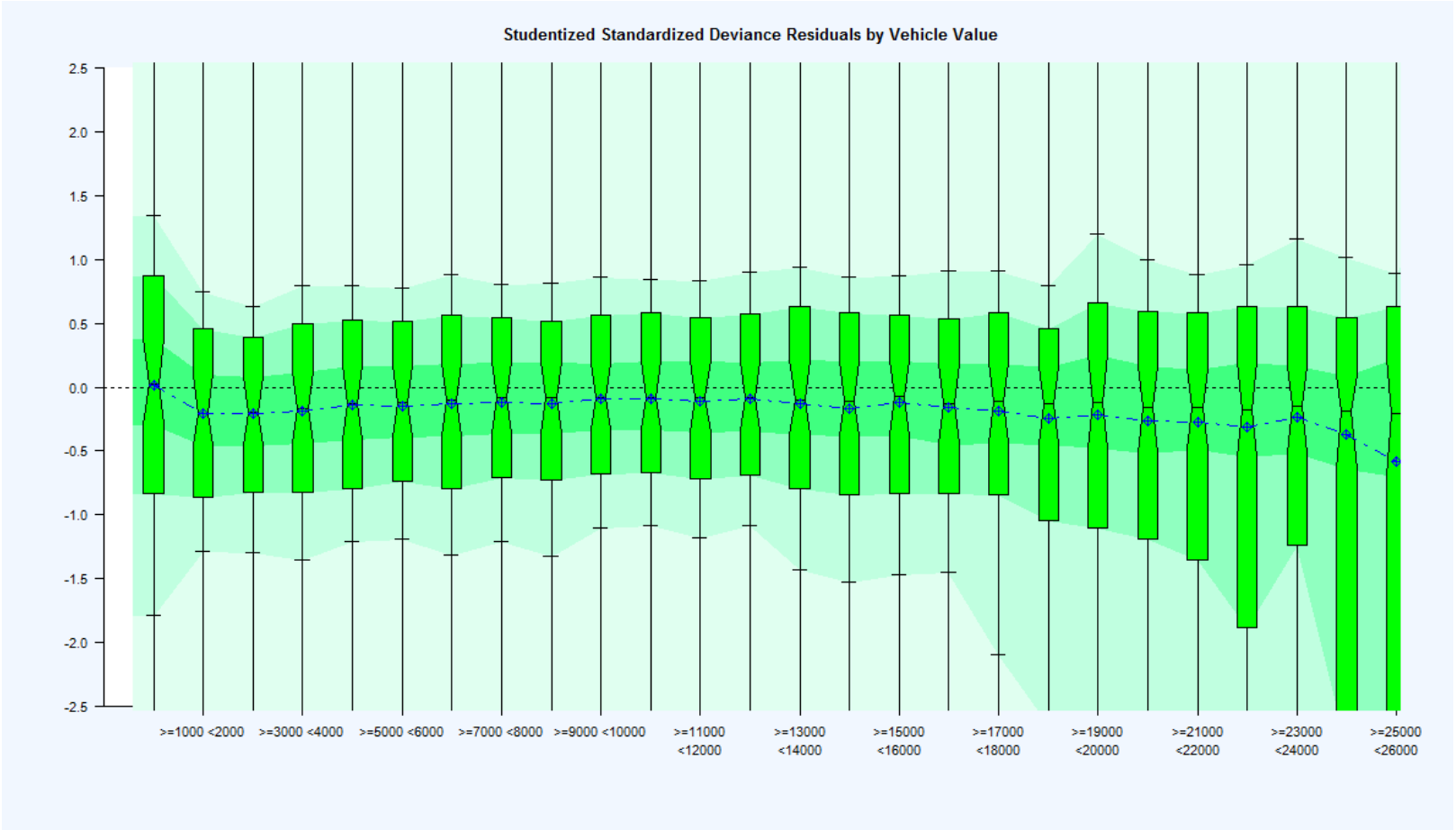
Residuals

With vehicle value added to the model…



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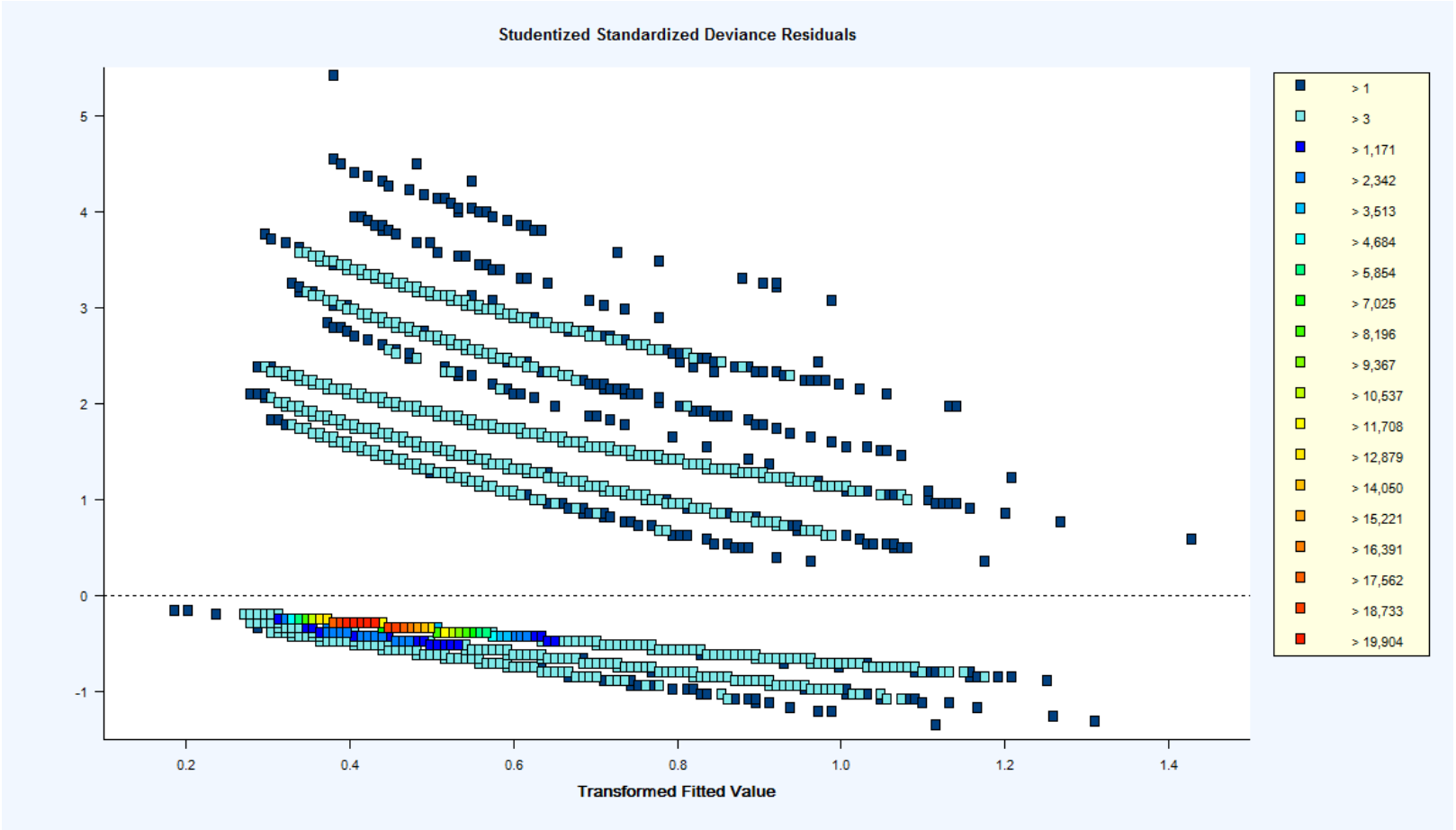
Residuals

Discrete distributions



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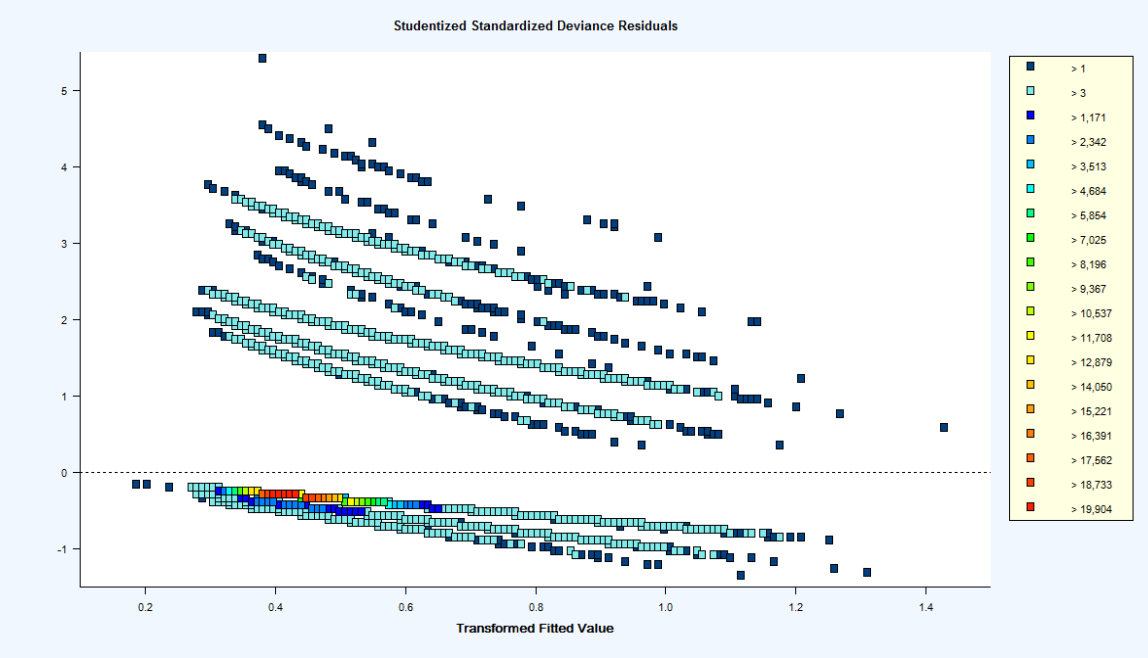
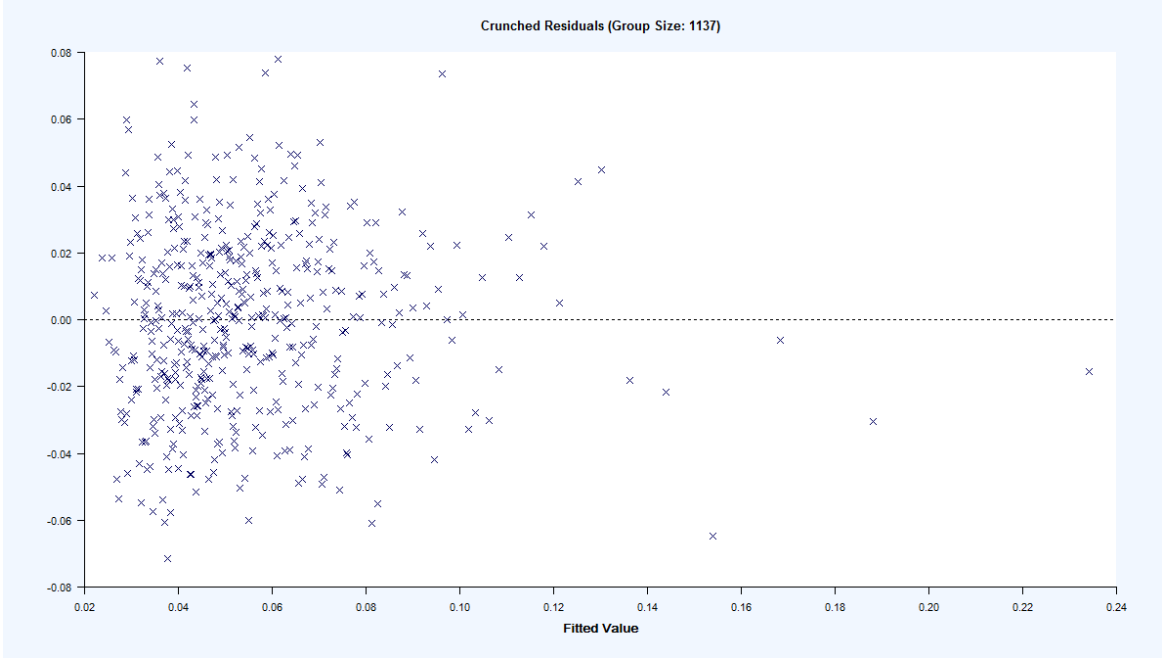
Residuals

Crunched residuals

- How can we make discrete data less discrete? Aggregate!
- Crunched residuals
  - Group observations with similar predicted values into buckets (much less likely that all observations have the same observed value)
  - Calculated residuals at the group level $r_c = \frac{\sum(Actual - Expected)}{\sqrt{V(\sum Expected)}}$





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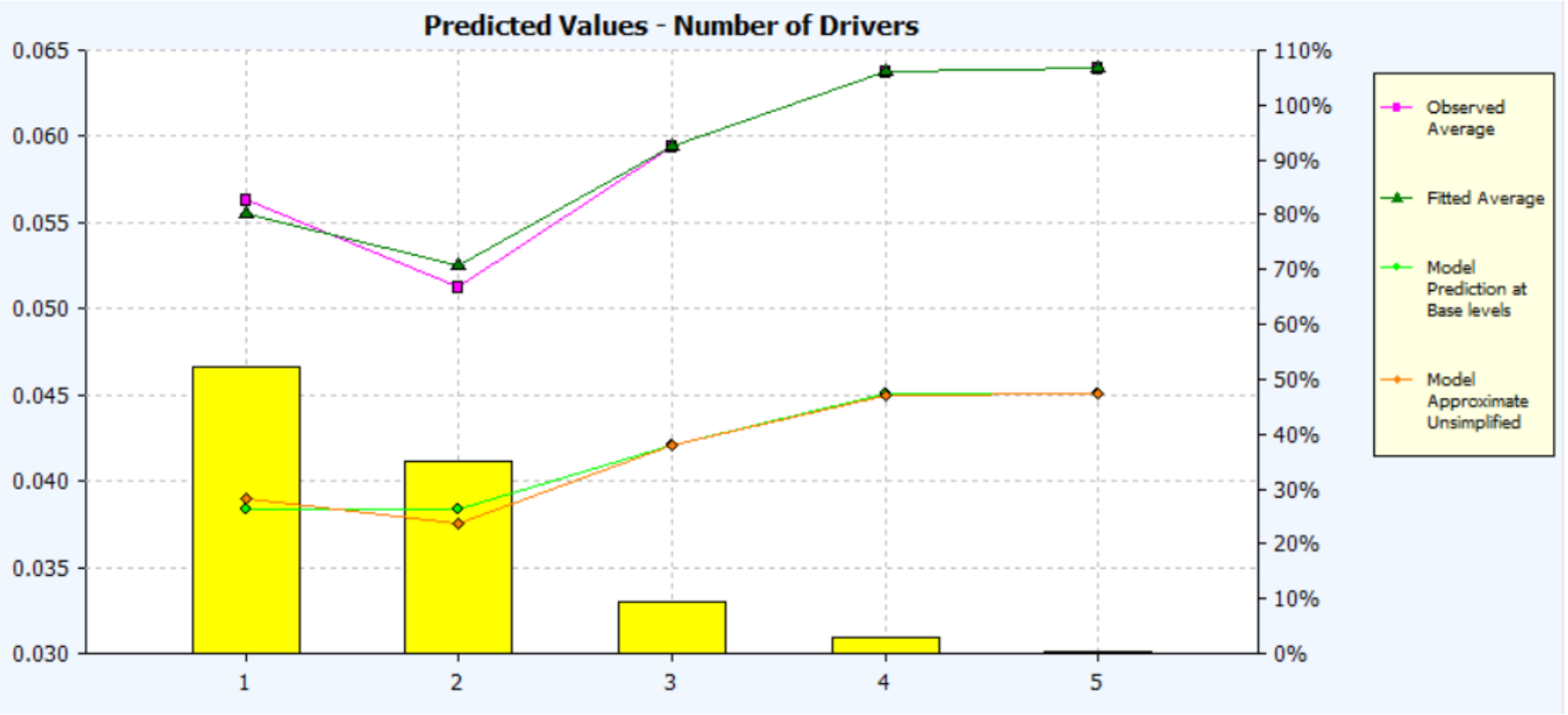
Summary Graphs

Overview



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Summary Graphs

Line definitions

- Observed Average
- Fitted Average
- Model Prediction at Base Levels:
  - Represents the effect in the model of this variable, holding all other variables constant
  - Similar to coefficients, can be converted to relativities
- Model Approximate Unsimplified:
  - Representation of the “true” effect of the variable, including both what is modeled and the leftover effect
  - The modeled component (Model Prediction at Base Levels) is multivariate
  - The leftover component is one-way

$$Model\ Approximate\ Unsimplified = Model\ Prediction\ at\ Base\ Levels * \underbrace{\frac{Observed\ Average}{Fitted\ Average}}_{\textbf{Residual/Leftover}}$$

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